Universal CMDB

Software Version: Content Pack 24.00 (CP24)

Discovery and Integrations Content Guide - Discovery Modules

Document Release Date: July 2017
Software Release Date: July 2017

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Part 1: Cloud and Virtualization > Cloud

Chapter 1: Amazon Web Services Discovery

This chapter includes:

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- How to Discover EC2, ECR, ECS, ELB, S3 Bucket, and RDS Services 43
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- AWS by Web Services Job 48
- Troubleshooting and Limitations – Amazon Web Services Discovery 51

Overview

Amazon Web Services (AWS) is a collection of remote computing services (also called web services) that together make up a cloud computing platform, offered over the Internet by Amazon.com.

Amazon Web Services' offerings are accessed over HTTP, using Representational State Transfer (REST) and SOAP protocols.

AWS discovery shows the state and configuration of your cloud based on Amazon techonologies. The discovery of these low-level infrastructure services are supported:

- **EC2 (Compute)**

  Amazon Elastic Compute Cloud (Amazon EC2) is a web service that provides resizable computing capacity in the cloud. You define your virtual Amazon EC2 environment with the operating system, services, databases, and application platform stack required for your hosted application. Amazon EC2 provides a full management console and APIs to manage your compute resources.

- **ECR**

  Amazon EC2 Container Registry (Amazon ECR) is a fully managed Docker container registry that allows you to easily store, manage, and deploy Docker container images.

- **ECS**

  Amazon EC2 Container Service (Amazon ECS) is a container management service that supports Docker containers and allows you to easily run applications on a managed cluster of Amazon EC2 instances.

- **ELB**

  Elastic Load Balancing (ELB) supports two types of load balancers: Application Load Balancers and Classic Load Balancers. It automatically distributes incoming application traffic across multiple Amazon EC2 instances. This increases the fault tolerance of your applications.

- **RDS (Relational database)**

  Amazon Relational Database Service (Amazon RDS) is a web service that provides capacity for MySQL or Oracle deployments in the cloud, while managing time consuming tasks like backup, scaling, and patching.

- **S3 Bucket**

Amazon Simple Storage Service (Amazon S3) is cloud storage for the Internet. To upload your data, you first create a bucket in one of the AWS Regions. You can then upload any number of objects to the bucket.

For more information about the preceding services, refer to https://aws.amazon.com/.

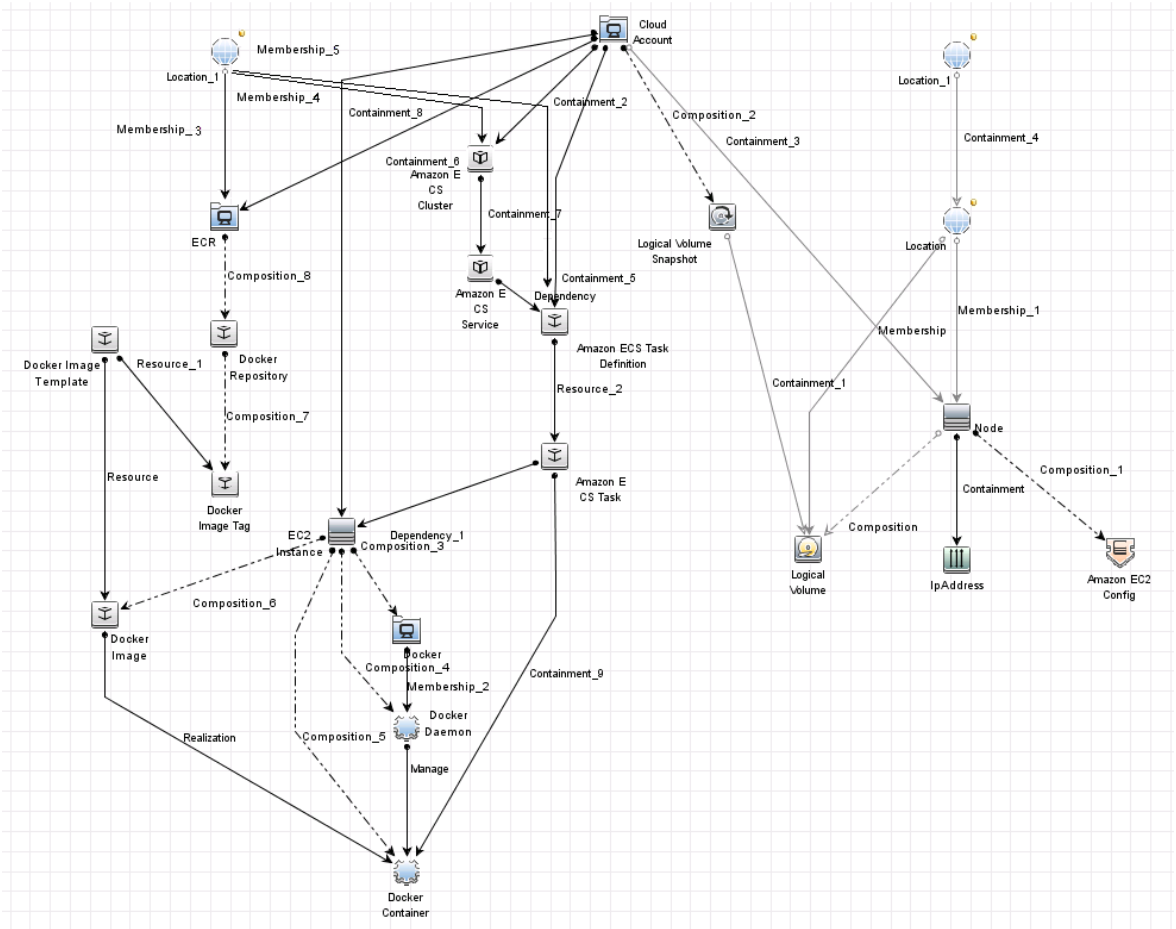
For communication with AWS, discovery uses Amazon SDK and IAM service for the authentication.

Topology

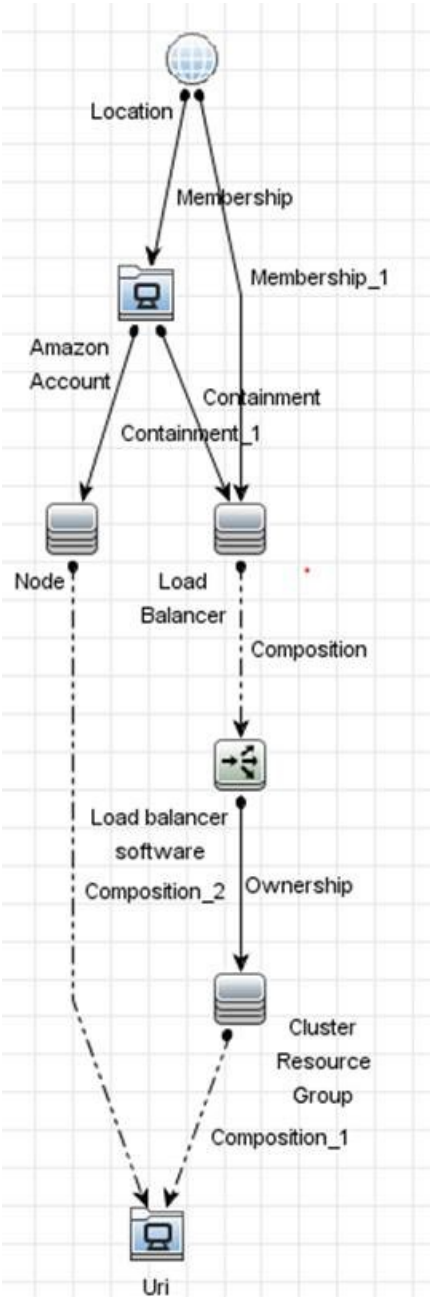
The following images display the topology of AWS discovery.

> **Note:** For a list of discovered CITs, see "Discovered CITs" on page 47.

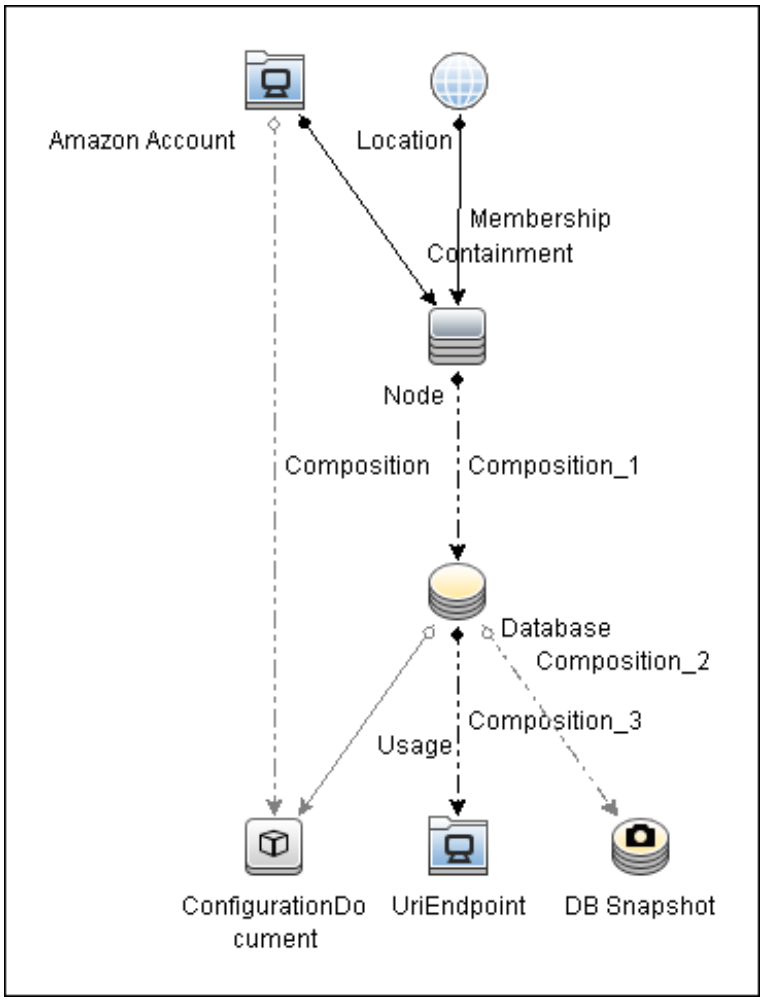
Amazon EC2, ECR, and ECS



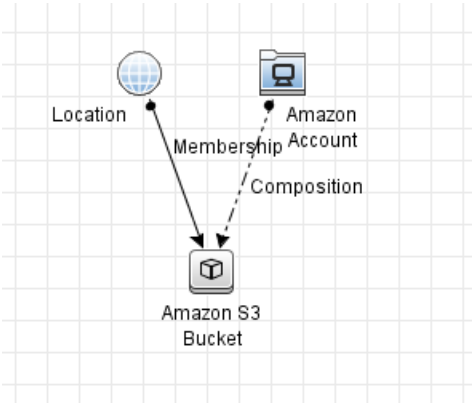
ELB


Location
Membership
Membership_1
Amazon
Account
Containment
Containment_1
Node
Load
Balancer
Composition
Load balancer
software
Composition_2
Ownership
Cluster
Resource
Group
Composition_1
Uri

Amazon RDS


Amazon Account
Location
Membership
Containment
Node
Composition
Composition_1
Database
Composition_2
Composition_3
Usage
ConfigurationDo
cument
UriEndpoint
DB Snapshot

Amazon S3 Bucket



How to Discover EC2, ECR, ECS, ELB, S3 Bucket, and RDS Services

This task describes how to discover two low-level AWS services, using a discovery protocol called **AWS Protocol**. This discovery process enables you to discover information about running node instances and their configuration (including information about AMI), corresponding block storage, and snapshots with information about regions and zones. All reported topology is in the scope of the Amazon account in which the discovery user is registered.

- Support using AWS Identity and Access Management (IAM) users in the AWS credential.
- Except AWS GovCloud, the permission for IAM Service is not required.
- The AWS Discovery only discovers those AWS components with users' permission.

This task contains the following steps:

- "Prerequisites - Probe IP address" below
- "Prerequisites - Credentials" below
- "Prerequisites - Driver setup" on the next page
- "Run the discovery" on page 45

1. Prerequisites - Probe IP address

Discovery requires a probe with at least one IP address in range to trigger.

2. Prerequisites - Credentials

AWS discovery uses one of three types of access credentials used to authenticate requests to AWS services: **access keys**.

To represent AWS credentials in UCMDB, you must define: **AWS Protocol**.

Credential Value	AWS Protocol Name
Access Key ID	Username
Secret Access Key	Password

More information about **access keys** can be found here.

To discover AWS GovCloud, configure the following parameters in **AWS Protocol**:

IAM Endpoint: **iam.us-gov.amazonaws.com**

EC2 Endpoint: **ec2.us-gov-west-1.amazonaws.com**

RDS Endpoint: **us-gov-west-1.amazonaws.com**

For more details about these endpoints, see AWS GovCloud (US) Endpoints.

> **Note:** For regular AWS discovery, the AWS credential should contain empty endpoints. With such settings, the default endpoints are used for discovery and all regions are discovered. The endpoint parameters are used for the following two scenarios:
>
> - Discovery of GovCloud: you must enter specific GovCloud endpoints used by the GovCloud.
> - Discovery of a specific region only: you must specify the endpoints for a particular region. Refer to the AWS documentation for the list of available regions and endpoints used by them.

For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

3. Prerequisites - Driver setup

> **Note:** This step is required for each probe where you want to run AWS discovery.

a. Download the Amazon SDK for Java from http://aws.amazon.com/sdkforjava/.

   The required version is 1.11.75 (referenced as ${VERSION} below) or newer.

b. Unpack the ZIP file to a temporary folder; for example, ${AWS_TEMP_DIR}.

c. Create a folder **${PROBE_ROOT_DIR}/content/lib/aws/**, referred to as ${AWS_PROBE_DIR}.

d. Copy the third-party library JAR files and SDK to ${AWS_PROBE_DIR}:

   ${AWS_TEMP_DIR}/lib/aws-java-sdk-${VERSION}.jar

   ${AWS_TEMP_DIR}/third-party/lib/jackson-annotations-<*version*>.jar

   ${AWS_TEMP_DIR}/third-party/lib/jackson-core-<*version*>.jar

   ${AWS_TEMP_DIR}/third-party/lib/jackson-databind-<*version*>.jar

   ${AWS_TEMP_DIR}/third-party/lib/jackson-dataformat-cbor-<*version*>.jar

${AWS_TEMP_DIR}/third-party/lib/httpclient-<*version*>.jar

${AWS_TEMP_DIR}/third-party/lib/httpcore-<*version*>.jar

${AWS_TEMP_DIR}/third-party/lib/joda-time-<*version*>.jar

An example of the file structure:

C:\hp\UCMDB\DataFlowProbe\content\lib\aws:

- aws-java-sdk-1.11.75.jar
- httpclient-4.5.2.jar
- httpcore-4.4.4.jar
- jackson-annotations-2.6.0.jar
- jackson-core-2.6.6.jar
- jackson-databind-2.6.6.jar
- jackson-dataformat-cbor-2.6.6.jar
- joda-time-2.8.1.jar

4. Run the discovery

   Run the **AWS by Web Services** job.

AWS by Web Services Adapter

This section includes:

- "Input CIT" on the next page
- "Triggered CI Data" on the next page
- "Used Scripts" on the next page
- "Discovered CITs" on page 47
- "Adapter Parameters" on page 48

Input CIT

Discovery Probe Gateway

Triggered CI Data

Name	Value
probeName	${SOURCE.name}

Used Scripts

- vendors.py
- iteratortools.py
- entity.py
- aws.py
- db.py
- db_platform.py
- db_builder.py
- aws_store.py
- aws_rds.py
- ecr_discoverer.py
- ecs_discoverer.py
- ecs.py
- ec2.py
- s3.py
- s3_discoverer.py
- AWS_by_WebServices.py

Discovered CITs

- Amazon Account
- Amazon EBS
- Amazon EC2 Config
- Amazon ECS Cluster
- Amazon ECS Service
- Amazon ECS Task
- Amazon ECS Task Definition
- Amazon Machine Image
- Amazon S3 Bucket
- Amazon Security Policy
- ClusterResourceGroup
- Composition
- ConfigurationDocument
- Containment
- Database
- DB Snapshot
- Dependency (node, aws_ami)
- Docker
- Docker Container
- Docker Daemon
- Docker Image
- Docker Image Tag
- Docker Image Template
- Docker Registry System
- Docker Repository
- IpAddress
- Load Balancer

- Load Balancer Software
- Load Balancing Cluster
- Location
- Logical Volume Snapshot
- LogicalVolume
- Manage
- Membership
- Node
- Ownership
- Realization
- Resource
- UriEndpoint
- Usage

> **Note:** To view the topology, see "Topology" on page 39.
>
> For the Location CIT, the discovered Location **US** is the same as **us-east-1**.

Adapter Parameters

Name	Default Value	Description
remoteJVMArgs		The JVM parameters that should be passed to the remote process.
remoteJVMClasspath	%minimal_ classpath%;../content/lib/aws/*	The class path used by the external Java process.
runInSeparateProcess	true	Indicates whether to run the adapter in the external JVM.

AWS by Web Services Job

This section includes:

- "Adapter" below
- "Trigger Query" below
- "Discovery Flow" below

Adapter

This job uses the **AWS by Web Services** adapter.

Trigger Query

Discovery Flow

Discovering AWS, there is no IP address to trigger on, so the job starts against a probe where there is at least one IP address in the range. (This is a UCMDB work flow requirement.)

Before exploring any service, UCMDB needs to take information about the account the discovery user belongs to. This is done using IAM service; the user has an ARN (Amazon Resource Name) where the account ID is stored.

EC2 Service Discovery

- Get Regions and availability zones
- Get **running** instances; without this information all EBS discovery fails
- Get detailed information about EBS which is used as mapped devices for each running instance

- Get EBS Snapshot information for mapped EBS only
- Get AMI for each running instance; if AMI is not found, the corresponding instances are not reported to UCMDB
- Get Elastic IP information for each instance
- Data is immediately reported to UCMDB after discovery of each service

ECR Service Discovery

- Get Images used by Containers
- Get Repositories
- Link Images to Repositories that Images belong to
- Data is immediately reported to UCMDB after discovery of each service

ECS Service Discovery

- Get Task Definitions
- Get Clusters
- Get Services, Tasks, and EC2 Instances in Cluster
- Get Containers in Task, and link them to the EC2 Instance that they belong to
- Data is immediately reported to UCMDB after discovery of each service

ELB Service Discovery

- Get Classic Load Balancer and Application Load Balancer
- Get related listener and target group
- Get EC2 from listener or target group
- Link Load Balancer with listener and EC2 instances (EC2 instances are in **running status** and with AMI available)
- Data is immediately reported to UCMDB after discovery of each service

S3 Bucket Service Discovery

- Get S3 Buckets
- Get S3 Bucket Region
- Get S3 Bucket Versioning Status

- Get S3 Bucket Replication Status
- Data is immediately reported to UCMDB after discovery of each service

RDS Service Discovery

- Get database instances; without this information all RDS discovery fails
- Get all available engines to enrich information for every database instance server
- Get security and parameter groups to enrich available information in database instances
- Get database snapshots
- Data is immediately reported to UCMDB after discovery of each service

Troubleshooting and Limitations – Amazon Web Services Discovery

This section describes troubleshooting and limitations for Amazon Web Services Discovery.

Problem: The following error messages occur during the discovery:

- `at com.sun.proxy.$Proxy49.getUser(Unknown Source)`
- `Request timestamp is too skewed. Timestamps must be within 900 seconds of server time. Timestamp date: 2015-06-30T04:17:39.196Z`

Solution: Change the probe time and time zone to the standard local time.

Chapter 2: Cloud Foundry Discovery

This chapter includes:

- Overview 53
- Supported Versions 53
- Topology 54
- How to Discover Cloud Foundry Topology by WebServices 55
- CloudFoundry by Web Services Job 57
  - Introduction 57
  - Adapter Information 57

Overview

Cloud Foundry is an open-source cloud-computing platform as a service (PaaS). It is a scalable platform for cloud applications.

The discovery of the following components are supported:

- **Applications**
- **Domains**
- **Organizations**
- **Quotas**
- **Routes**
- **Services and Service Instances**
- **Services Plans**
- **Spaces**

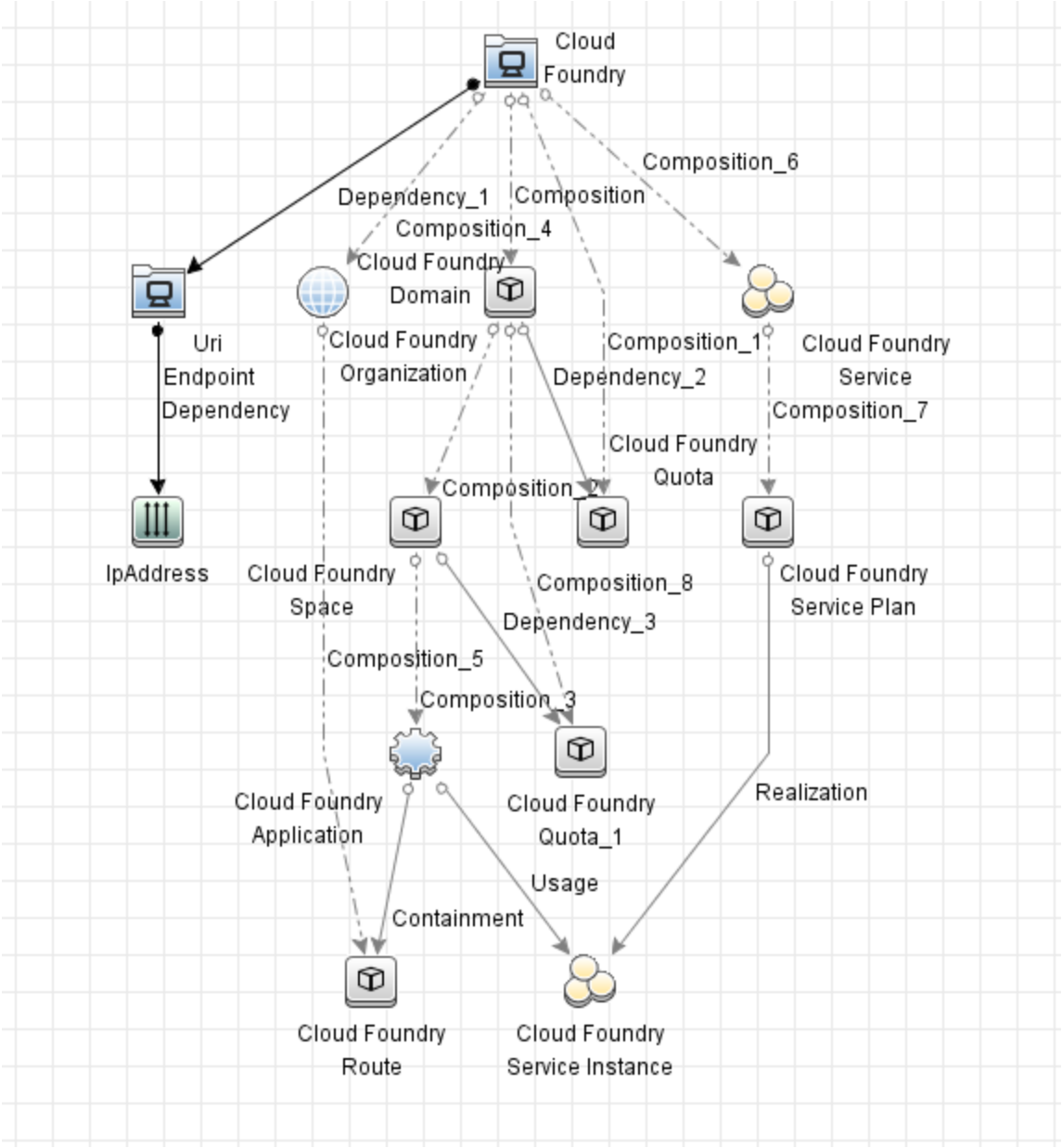
For details about these components, see the Cloud Foundry Documentation website.

Supported Versions

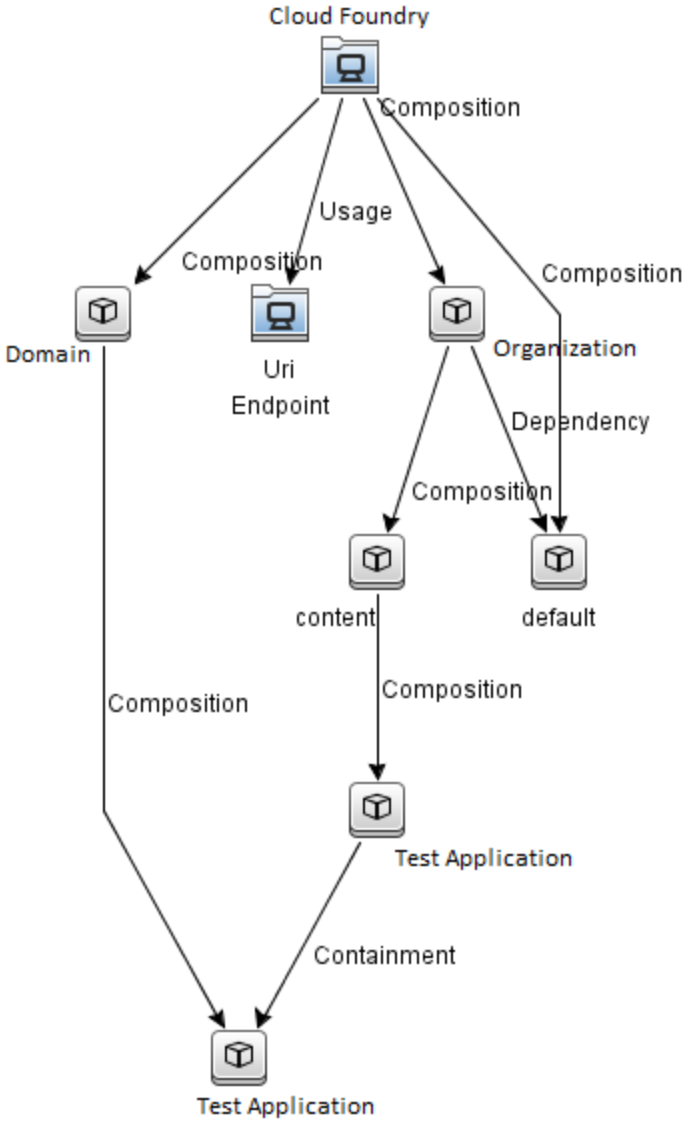
Cloud Foundry discovery supports Cloud Foundry CC API version 2.

Topology

The following image displays the topology of the Cloud Foundry discovery.



For example,



How to Discover Cloud Foundry Topology by WebServices

This task describes how to discover Cloud Foundry components using HTTP Protocol. This discovery process enables you to discover information about running applications, corresponding services, and service plans, service instances with information about spaces and organizations.

This task contains the following steps:

1. Prerequisites – Set up protocol credentials

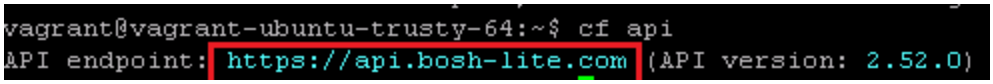
   Cloud Foundry discovery uses the HTTP Protocol.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Configure the URI endpoint

   a. Retrieve the Cloud Foundry API endpoint.

      i. Run the `cf api` command in Cloud Foundry CLI. The output should be like as follows:

      ii. Note down the API endpoint.

   b. Edit **UriEndpointConfiguration.xml**.

      i. Go to **Data Flow Management > Adapter Management > Resources** pane.

      ii. Click the **Find resource** button, enter **UriEndpointConfiguration.xml** in the **Name** field, and then click the **Find Next** button.

      iii. In **UriEndpointConfiguration.xml**, set the proper Data Flow Probe name on which the trigger UriEndpoint runs, set the **url** to the Cloud Foundry API endpoint that you noted down, and set the **type** to **cloudfoundry** as follows:

      ```
      <dataflowprobe name="<Data Flow Probe name>">
        <uri-endpoint>
          <url><Cloud Foundry API endpoint></url>
          <type>cloudfoundry</type>
        </uri-endpoint>
      </dataflowprobe>
      ```

3. Run the discovery

   Run the following jobs in the following order:

   a. **Manual UriEndpoint Discovery**

   b. **CloudFoundry by Web Services**

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

CloudFoundry by Web Services Job

This section includes details about the job.

Introduction

This job discovers applications and services on a Cloud Foundry.

Trigger TQL

CI	Attribute Value
UriEndpoint	(Type Equal cloudfoundry) AND (NOT (IP Probe Name Is null))

Adapter Information

This job uses the **CloudFoundry by WebServices** adapter.

Adapter Type

Jython

Input CIT

UriEndpoint

Input TQL

CI	Attribute Value
SOURCE	NOT IP Probe Name Is null

Triggered CI Data

Name	Value
endpoint	${SOURCE.uri}

Used Scripts

- rest_cache.py
- rest_json.py
- rest_requests.py
- cloudfoundry.py
- cloudfoundry_client.py
- cloudfoundry_discoverer.py
- cloudfoundry_by_webservices.py

Discovered CITs

- Cloud Foundry
- Cloud Foundry Application
- Cloud Foundry Domain
- Cloud Foundry Organization
- Cloud Foundry Quota
- Cloud Foundry Route
- Cloud Foundry Service
- Cloud Foundry Service Instance
- Cloud Foundry Service Plan
- Cloud Foundry Space

Chapter 3: Cloud Foundry Event Discovery

This chapter includes:

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Event Types 60

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How to Use Cloud Foundry Event Discovery 62

CloudFoundry Event Monitor Job 64

Troubleshooting and Limitations – Cloud Floundry Event Discovery 66

Overview

Cloud Foundry provides RESTful API to get the events. The **Cloud Foundry Event Monitor** job queries the events every 30 seconds and reports them into UCMDB.

For details about the event based discovery, see the *Event Based Discovery* section in the *HPE UCMDB Discovery and Integrations Content Guide - General Reference*.

Event Types

Cloud Foundry Event Discovery handles the following Events:

Name	Description	Operation in UCMDB
audit.app.create	Signals the creation of an application	Create a Cloud Foundry Application CI
audit.app.delete-request	Signals the deletion of an application	Delete a Cloud Foundry Application CI
audit.route.create	Signals the creation of a route	Create a Cloud Foundry Route CI
audit.route.delete-request	Signals the deletion of a route	Delete a Cloud Foundry Route CI
audit.service.create	Signals the creation of a service	Create a Cloud Foundry Service CI
audit.service.delete	Signals the deletion of a service	Delete a Cloud Foundry Service CI
audit.service_ instance.create	Signals the creation of a service instance	Create a Cloud Foundry Service Instance CI
audit.service_ instance.delete	Signals the deletion of a service instance	Delete a Cloud Foundry Service Instance CI
audit.service_ plan.create	Signals the creation of a service plan	Create a Cloud Foundry Service Plan CI
audit.service_ plan.delete	Signal the deletion of a service plan	Delete a Cloud Foundry Service Plan CI
audit.space.create	Signals the creation of a space	Create a Cloud Foundry Space CI
audit.space.delete-request	Signals the deletion of a space	Delete a Cloud Foundry Space CI
audit.service_	Signals the creation of a relationship	Create a relationship between the

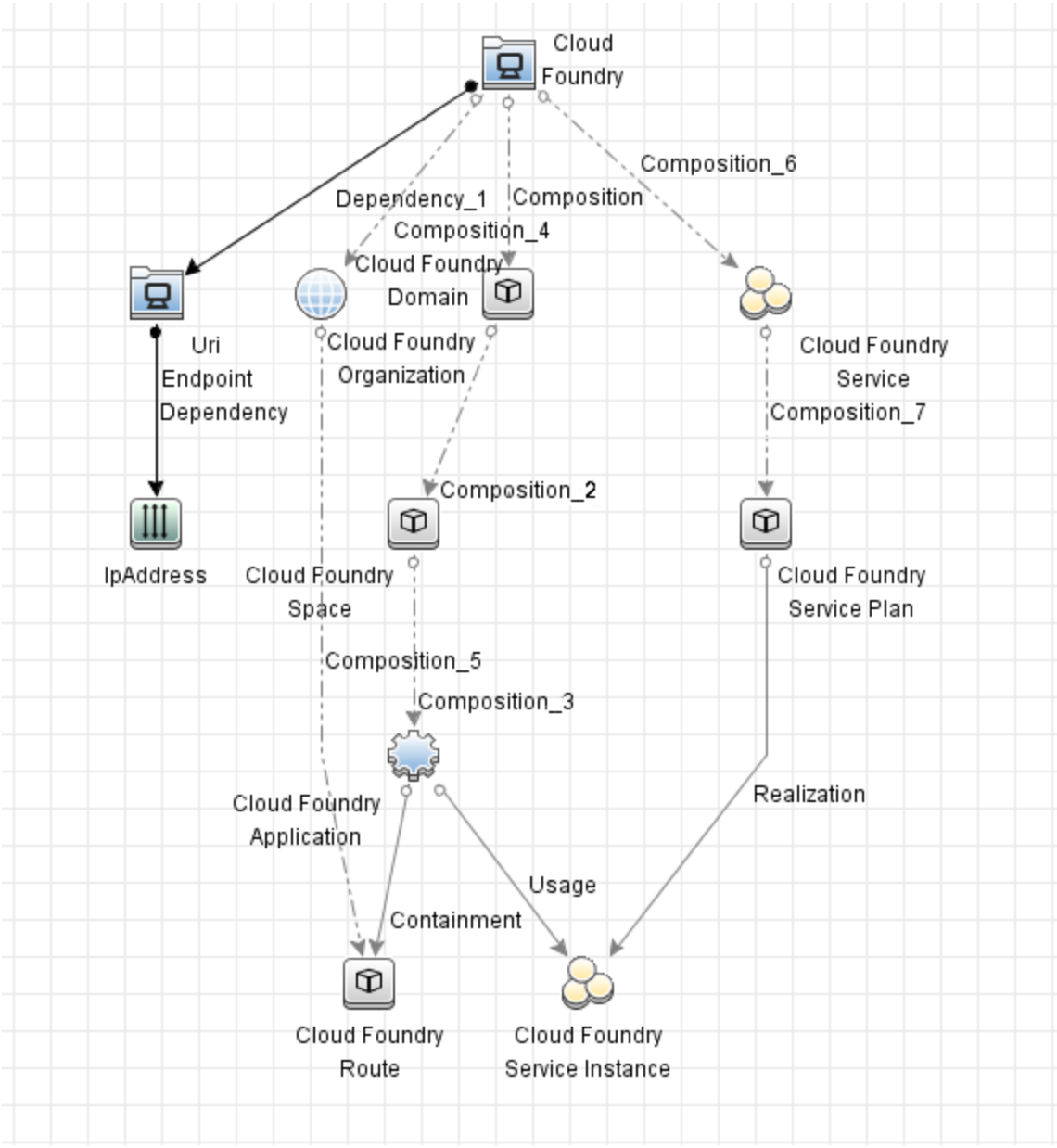
Name	Description	Operation in UCMDB
binding.create	between the application and the service instance that the application is bound to	Application and the Service instance that the application is bound to
audit.service_ binding.delete	Signals the deletion of a relationship between the application and the service instance that the application is bound to	Delete a relationship between the Application and the Service instance that the application is bound to
audit.app.map-route	Signals the creation of a relationship between an application and a route	Create a relationship between an application and a route
audit.app.unmap-route	Signals the deletion of a relationship between an application and a route	Delete a relationship between an application and a route

Supported Versions

Cloud Foundry Event Discovery supports Cloud Foundry CC API version 2.

Topology

The following image displays the topology of the Cloud Foundry Event Discovery.



How to Use Cloud Foundry Event Discovery

This task includes the following steps:

1. Prerequisites – Set up protocol credentials

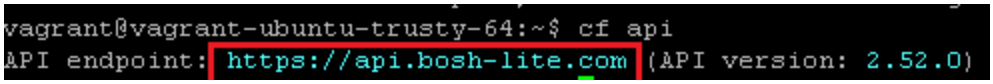
   Cloud Foundry event discovery uses the HTTP Protocol.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Configure the URI endpoint

   a. Retrieve the Cloud Foundry API endpoint.

      i. Run the `cf api` command in Cloud Foundry CLI. The output should be like as follows:

      ii. Note down the API endpoint.

   b. Edit **UriEndpointConfiguration.xml**.

      i. Go to **Data Flow Management > Adapter Management > Resources** pane.

      ii. Click the **Find resource** button, enter **UriEndpointConfiguration.xml** in the **Name** field, and then click the **Find Next** button.

      iii. In **UriEndpointConfiguration.xml**, set the proper Data Flow Probe name on which the trigger UriEndpoint runs, set the **url** to the Cloud Foundry API endpoint that you noted down, and set the **type** to **cloudfoundry** as follows:

      ```
      <dataflowprobe name="<Data Flow Probe name>">
        <uri-endpoint>
          <url><Cloud Foundry API endpoint></url>
          <type>cloudfoundry</type>
        </uri-endpoint>
      </dataflowprobe>
      ```

3. Run the discovery

   Run the following jobs in the following order:

   a. **Manual UriEndpoint Discovery**

   b. **CloudFoundry by Web Services**

   c. **CloudFoundry Event Monitor**

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

CloudFoundry Event Monitor Job

This section contains information about the job.

Introduction

This job is used to monitor Cloud Foundry events.

Trigger TQL

CI	Attribute Value
UriEndpoint	Type Equal cloudfoundry AND (NOT URI Probe Name Is null)

Adapter Information

This job uses the **CloudFoundry Event Monitor** adapter.

Adapter Type

Jython

Input CIT

UriEndpoint

Input Query

CI	Attribute Value
SOURCE	NOT URI Probe Name Is null

Triggered CI Data

Name	Value
endpoint	${SOURCE.uri}

Used Script

- cloudfoundry.py
- cloudfoundry_client.py
- cloudfoundry_discoverer.py
- cloudfoundry_event_monitor.py
- json_stream.py
- rest_requests.py

Discovered CITs

- Cloud Foundry
- Cloud Foundry Application
- Cloud Foundry Route
- Cloud Foundry Service
- Cloud Foundry Service Instance
- Cloud Foundry Service Plan

- Cloud Foundry Space

Troubleshooting and Limitations – Cloud Floundry Event Discovery

This section includes:

Troubleshooting – Cloud Foundry Event Discovery 66
Limitations – Cloud Foundry Event Discovery 67

Troubleshooting – Cloud Foundry Event Discovery

This section describes troubleshooting for the Cloud Foundry Event Discovery.

- Check whether the **CloudFoundry Event Monitor** job is started successfully

  In the communication log, if the following information occurs, the connection between Data Flow Probe and Cloud Foundry is established:

```
<log start="11:07:38" severity="info">Start sourceCloudFoundry event
pulling</log>

<log start="11:07:38" severity="info">Start CloudFoundry event
source...</log>
```

- Check whether the **CloudFoundry Event Monitor** job can receive events successfully

  In **probeMgr-adaptersDebug.log** of Data Flow Probe on which the **CloudFoundry Event Monitor** job runs, if the following information occurs, the job can receive events from the target Cloud Foundry:

```
<2016-10-08 16:20:37,562> [DEBUG] [JobExecuterWorker-0:CloudFoundry Event
Monitor:Event Hub Worker:Thread-5] - Event type:audit.space.create

<2016-10-08 16:20:37,563> [DEBUG] [JobExecuterWorker-0:CloudFoundry Event
Monitor:Event Hub Worker:Thread-4] - handle event {...}

<2016-10-08 16:20:37,891> [DEBUG] [JobExecuterWorker-0:CloudFoundry Event
Monitor:Event Hub Worker:Thread-4] - Reported CIs: [...]
```

- Check whether the **CloudFoundry Event Monitor** job works continuously

  In the communication log, if the following information is printed out every 30 seconds to indicate the monitor is working, the connection between Data Flow Probe and Cloud Foundry is established:

  ```
  <log start="11:07:40" severity="debug">Get Event from: 2016-09-
  29T03:13:41Z</log>
  ```

- Check whether connection issues occur between Data Flow Probe and Cloud Foundry

  In the communication log, if the following information occurs, the connection between Data Flow Probe and Cloud Foundrycannot be established:

  ```
  <log start="14:18:34" severity="debug">Failed to connect to CloudFoundry.
  ...
  </log>
  ```

Limitations – Cloud Foundry Event Discovery

This section describes limitations for the Cloud Foundry Event Discovery.

- Because the **CloudFoundry Event Monitor** job needs to monitor events from Cloud Foundry continuously, this job will never stop. In the control panel, the status of this job is **Reached Probe** forever. In the communication log, the following message occurs:

  ```
  ...Incomplete communication log...
  ```

- For the **audit.service_binding.delete** event, only the service-bindings reported by the **Cloud Foundry Event Monitor** job can be deleted.
- For the **audit.route.delete-request** event, only the routes reported by the **Cloud Foundry Event Monitor** job can be deleted.

Chapter 4: Microsoft Azure Discovery

This chapter includes:

- Overview 69
- Topology 69
- Discovery Mechanism 70
- How to Discover Microsoft Azure Topology by WebServices 70
- How to Authenticate using Azure Active Directory 72
- Azure by WebServices Job 77
  - Introduction 77
  - Adapter Information 77
- Troubleshooting and Limitations – Microsoft Azure Discovery 79

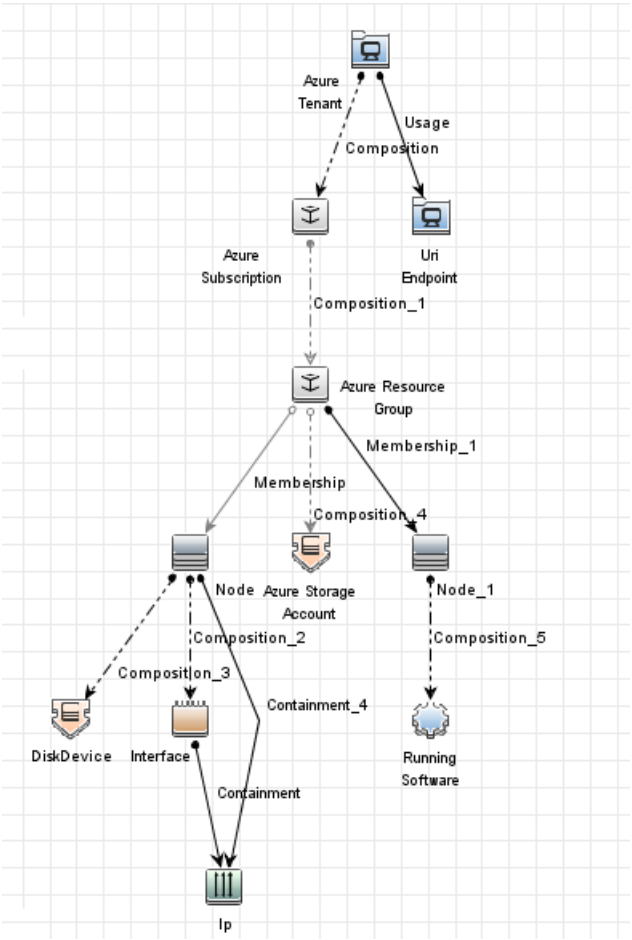
Overview

Microsoft Azure is a cloud-computing platform and infrastructure. It is created by Microsoft for building, deploying, and managing applications and services through a global network of Microsoft-managed data centers.

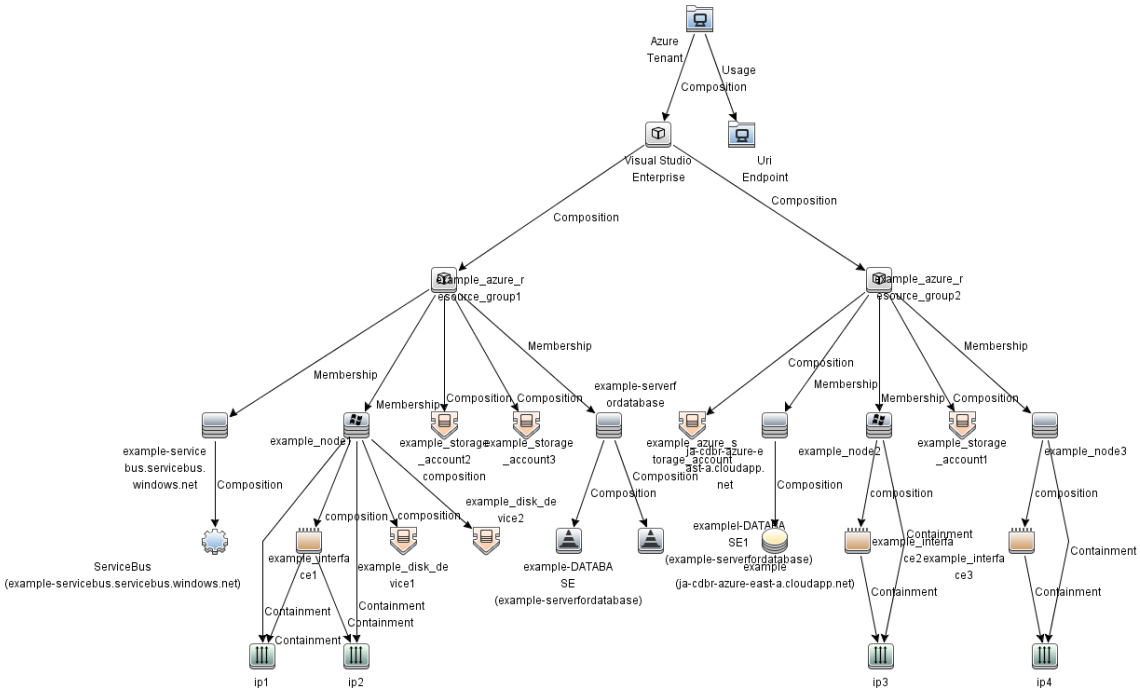
> **Note:** Microsoft Azure discovery requires UCMDB 10.22 or later.

Topology

The following image displays the topology of the Microsoft Azure discovery.



For example,



Discovery Mechanism

The **Azure by WebServices** job depends on Microsoft Azure SDK. The job retrieves all resources from Microsoft Azure and then maps them to UCMDB CI types according to the configured mapping file. The mapping and relationship definition of all CI types can be customized but must follow the UCMDB reconciliation rule.

How to Discover Microsoft Azure Topology by WebServices

This task describes how to discover Microsoft Azure components using HTTP Protocol. This discovery process enables you to discover information about resource groups, virtual machines, networks and storage accounts with information about subscriptions and tenants.

> **Note:** Virtual Machine (classic) cannot be discovered, because Microsoft recommends that most new deployments use the Resource Manager model.

This task contains the following steps:

1. Prerequisites – Set up protocol credentials

   Microsoft Azure discovery uses the HTTP Protocol.

   Retrieve the **CLIENT ID** and **keys** from Microsoft Azure as the **Username** and **Password** of HTTP protocol to configure the credential. For details, see "How to Authenticate using Azure Active Directory" on the next page.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Configure the URI endpoint

   a. Retrieve the Microsoft Azure **tenant_id**. For details, see "How to Authenticate using Azure Active Directory" on the next page.

   b. Edit **UriEndpointConfiguration.xml**.

      i. Go to **Data Flow Management > Adapter Management > Resources** pane.

      ii. Click the **Find resource** button, enter **UriEndpointConfiguration.xml** in the **Name** field, and then click the **Find Next** button.

      iii. In **UriEndpointConfiguration.xml**, set the proper Data Flow Probe name on which the trigger UriEndpoint runs and set the **url** and **type** as follows:

```
<dataflowprobe name="<Data Flow Probe name>">
  <uri-endpoint>
    <url>https://login.microsoftonline.com/<tenant_id></url>
    <type>azure</type>
  </uri-endpoint>
</dataflowprobe>
```

3. Run the discovery

   Run the following jobs in the following order:

   a. **Manual UriEndpoint Discovery**

   b. **Azure by WebServices**

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

How to Authenticate using Azure Active Directory

> **Note:** Requests to the management service must be authenticated using one of the following methods:
>
> - Authenticate using Azure Active Directory
> - Authenticate using a management certificate
>
> Currently, only the Azure Active Directory authentication is supported.

Secure requests to the management service can be authenticated by creating an Azure AD application and using the **Active Directory Authentication Library** to obtain an access token from the application.

1. Add an application to Azure AD

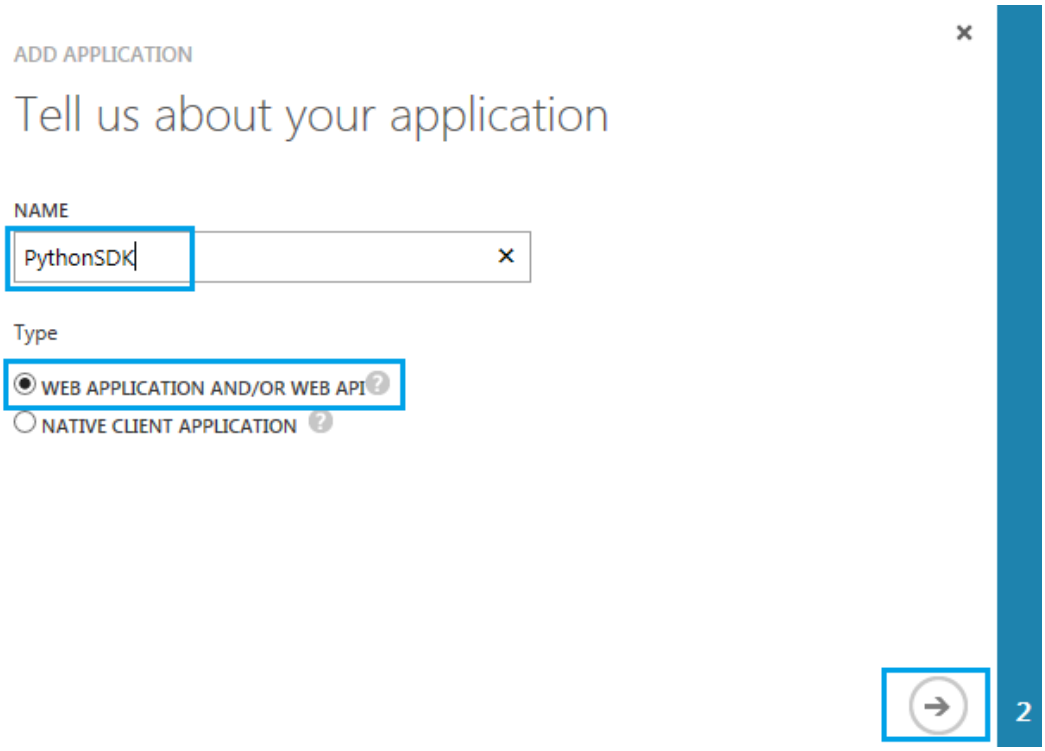
   a. Sign in to Microsoft Azure, and then click **Browse > Active Directory** to go to Azure Management Portal.

   b. Towards the bottom of the left menu, click **Active Directory** and then click **Default Directory**.

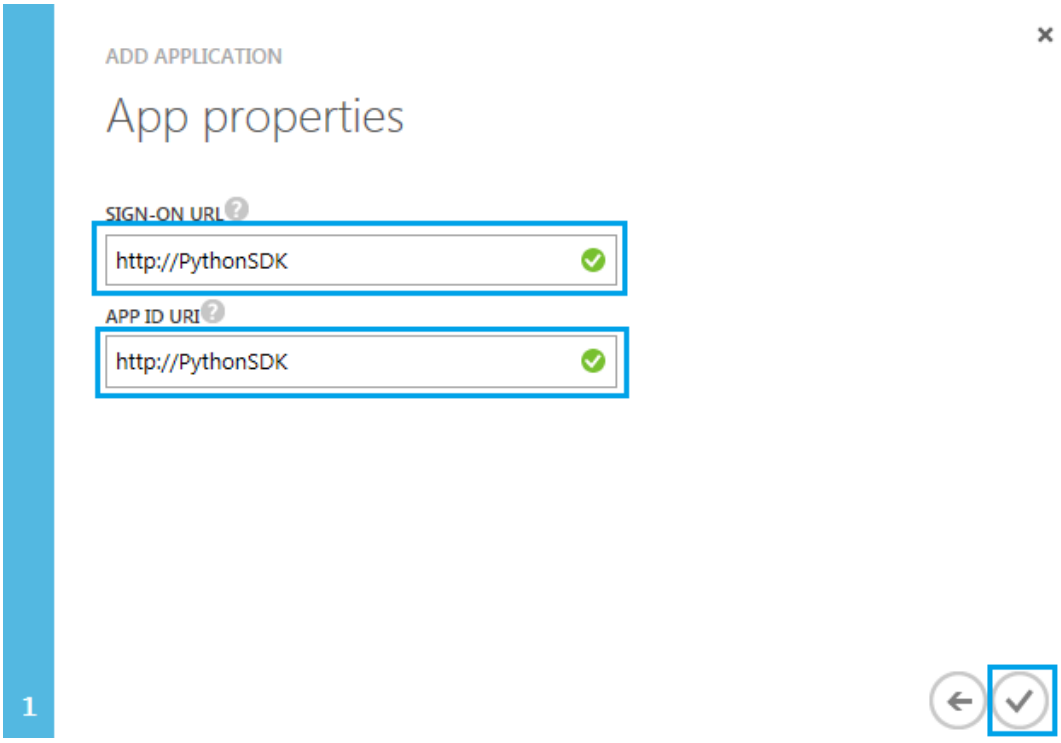
   c. On the default directory page, click **Applications**, and then at the bottom of the menu click **ADD** to add a new application.

   d. Click **Add an application you're developing**.

e. Enter the name of the application, select **WEB APPLICATION AND/OR WEB API**, and then click the right arrow.



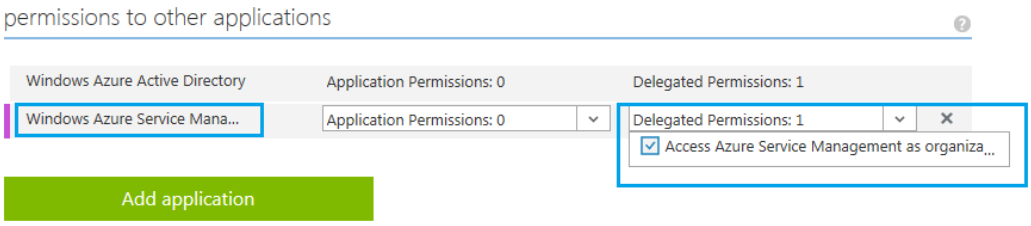
f. Enter a URI for the application as follows, and then click the check mark.



g. After the application is created, you must add permission for the application to access the Service Management APIs. Go to the page for your application, and then click **Configure**.

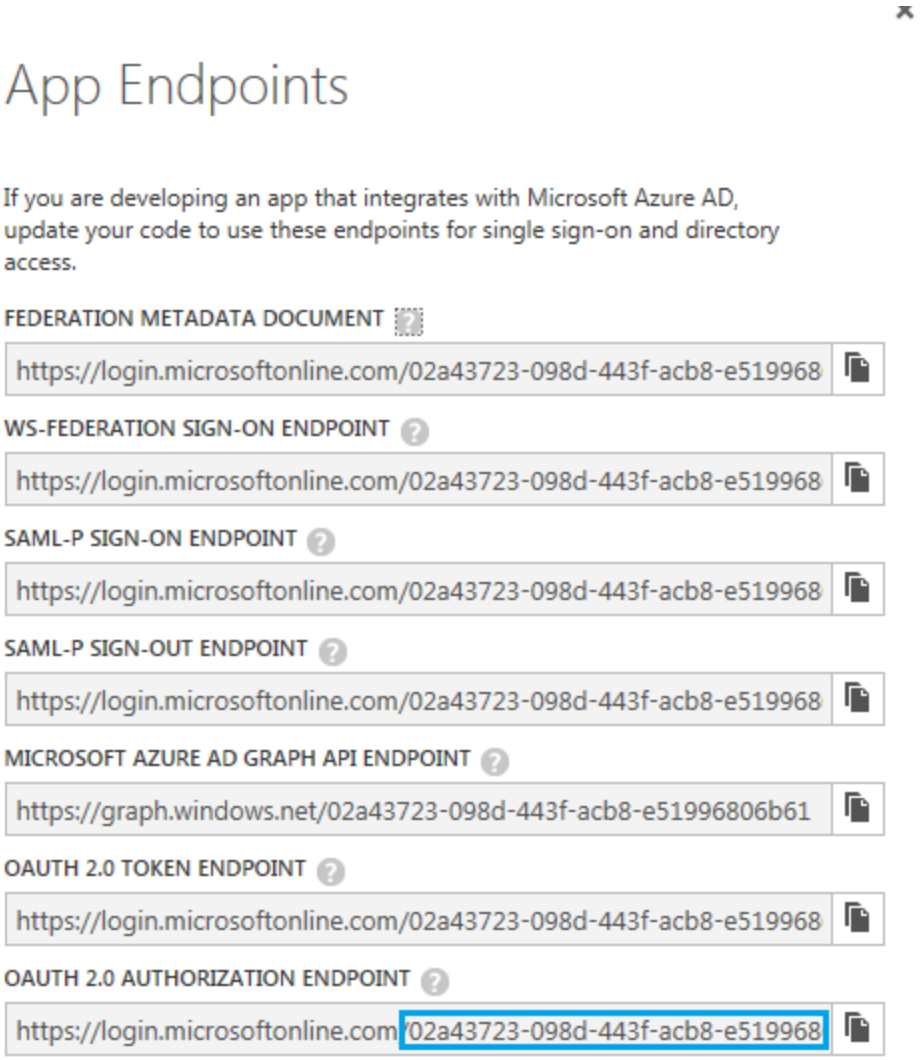
h. In the **permissions to other applications** section at the bottom of the configuration page, click **Add application**, and then select **Windows Azure Service Management API**.

i. Click **Delegated Permissions: 0**, and then select **Access Azure Service Management**.

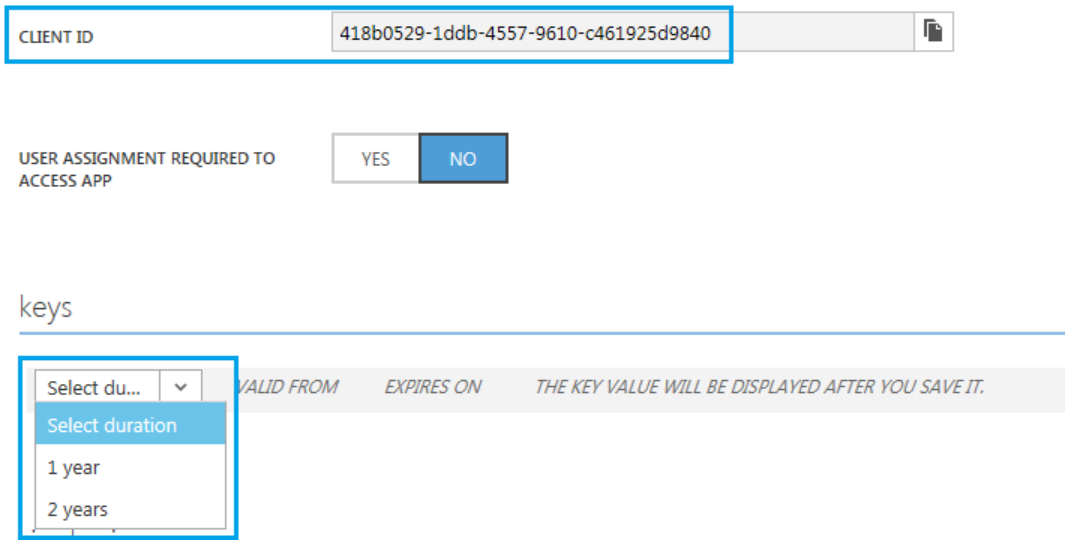


j. Click **SAVE** on the bottom menu.

k. Click **VIEW ENDPOINTS** on the bottom menu to retrieve **tenant_id** in the placeholder.



l. Find **CLIENT ID** and **keys** on the Configuration page of the application, and click **Select duration** to select duration for the key.



m. Take **CLIENT ID** as the **Username** of HTTP protocol and **keys** as the **Password** of HTTP protocol to configure the credential.

For more details, see https://msdn.microsoft.com/en-us/library/azure/ee460782.aspx#bk_ad.

2. Provide access to the application

Because the **Azure by WebServices** discovery job uses Microsoft Azure Python SDK (Azure Active Directory Library for Python), you need to provide access to the application that you added.

Using PowerShell, you can run the following:

```
### Install the Azure Resource Manager (ARM) PowerShell module from the
### PowerShell Gallery
Install-Module -Name AzureRm

### Note: If this command fails, you can install Azure PowerShell from WebPI.
### For details, see
### https://azure.microsoft.com/en-us/documentation/articles/powershell-install-configure/.

### Install the AzureRm child modules (this may take a few minutes)
Install-AzureRm

### Authenticate to Microsoft Azure (an authentication dialog will open)
$null = Login-AzureRmAccount

### List out the Microsoft Azure subscriptions available to your account
Get-AzureRmSubscription | Format-Table -AutoSize
```

```
### Select the Microsoft Azure subscription you want to manipulate
Set-AzureRmContext -SubscriptionId ABCDEFGH-1234-1234-1234-ABCDEFGH

### List out the Azure Active Directory (AAD) Service Principals in your AAD
### tenant
Get-AzureRmADServicePrincipal | Sort-Object -Property DisplayName

### Assign the "contributor" role to your Azure Active Directory (AAD)
### Service Principal
New-AzureRmRoleAssignment -ServicePrincipalName http://PythonSDK -
RoleDefinitionName Contributor
```

For more details, see Microsoft Azure Active Directory Authentication Library (ADAL) for Python.

Azure by WebServices Job

This section includes details about the job.

Introduction

This job discovers applications and services on an Azure.

Trigger TQL

CI	Attribute Value
UriEndpoint	Type Equal azure AND NOT URI Probe Name Is null

Adapter Information

This job uses the **Azure by WebServices** adapter.

Adapter Type

Jython

Input CIT

UriEndpoint

Input TQL

CI	Attribute Value
SOURCE	NOT URI Probe Name Is null

Triggered CI Data

Name	Value
endpoint	${SOURCE.uri}

Used Scripts

- vendors.py
- rest_json.py
- rest_cache.py
- rest_requests.py
- azure.py
- azure_configuration.py
- azure_client.py
- azure_discoverer.py
- azure_by_webservices.py

Discovered CITs

- Azure Resource Group
- Azure Storage Account
- Azure Subscription
- Azure Tenant
- Composition
- Containment
- DiskDevice
- Interface
- IpAddress
- Membership
- MySQL
- Node
- Realization
- RunningSoftware
- SQL Server
- UriEndpoint
- Usage

Troubleshooting and Limitations – Microsoft Azure Discovery

Limitation: If you stop and start the virtual machine included in Microsoft Azure discovery, and then clean the Data Flow Probe cache in Universal Discovery, duplicate nodes will be created.

Workaround: None.

Chapter 5: OpenStack Discovery

This chapter includes:

- Overview 81
- Supported Versions 81
- Topology 82
- How to Discover OpenStack Topology by Web Services 85
- OpenStack by Web Services Job 85
  - Introduction 85
  - Adapter Information 86
- Troubleshooting and Limitations – OpenStack Discovery 88

Overview

OpenStack is an open-source cloud-computing platform for both public and private clouds. It controls large pools of compute, storage, and networking resources throughout a data center.

OpenStack is managed through a dashboard that gives administrators control while empowering their users to provision resources through a web interface.

OpenStack discovery shows the state and configuration of your cloud using jclouds APIs. The discovery of these low-level infrastructure services are supported:

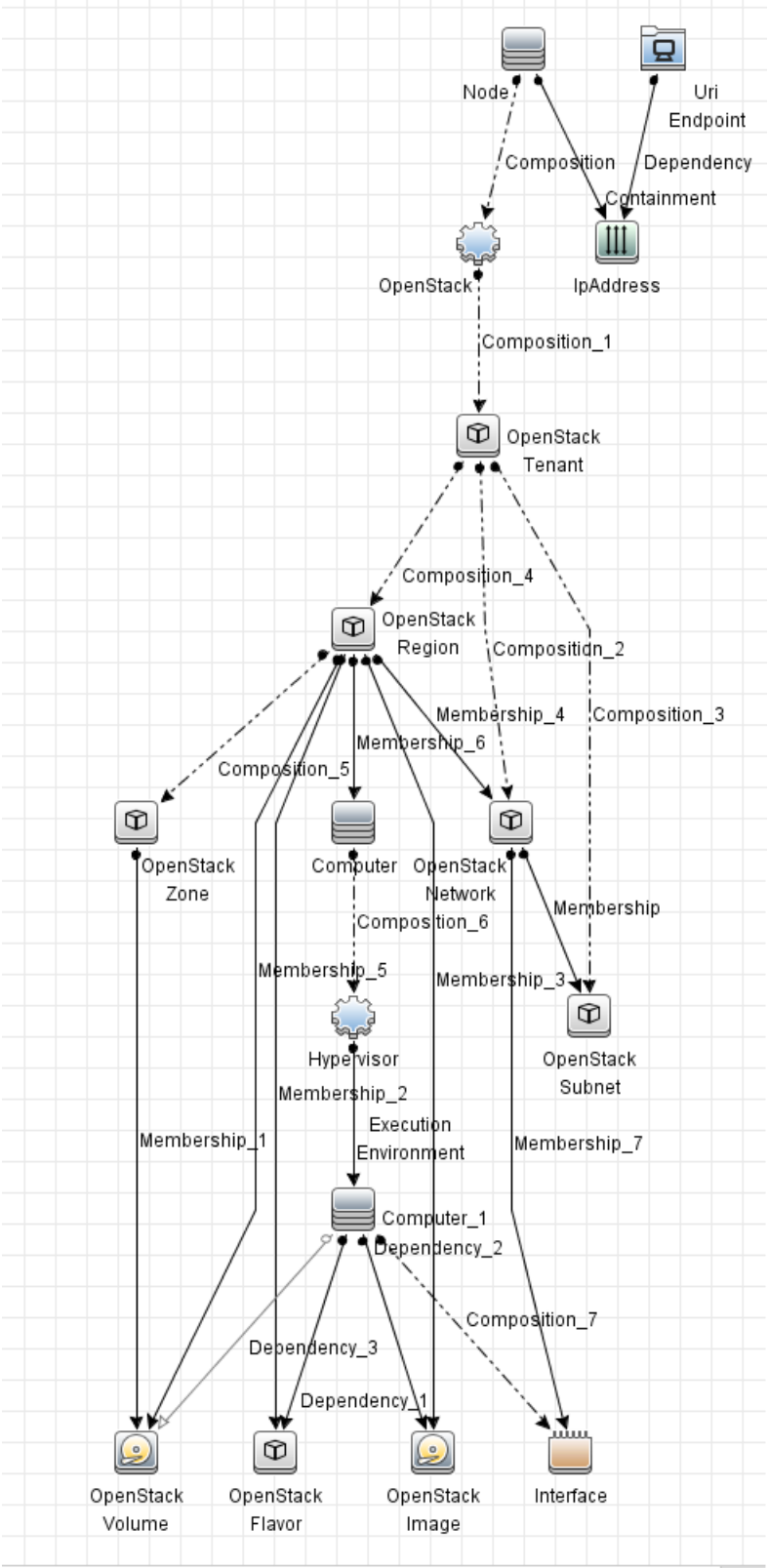
- **Nova (Compute)**
  - Manages the lifecycle of compute instances in an OpenStack environment.
  - Its responsibilities include spawning, scheduling, and decommissioning of virtual machines on demand.
- **Neutron (Networking)**
  - Enables Network-Connectivity-as-a-Service for other OpenStack services, such as OpenStack Compute.
  - Provides an API for you to define networks and attachments into them.
  - Has a pluggable architecture that supports many popular networking vendors and technologies.
- **Cinder (Volume)**
  - Provides the persistent block storage to running instances.
  - Its pluggable driver architecture facilitates the creation and management of block storage devices.
- **Glance (Image)**
  - Stores and retrieves virtual machine disk images. OpenStack Compute makes use of this during the instance provisioning.
- **Keystone (identity)**
  - Provides an authentication and authorization service for other OpenStack services.
  - Provides a catalog of endpoints for all OpenStack services.

Supported Versions

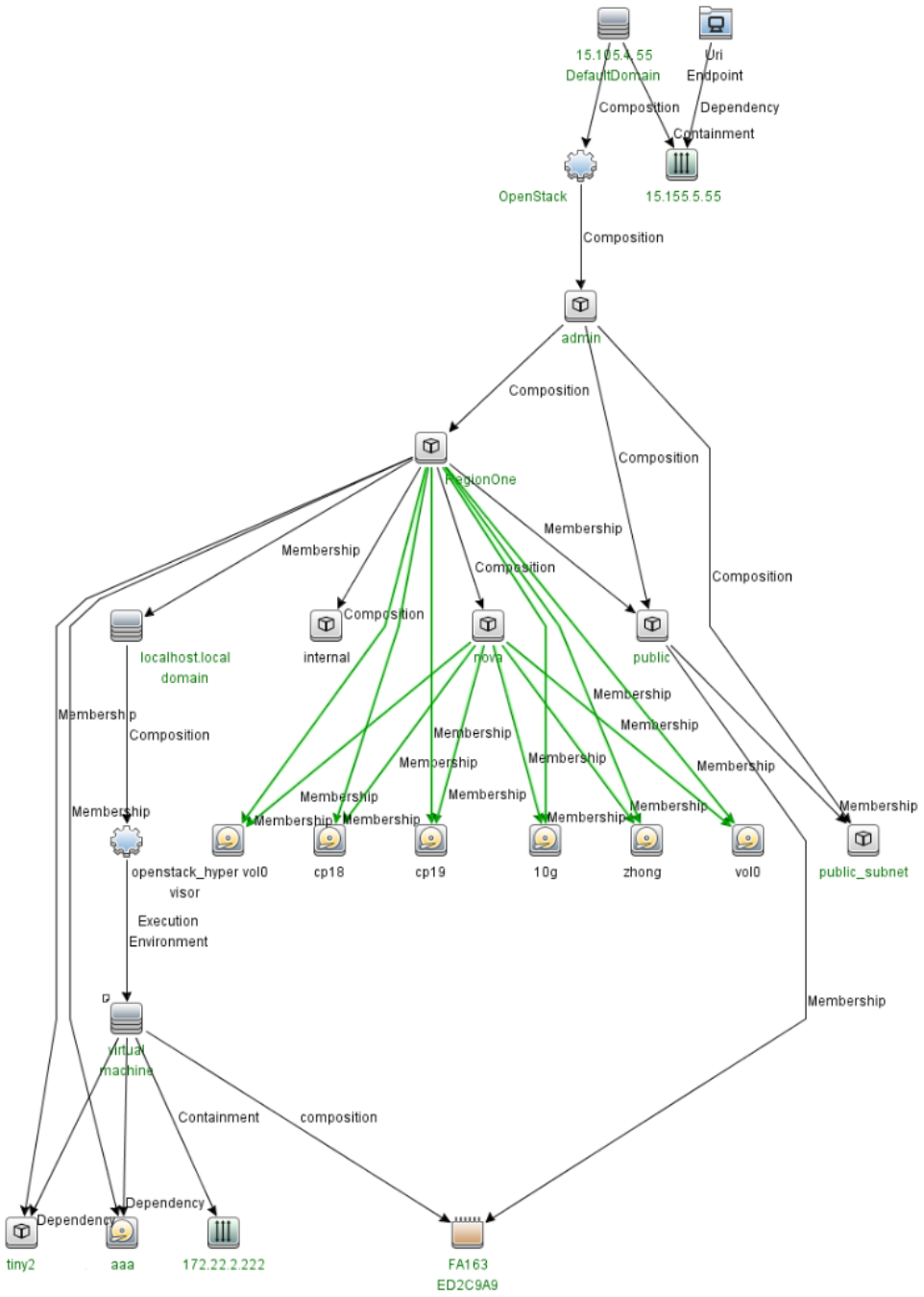
OpenStack discovery supports Liberty, Mitaka, Newton, and Ocata.

Topology

The following image displays the topology of the OpenStack discovery.



For example,


15.155.5.55
DefaultDomain
Uri
Endpoint
Composition
Dependency
Containment
OpenStack
15.155.5.55
Composition
admin
Composition
Composition
RegionOne
Membership
Membership
Composition
Composition
localhost.local
domain
Composition
internal
nova
public
Membership
Membership
Membership
Membership
Membership
Membership
Membership
Membership
Membership
Membership
Membership
Membership
Membership
Composition
Membership
openstack_hyper
visor
vol0
cp18
cp19
10g
zhong
vol0
public_subnet
Execution
Environment
p
Membership
virtual
machine
Containment
composition
Dependency
Dependency
tiny2
aaa
172.22.2.222
FA163
ED2C9A9

How to Discover OpenStack Topology by Web Services

This task describes how to discover OpenStack components using HTTP Protocol. This discovery process enables you to discover information about running node instances, corresponding block storage, and networks with information about regions and zones.

This task contains the following steps:

1. Prerequisites - Set up protocol credentials

   OpenStack discovery uses the HTTP Protocol.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Run the discovery

   Run the following jobs in the following order:

   a. **Manual UriEndpoint Discovery**

   b. **OpenStack by Web Services**

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

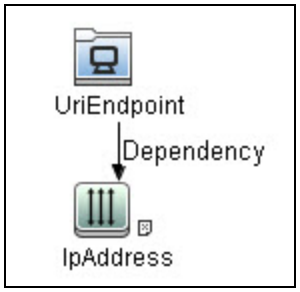
OpenStack by Web Services Job

This section includes details about the job.

Introduction

This job discovers projects, compute resources, networks, storage and other details on an OpenStack using the HTTP protocol.

Trigger TQL



CI	Attribute Value
UriEndpoint	Type Equal openstack
IpAddress	NOT IP Probe Name Is null

Adapter Information

This job uses the **OpenStack by WebServices** adapter.

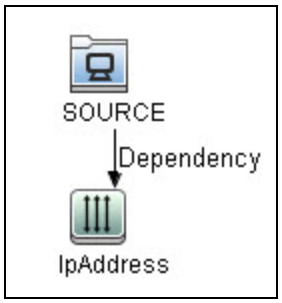
Adapter Type

Jython

Input CIT

UriEndpoint

Input TQL



Triggered CI Data

Name	Value
endpoint	${SOURCE.uri}
ip	${IpAddress.name}

Used Scripts

- vendors.py
- openstack_client.py
- openstack.py
- openstack_discoverer.py
- openstack_by_webservices.py

Discovered CITs

- Composition
- Containment
- Dependency
- ExecutionEnvironment
- Interface
- IpAddress
- Membership
- Node
- OpenStack Flavor
- OpenStack Image
- OpenStack Network
- OpenStack Region
- OpenStack Subnet
- OpenStack Tenant

- OpenStack Volume
- OpenStack Zone
- Usage
- Virtualization Layer Software

Adapter Parameters

Parameter	Default Value	Description
remoteJVMArgs		The JVM parameters that should be passed to the remote process.
remoteJVMClasspath	../runtime/probeManager/discoveryResources/openstack/*;%minimal_classpath%	The external JVM classpath.
runInSeparateProcess	true	Indicates whether to run the adapter in the external JVM.

Troubleshooting and Limitations – OpenStack Discovery

This section describes troubleshooting and limitations for the OpenStack discovery.

Problem: The HTTPS certificate of the OpenStack Identity API access endpoint is invalid or expired.

Solution: Download the certificate and import the certificate into the Data Flow Probe Trusted Store. To do so,

1. Download the HTTPS certificate of the OpenStack Identity API access endpoint. Perform the following steps:
   a. Open the Microsoft Internet Explorer and go to the address of the OpenStack Identity API access endpoint.
   b. Click the **Lock** button on the **Address** bar, and then click **View certificates**.
   c. In the Certificate dialog box, click the **Details** tab, and then click **Copy to File...**.
   d. In the Certificate Export Wizard dialog box, click **Next**.

- Select the format **DER encoded binary X.509 (.CER)**.
- Type a certificate file name, for example, **snow_host.cert**, and then save it to a temporary location.

e. Click **Finish**. You can see the **The export was successful** message.

2. Locate the JRE security folder. By default it is located at ***<DataFlowProbe installation folder>*\bin\jre\lib\security**.
3. Back up the **cacerts** file by copying it to another folder.
4. Import the previously created certificate file **snow_host.cert** into the Data Flow Probe Trusted Store.

   Open a Command Prompt window and run the following commands on the local Data Flow Probe:

   ```
   cd <DataFlowProbe installation folder>\bin\jre\bin
   keytool.exe -import -storepass <truststore pass> -keystore <DataFlowProbe
   installation folder>\bin\jre\lib\security\
   cacerts -trustcacerts -file <the path of the certificate file snow_
   host.cert>
   ```

5. In the Command Prompt window, when the message **Trust this certificate?** appears, enter **yes**.
6. Restart the Data Flow Probe service.

Chapter 6: OpenStack Event Discovery

This chapter includes:

Overview 91

Event Types 91

Supported Versions 91

Topology 92

How to Use OpenStack Event Discovery 92

Manual AMQP for OpenStack Job 93

OpenStack Event Monitor Job 95

Troubleshooting and Limitations – OpenStack Event Discovery 97

Overview

OpenStack is one of the most popular Cloud providers. In OpenStack, the Nova (Compute node) sends events to a message queue by the Advanced Message Queuing Protocol (AMQP). By default, the message queue server is the RabbitMQ server. An Event Source is implemented to act as an AMQP client to subscribe events from the AMQP server.

For details about the event based discovery, see the *Event Based Discovery* section in the *HPE UCMDB Discovery and Integrations Content Guide - General Reference*.

> **Note:** This discovery requires UCMDB 10.22 or later.

Event Types

HPE has subscribed the exchange **nova** and routing key **notifications.info**. OpenStack Event Discovery handles the following Events:

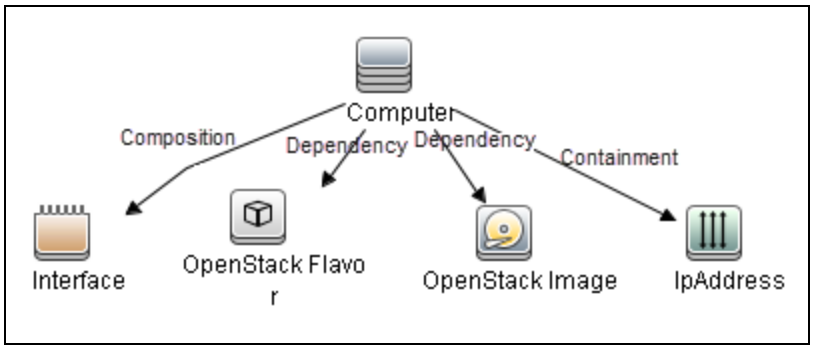
Name	Description	Operation in UCMDB
compute.instance.create.end	Signals the successful end of an instance creation operation	Create Node CI
compute.instance.delete.end	Signals the successful end of an instance deletion operation	Delete Node CI
compute.instance.resize.start	Signals the beginning of a resize or code migration operation	
compute.instance.finish_ resize.end	Signals the end of a successful resize or code migration operation	Move a relationship between virtual machine and Host
compute.instance.live_ migration.post.dest. [start/end]	Signal the beginning or end of an instance live migration	Move a relationship between virtual machine and Host

Supported Versions

OpenStack event discovery supports Liberty, Mitaka, Newton, and Ocata.

Topology

The following image displays the topology of the OpenStack Event Discovery.



How to Use OpenStack Event Discovery

This task includes the following steps:

1. Prerequisite – Configuration in OpenStack

   Enable notifications in Nova. Make sure that the following configuration exists in **nova.conf** (**/etc/nova/nova.conf**) and restart Nova-related services.

   ```
   [DEFAULT]
   notification_topics=notifications
   notification_driver=messagingv2
   ```

2. Prerequisite – Configuration in UCMDB

   - Create a new AMQP protocol for the AMQP server.

     For details on how to create a protocol, see the *Protocol Parameter Dialog Box* section in the *HPE Universal CMDB Data Flow Management Guide* document.

     For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

   - Add the IP address of the AMQP server to the Range of Data Flow Probe.

For Range information, see the *New/Edit Range Dialog Box* section in the *HPE Universal CMDB Data Flow Management Guide* document.

3. Run the discovery

   a. Run the **Range IPs by ICMP** job to discover IP addresses.

   b. Run the **Manual AMQP for OpenStack** job to discover the AMQP server that is used by OpenStack.

   > **Note:** You need to first click **Add CI** in the Discovery Progress pane to add the IpAddress CI that belongs to the AMQP server and then activate the **Manual AMQP for OpenStack** job.

   c. Wait until the **Manual AMQP for OpenStack** job is finished. Messaging Server CI should be discovered.

   d. Run the **OpenStack Event Monitor** job to monitor events from the AMQP server.

   e. Wait for OpenStack events.

> **Note:** The **Manual AMQP for OpenStack** and **OpenStack Event Monitor** jobs only work on Jython 2.7 that is bundled with UCMDB 10.22 or later. This is because the driver of the AMQP protocol only supports Jython 2.7.

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

Manual AMQP for OpenStack Job

This section contains information about the job.

Introduction

This job is used to find AMQP servers (typically Rabbit MQ server) that is consumed by OpenStack from IP addresses.

Adapter Information

This job uses the **AMQP for Consumer** adapter.

Adapter Type

Jython

Input CIT

IpAddress

Input Query

Triggered CI Data

Name	Value
ip_address	${SOURCE.name}

Used Script

- amqp_event_source.py
- amqp_for_consumer.py

Discovered CITs

- Composition (node, messaging_server)
- Containment (node, ip_address)
- IpAddress
- MessagingServer
- Node

Adapter Parameters

Parameter	Description
Consumer	The consumer of AMQP, for example, OpenStack.
Exchange	The exchange for AMQP.
RoutingKey	The routing key for AMQP.

OpenStack Event Monitor Job

This section contains information about the job.

Introduction

This job is used to monitor OpenStack events from the AMQP server and then to add, update, or delete CIs in UCMDB.

Trigger TQL

CI	Attribute Value
MessagingServer	DiscoveredProductName Equal AMQP AND (NOT Reference to the credentials dictionary entry Is null) AND (NOT Application IP Is null) AND Note Equal OpenStack

Adapter Information

This job uses the **OpenStack Event Monitor** adapter.

Adapter Type

Jython

Input CIT

MessagingServer

Input Query

Triggered CI Data

Name	Value
credentialsId	${SOURCE.credentials_id}
ip_address	${SOURCE.application_ip}
port	${SOURCE.application_port:}

Used Script

- event_hub.py
- amqp_event_source.py
- openstack_event_monitor.py

Discovered CITs

- Composition (host_node, interface)
- Computer
- Containment (host_node, ip_address)

- Dependency (host_node, openstack_flavor)
- Dependency (host_node, openstack_image)
- Interface
- IpAddress
- OpenStack Flavor
- OpenStack Image

Adapter Parameters

Parameter	Description
AcceptDeleteNodeEvent	Indicates whether to report the deleted node to UCMDB. **Default:** false. If one node is deleted from OpenStack, • Setting this parameter to **true**, this node will be deleted in UCMDB. • Setting this parameter to **false**, the delete event will be ignored.

Troubleshooting and Limitations – OpenStack Event Discovery

This section includes:

Troubleshooting – OpenStack Event Discovery 97
Limitations – OpenStack Event Discovery 100

Troubleshooting – OpenStack Event Discovery

This section describes troubleshooting for the OpenStack Event Discovery.

- Check whether the **OpenStack Event Monitor** job is started successfully

  In the communication log, if the following information occurs, the connection between Data Flow Probe and the AMQP server is established:

```
<log start="17:13:25" severity="info">Begin drain events...</log>
```

```
<log start="17:13:26" severity="info">Connection established.</log>
```

- Check whether the **OpenStack Event Monitor** job can receive events successfully

  In **probeMgr-adaptersDebug.log** of Data Flow Probe on which the **OpenStack Event Monitor** job runs, if the following information occurs, the job can receive events from the target AQMP server:

```
<2016-08-15 10:24:06,427> [DEBUG] [JobExecuterWorker-3:OpenStackEventMonitor_
192.168.1.1] - Insert message to queue:compute.instance.create.start

<2016-08-15 10:24:06,427> [DEBUG] [JobExecuterWorker-3:OpenStackEventMonitor_
192.168.1.1:Event Hub Worker:Thread-17] - Filter event
type:compute.instance.create.start:False

<2016-08-15 10:24:12,708> [DEBUG] [JobExecuterWorker-3:OpenStackEventMonitor_
192.168.1.1] - Insert message to queue:compute.instance.create.end

<2016-08-15 10:24:12,708> [DEBUG] [JobExecuterWorker-3:OpenStackEventMonitor_
192.168.1.1:Event Hub Worker:Thread-18] - Filter event
type:compute.instance.create.end:True

<2016-08-15 10:24:12,708> [DEBUG] [JobExecuterWorker-3:OpenStackEventMonitor_
192.168.1.1:Event Hub Worker:Thread-18] - handle event {...}

<2016-08-15 10:24:12,708> [DEBUG] [JobExecuterWorker-3:OpenStackEventMonitor_
192.168.1.1:Event Hub Worker:Thread-18] - Event
type:compute.instance.create.end

<2016-08-15 10:24:12,708> [DEBUG] [JobExecuterWorker-3:OpenStackEventMonitor_
192.168.1.1:Event Hub Worker:Thread-18] - Create host:test123

<2016-08-15 10:24:12,927> [DEBUG] [JobExecuterWorker-3:OpenStackEventMonitor_
192.168.1.1:Event Hub Worker:Thread-18] - Added CIs[...]
```

- Check whether the **OpenStack Event Monitor** job works continuously

  In the communication log, if the following information is printed out every one minute to indicate the monitor is working, the connection between Data Flow Probe and the AMQP server is established:

```
<log start="10:51:21" severity="debug">AMQP connection status check.</log>
```

- Check whether connection issues occur between Data Flow Probe and the AMQP server.

  In the communication log, if the following information occurs, the connection between Data Flow

Probe and the AMQP server cannot be established:

```
<log start="10:57:50" severity="error">Connection error. Reconnect in 2
seconds. Reason:[Errno 10061] Connection refused</log>

<log start="10:57:54" severity="error">Connection error. Reconnect in 4
seconds. Reason:[Errno 10061] Connection refused</log>

<log start="10:57:59" severity="error">Connection error. Reconnect in 6
seconds. Reason:[Errno 10061] Connection refused</log>

<log start="10:58:07" severity="error">Connection error. Reconnect in 8
seconds. Reason:[Errno 10061] Connection refused</log>

<log start="10:58:16" severity="error">Connection error. Reconnect in 10
seconds. Reason:[Errno 10061] Connection refused</log>

<log start="10:58:27" severity="error">Connection error. Reconnect in 12
seconds. Reason:[Errno 10061] Connection refused</log>

<log start="10:58:41" severity="error">Connection error. Reconnect in 14
seconds. Reason:[Errno 10061] Connection refused</log>

<log start="10:58:56" severity="error">Connection error. Reconnect in 16
seconds. Reason:[Errno 10061] Connection refused</log>

<log start="10:59:14" severity="error">Connection error. Reconnect in 18
seconds. Reason:[Errno 10061] Connection refused</log>

<log start="10:59:33" severity="error">Connection error. Reconnect in 20
seconds. Reason:[Errno 10061] Connection refused</log>

<log start="10:59:55" severity="error">Connection error. Reconnect in 22
seconds. Reason:[Errno 10061] Connection refused</log>

<log start="11:00:18" severity="error">Connection error. Reconnect in 24
seconds. Reason:[Errno 10061] Connection refused</log>

<log start="11:00:44" severity="error">Connection error. Reconnect in 26
seconds. Reason:[Errno 10061] Connection refused</log>

<log start="11:01:11" severity="error">Connection error. Reconnect in 28
seconds. Reason:[Errno 10061] Connection refused</log>

<log start="11:01:41" severity="error">Connection error. Reconnect in 30
seconds. Reason:[Errno 10061] Connection refused</log>

<log start="11:02:12" severity="error">Connection error. Reconnect in 32
seconds. Reason:[Errno 10061] Connection refused</log>

<log start="11:02:45" severity="error">Connection error. Reconnect in 32
seconds. Reason:[Errno 10061] Connection refused</log>
```

Limitations – OpenStack Event Discovery

This section describes limitations for the OpenStack Event Discovery.

Because the **OpenStack Event Monitor** job needs to monitor events from OpenStack continuously, this job will never stop. In the control panel, the status of this job is **Reached Probe** forever. In the communication log, the following message occurs:

```
...Incomplete communication log...
```

Chapter 7: VMware vCloud Discovery

This chapter includes:

Overview 102
Supported Versions 102
Topology 102
How to Discover vCloud by vCloud Director 103
How to Discover vCloud by URL 105
How to Add vCloud SDK Dependencies to the Probe 105
vCloud_Director_by_vCloud_API Adapter 106
vCloud_Director_URL_by_vCloud_API Adapter 108
vCloud Director by vCloud API Job 110
vCloud Director URL by vCloud API Job 111
Troubleshooting and Limitations – VMware vCloud Discovery 111

Overview

VMware vCloud Director creates policy based virtual data centers by grouping together IT resources from multiple clusters.

The vCloud discovery process allows you to discover vCloud topology, including Organizations, Catalogs, Virtual Datacenters, vApps including Virtual Machines, vApps Templates, and Media.

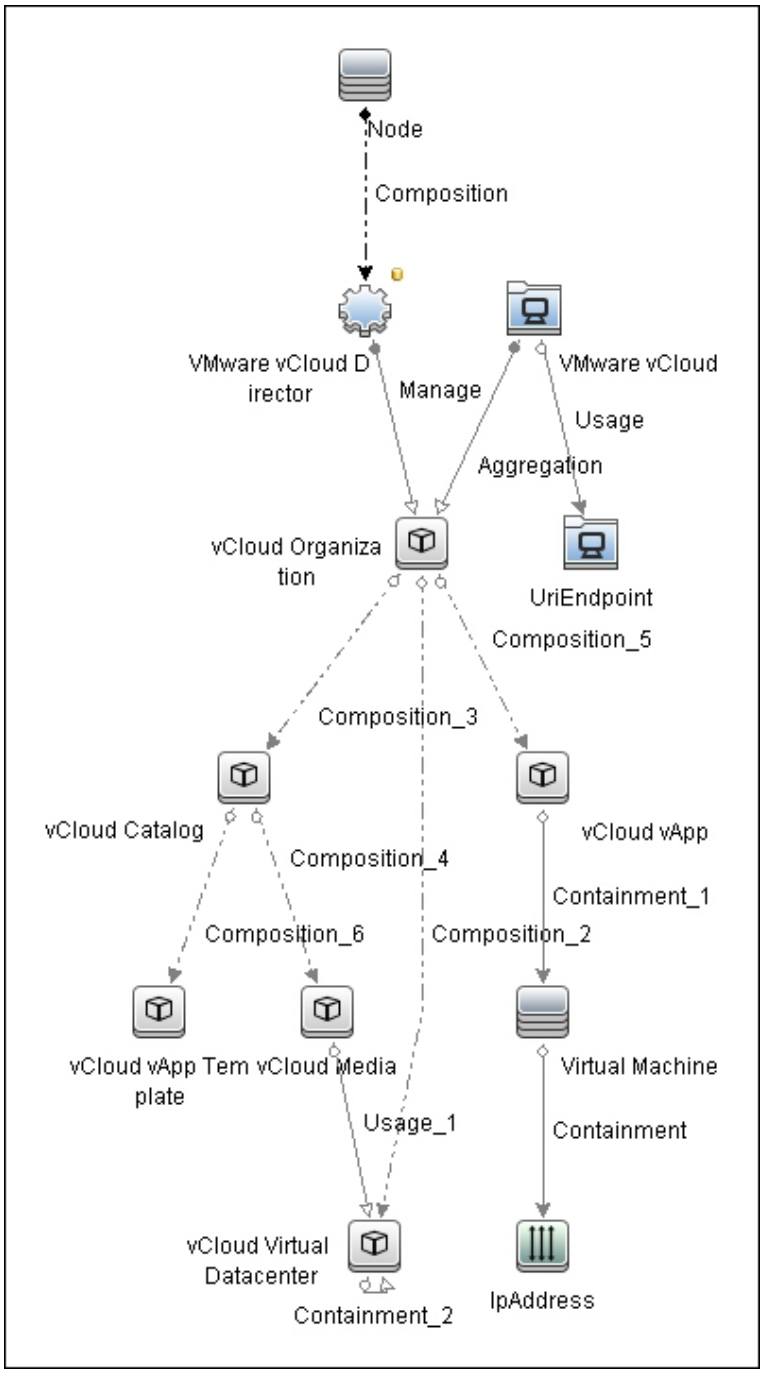
Supported Versions

VMware vCloud Discovery supports VMware vCloud Director Version 1.5 - 5.1.2, 5.5, and 5.6.

Topology

The following image displays the topology of vCloud discovery.

> **Note:** For a list of discovered CITs, see "Discovered CITs" on page 107.



How to Discover vCloud by vCloud Director

This section describes how to discover the vCloud topology by discovering the vCloud Director application.

This task contains the following steps.

- "Prerequisites " below
- "Run the job" below

1. Prerequisites

   a. Shell connectivity to the host where the vCloud Director application runs.

   b. vCloud SDK jar files must be in the probe. See "How to Add vCloud SDK Dependencies to the Probe" on the next page.

   c. Define the following credentials:

      - **SSH** or **Telnet**
      - **vCloud**

        For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Run the job

   a. Run the **Range IPs by ICMP** job to discover the target IPs.

   b. Run the **Host Connection by Shell** job to discover the target host and shell connectivity to it.

   c. Run the **Host Applications by Shell** job to discover applications of the target host, including the VMware vCloud Director application.

   d. Run the **vCloud Director by vCloud API** job to discover the vCloud topology.

How to Discover vCloud by URL

This section describes how to discover the vCloud topology using the URL of vCloud Director.

This task contains the following steps.

- "Prerequisites " below
- "Run the job" below

1. Prerequisites

   a. vCloud SDK jar files must be in the probe. See "How to Add vCloud SDK Dependencies to the Probe" below.

   b. Define the **vCloud** credential.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Run the job

   Run the **vCloud Director URL by vCloud API** job to discover the vCloud topology.

   a. Set the **baseUrl** parameter with the connection URL of the target vCloud Director.

   b. After activating the job, manually add the probe which runs the discovery as an input CI.

How to Add vCloud SDK Dependencies to the Probe

To add vCloud SDK dependencies to the probe:

1. Download the VMware vCloud SDK archive from VMware community site:

   http://communities.vmware.com/community/vmtn/developer/forums/vcloudsdkjava

   The recommended version is 5.1.

2. Copy the following jar files to the **%PROBE_ROOT%\runtime\probeManager\discoveryResources\vcloud** folder:

- **SDK-<version>\rest-api-schemas-<version>.jar**
- **SDK-<version>\vcloud-java-sdk-<version>.jar**

3. Restart the probe.

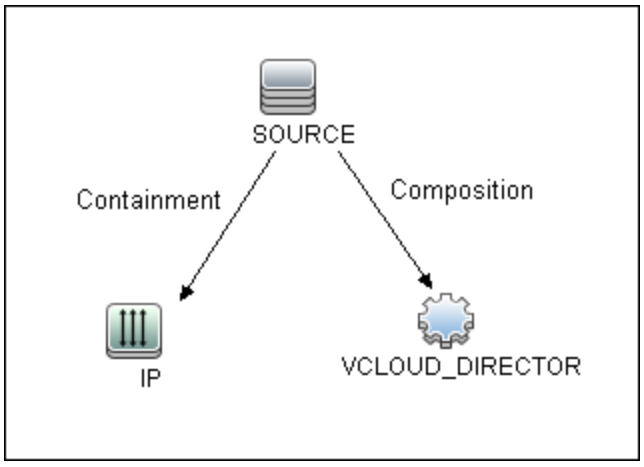
vCloud_Director_by_vCloud_API Adapter

This section contains details about the adapter.

Input CIT

Node

Input Query



Node Name	Condition
SOURCE	None
IP	NOT IP Probe Name Is null
VCLOUD_DIRECTOR	DiscoveredProductName Equal VMware vCloud Director

Triggered CI Data

Name	Value
ip_addresses	${IP.name}
vCloudDirectorId	S{VCLOUD_DIRECTOR.root_id}

Used Scripts

- vcloud.py
- vcloud_director_by_vcloud_api.py
- vcloud_discover.py
- vcloud_report.py

Discovered CITs

- Aggregation
- Composition
- Containment
- Interface
- IpAddress
- Manage
- Node
- UriEndpoint
- Usage
- vCloud Catalog
- vCloud Media
- vCloud Organization

- vCloud vApp
- vCloud vApp Template
- vCloud Virtual Datacenter
- VMware vCloud
- VMware vCloud Director

> **Note:** To view the topology, see "Topology" on page 102.

Parameters

Name	Description
reportPoweredOffVms	When set to **True**, powered off virtual machines are reported. When set to **False**, powered off virtual machines are not reported. **Default**: False

vCloud_Director_URL_by_vCloud_API Adapter

This section contains details about the adapter.

Input CIT

Discovery Probe Gateway

Used Scripts

- vcloud.py
- vcloud_director_url_by_vcloud_api.py
- vcloud_discover.py
- vcloud_report.py

Discovered CITs

- Aggregation
- Composition
- Containment
- Interface
- IpAddress
- Manage
- Node
- UriEndpoint
- Usage
- vCloud Catalog
- vCloud Media
- vCloud Organization
- vCloud vApp
- vCloud vApp Template
- vCloud Virtual Datacenter
- VMware vCloud
- VMware vCloud Director

> **Note:** To view the topology, see "Topology" on page 102.

Parameters

Name	Description
baseUrl	The connection URL of the target vCloud Director
reportPoweredOffVms	When set to **True**, powered off virtual machines are reported.

Name	Description
	When set to **False**, powered off virtual machines are not reported. **Default**: False

vCloud Director by vCloud API Job

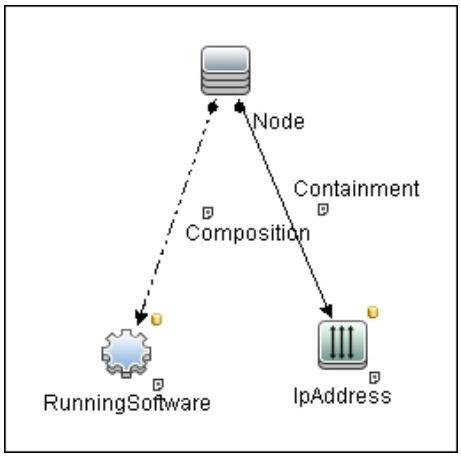
This section contains details about the job.

Adapter

This job uses the vCloud_Director_by_vCloud_API adapter.

Trigger Query

vcloud_director_on_host_with_ip



Node Name	Condition
Node	None
IpAddress	NOT IP Probe Name Is null
RunningSoftware	DiscoveredProductName Equal VMware vCloud Director

Parameters

Parameters are not overridden by default and use the values from the adapter.

vCloud Director URL by vCloud API Job

This section contains details about the job.

- **Adapter**

  This job uses the vCloud_Director_URL_by_vCloud_API adapter.

- **Trigger Query**

  None

- **Parameters**

  Parameters are not overridden by default and use the values from the adapter.

Troubleshooting and Limitations – VMware vCloud Discovery

A virtual machine which is part of vApps, and has neither a MAC address available nor a connected network adapter, is not reported.

Chapter 8: VMware vCloud Event Discovery

This chapter includes:

Overview 113

Event Types 113

Topology 114

How to Use VMware vCloud Event Discovery 114

vCloud Event Monitor Job 116

Troubleshooting and Limitations – VMware vCloud Event Discovery 118

Overview

vCloud is a Cloud solution from VMware. vCloud can send events of virtual machine changes to a AMQP server. The **vCloud Event Monitor** job can monitor these events and report them into UCMDB.

For details about the event based discovery, see the *Event Based Discovery* section in the *HPE UCMDB Discovery and Integrations Content Guide - General Reference*.

> **Note:** This discovery requires UCMDB 10.22 or later.

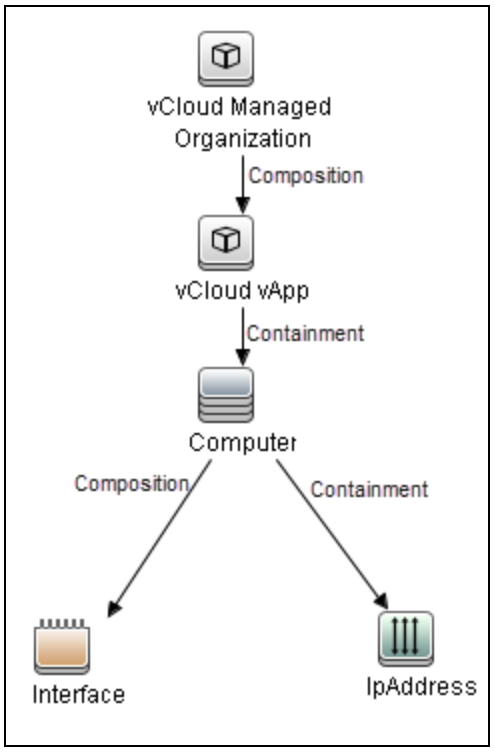
Event Types

VMware vCloud Event Discovery handles the following Events:

Name	Description	Operation in UCMDB
om/vmware/vcloud/event/vm/create	Signals the successful end of an instance creation operation	Create Node CI
com/vmware/vcloud/event/vm/delete	Signals the successful end of an instance deletion operation	Delete Node CI

Topology

The following image displays the topology of the VMware vCloud Event Discovery.



How to Use VMware vCloud Event Discovery

This task includes the following steps:

1. Prerequisite – Configuration in VMware vCloud

   Go to **VMware vCloud Director > System > Administrator > Administration** pane **> System Settings > Extensibility > Settings** tab:

   - Under **Notifications**, select **Enable Notifications** to enable non-blocking AMQP notifications of all system events.
   - Under **AMQP Broker settings**, fill in the following fields:
     - **AMQP host.** The host name for the AMQP server
     - **AMQP port.** The port number for the AMQP server. The default value is **5672**.

- **Exchange.** The exchange for events. The default value is **vcd.notifications20**.
- **vHost.** The virtual host for AMQP. The default value is */*.
- **Prefix.** The prefix of exchange. The default value is **vcd**.
- **User Name.** The user name of the AMQP account.
- **Password**: The password of the AMQP account.

2. Prerequisite – Configuration in UCMDB

   ◦ Create a vCloud protocol to access vCloud.

   ◦ Create an AMQP protocol for the AMQP server.

   Because the AMQP settings are already configured in vCloud, you can retrieve all these settings except the password. The **vCloud Event Monitor** job reads the settings from vCloud first. If some of the settings are not configured in vCloud, the settings in UCMDB AMQP protocol will be used.

   For details on how to create a protocol, see the *Protocol Parameter Dialog Box* section in the *HPE Universal CMDB Data Flow Management Guide* document.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

3. Run the discovery

   a. Run the **vCloud Director URL by vCloud API** or **vCloud Director by vCloud API** job to discover vCloud Director.

   For details on how to discover vCloud Director, see "How to Discover vCloud by URL" on page 105 and "How to Discover vCloud by vCloud Director" on page 103.

   b. Wait until the preceding job is finished. VMware vCloud Director CI should be discovered.

   c. Run the **vCloud Event Monitor** job to monitor events from the AMQP server.

   d. Wait for vCloud events.

> **Note:** The **vCloud Event Monitor** job only works on Jython 2.7 that is bundled with UCMDB 10.22 or later. This is because the driver of the AMQP protocol only supports Jython 2.7.

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

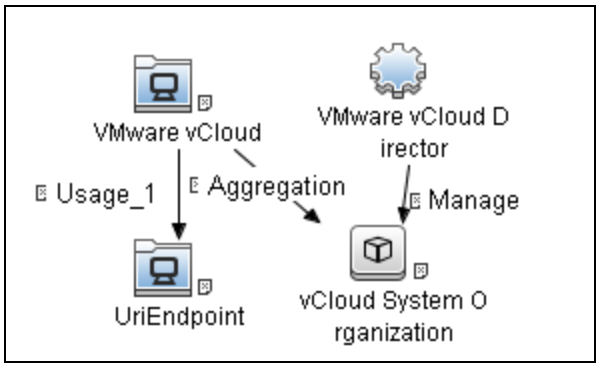
vCloud Event Monitor Job

This section contains information about the job.

Introduction

This job is used to monitor VMware vCloud events from the AMQP server and then to add, update, or delete CIs in UCMDB.

Trigger TQL



CI	Attribute Value
VMware vCloud Director	NOT Reference to the credentials dictionary entry Is null

Adapter Information

This job uses the **vCloud Event Monitor** adapter.

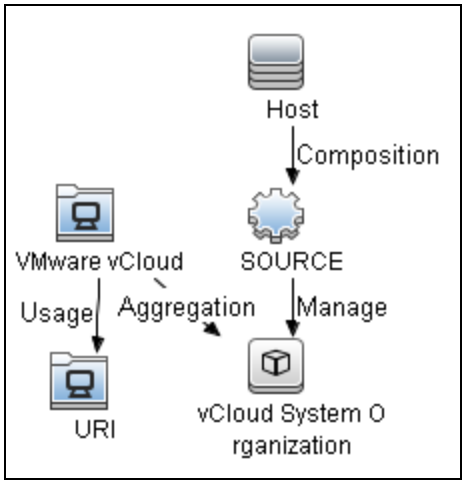
Adapter Type

Jython

Input CIT

VMware vCloud Director

Input Query



Triggered CI Data

Name	Value
url	${URI.uri:}
vcloud_credential	${SOURCE.credentials_id:}

Used Script

- event_hub.py
- amqp_event_source.py
- vcloud_event_monitor.py

Discovered CITs

- Composition (host_node, interface)
- Composition (vcloud_managed_organization, vcloud_vapp)
- Computer
- Containment (host_node, ip_address)
- Containment (vcloud_vapp, host_node)

- Interface
- IpAddress
- vCloud Managed Organization
- vCloud vApp

Adapter Parameters

Name	Default Value	Description
RefreshSessionInterval	600	The interval (in seconds) to refresh the vCloud session to prevent it from expiring.
AcceptDeleteNodeEvent	false	Indicates whether to report the deleted node to UCMDB. If one node is deleted from VMware vCloud, • Setting this parameter to **true**, this node will be deleted in UCMDB. • Setting this parameter to **false**, the delete event will be ignored.
remoteJVMArgs		The JVM parameters that should be passed to the remote process.
remoteJVMClasspath	%minimal_classpath%; ../runtime/probeManager/ discoveryResources/http/*; ../runtime/probeManager/ discoveryResources/vcloud/*	The class path used by the external Java process.
runInSeparateProcess	true	Indicates whether to run the adapter in the external JVM. **Note:** Do not change this parameter from the default.

Troubleshooting and Limitations – VMware vCloud Event Discovery

This section includes:

Troubleshooting – VMware vCloud Event Discovery 119
Limitations – VMware vCloud Event Discovery 123

Troubleshooting – VMware vCloud Event Discovery

This section describes troubleshooting for the VMware vCloud Event Discovery.

> **Note:** For troubleshooting, you can find useful information in the following three logs:
>
> - The communication log
> - **probeMgr-adaptersDebug.log**
> - **RemoteProcesses.log**

- Check whether the **vCloud Event Monitor** job is started successfully

  In **RemoteProcess.log**, if the following information occurs, the connection between Data Flow Probe and the AMQP server is established:

```
<2016-08-16 10:27:31,486> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 10:27:31,486> [INFO ]
[JobExecuterWorker-5:vCloudEventMonitor] (?:?) - Begin drain events...

<2016-08-16 10:27:31,597> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 10:27:31,597> [INFO ]
[JobExecuterWorker-5:vCloudEventMonitor] (?:?) - Connection established.
```

- Check whether the **vCloud Event Monitor** job can receive events successfully

  In **RemoteProcess.log** of Data Flow Probe on which the **vCloud Event Monitor** job runs, if the following information occurs, the job can receive events from the target AQMP server:

```
<2016-08-16 11:44:46,099> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:44:46,099> [DEBUG]
[JobExecuterWorker-5:vCloudEventMonitor] (?:?) - Raw vCloud event:{...}

<2016-08-16 11:44:52,755> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:44:52,755> [DEBUG]
[JobExecuterWorker-5:vCloudEventMonitor] (?:?) - Raw vCloud event:{...}

<2016-08-16 11:44:52,771> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:44:52,771> [DEBUG]
[JobExecuterWorker-5:vCloudEventMonitor] (?:?) - Current thread
name:JobExecuterWorker-5:vCloudEventMonitor
```

```
<2016-08-16 11:44:52,771> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:44:52,771> [INFO ]
[JobExecuterWorker-5:vCloudEventMonitor] (?:?) - Add a worker:Thread
Pool:1/2, Queue: 1/100

<2016-08-16 11:44:52,771> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:44:52,771> [DEBUG]
[JobExecuterWorker-5:vCloudEventMonitor:Event Hub Worker:Thread-5] (?:?) -
Handle event {...}

<2016-08-16 11:44:52,771> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:44:52,771> [DEBUG]
[JobExecuterWorker-5:vCloudEventMonitor:Event Hub Worker:Thread-5] (?:?) -
Event type:com/vmware/vcloud/event/vm/create

<2016-08-16 11:44:52,771> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:44:52,771> [DEBUG]
[JobExecuterWorker-5:vCloudEventMonitor:Event Hub Worker:Thread-5] (?:?) -
Get vm by id:urn:vcloud:vm:69051b97-7c77-469a-bc78-813d2fbb6f59

<2016-08-16 11:44:53,349> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:44:53,349> [DEBUG]
[JobExecuterWorker-5:vCloudEventMonitor:Event Hub Worker:Thread-5] (?:?) -
Create host:Newtemp-4G-001

<2016-08-16 11:44:53,787> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:44:53,787> [DEBUG]
[JobExecuterWorker-5:vCloudEventMonitor:Event Hub Worker:Thread-5] (?:?) -
Vapp name:vApp_system_89

<2016-08-16 11:44:54,068> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:44:54,037> [DEBUG]
[JobExecuterWorker-5:vCloudEventMonitor:Event Hub Worker:Thread-5] (?:?) -
Org name:Zerg-SH

<2016-08-16 11:44:54,068> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:44:54,052> [DEBUG]
[JobExecuterWorker-5:vCloudEventMonitor:Event Hub Worker:Thread-5] (?:?) -
Org id:bb8b5a68-e5de-4962-994b-d85df8f8bd2c

<2016-08-16 11:44:54,068> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:44:54,068> [DEBUG]
[JobExecuterWorker-5:vCloudEventMonitor:Event Hub Worker:Thread-5] (?:?) -
Added CIs[...]
```

- Check whether the **vCloud Event Monitor** job works continuously

  In **RemoteProcess.log**, if the following information is printed out every one minute to indicate the monitor is working, the connection between Data Flow Probe and the AMQP server is established:

```
<2016-08-16 10:29:32,175> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 10:29:32,175> [DEBUG]
[JobExecuterWorker-5:vCloudEventMonitor] (NativeMethodAccessorImpl.java:?) -
AMQP connection status check.
```

- Check whether connection issues occur between Data Flow Probe and the AMQP server.

  In the communication log, if the following information occurs, the connection between Data Flow Probe and the AMQP server cannot be established:

```
<2016-08-16 11:02:42,128> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:02:42,128>
[ERROR] [JobExecuterWorker-5:vCloudEventMonitor]
(NativeMethodAccessorImpl.java:?) - Connection error. Reconnect in 2 seconds.
Reason:[Errno 10061] Connection refused

<2016-08-16 11:02:46,222> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:02:46,222>
[ERROR] [JobExecuterWorker-5:vCloudEventMonitor]
(NativeMethodAccessorImpl.java:?) - Connection error. Reconnect in 4 seconds.
Reason:[Errno 10061] Connection refused

<2016-08-16 11:02:52,285> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:02:52,285>
[ERROR] [JobExecuterWorker-5:vCloudEventMonitor]
(NativeMethodAccessorImpl.java:?) - Connection error. Reconnect in 6 seconds.
Reason:[Errno 10061] Connection refused

<2016-08-16 11:03:00,363> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:03:00,363>
[ERROR] [JobExecuterWorker-5:vCloudEventMonitor]
(NativeMethodAccessorImpl.java:?) - Connection error. Reconnect in 8 seconds.
Reason:[Errno 10061] Connection refused

<2016-08-16 11:03:10,441> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:03:10,441>
[ERROR] [JobExecuterWorker-5:vCloudEventMonitor]
(NativeMethodAccessorImpl.java:?) - Connection error. Reconnect in 10
seconds.Reason:[Errno 10061] Connection refused

<2016-08-16 11:03:22,503> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:03:22,503>
[ERROR] [JobExecuterWorker-5:vCloudEventMonitor]
(NativeMethodAccessorImpl.java:?) - Connection error. Reconnect in 12
seconds.Reason:[Errno 10061] Connection refused
```

```
<2016-08-16 11:03:36,550> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:03:36,550>
[ERROR] [JobExecuterWorker-5:vCloudEventMonitor]
(NativeMethodAccessorImpl.java:?) - Connection error. Reconnect in 14
seconds.Reason:[Errno 10061] Connection refused

<2016-08-16 11:03:52,628> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:03:52,628>
[ERROR] [JobExecuterWorker-5:vCloudEventMonitor]
(NativeMethodAccessorImpl.java:?) - Connection error. Reconnect in 16
seconds.Reason:[Errno 10061] Connection refused

<2016-08-16 11:04:10,675> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:04:10,675>
[ERROR] [JobExecuterWorker-5:vCloudEventMonitor]
(NativeMethodAccessorImpl.java:?) - Connection error. Reconnect in 18
seconds.Reason:[Errno 10061] Connection refused

<2016-08-16 11:04:30,753> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:04:30,753>
[ERROR] [JobExecuterWorker-5:vCloudEventMonitor]
(NativeMethodAccessorImpl.java:?) - Connection error. Reconnect in 20
seconds.Reason:[Errno 10061] Connection refused

<2016-08-16 11:04:52,800> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:04:52,800>
[ERROR] [JobExecuterWorker-5:vCloudEventMonitor]
(NativeMethodAccessorImpl.java:?) - Connection error. Reconnect in 22
seconds.Reason:[Errno 10061] Connection refused

<2016-08-16 11:05:16,863> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:05:16,863>
[ERROR] [JobExecuterWorker-5:vCloudEventMonitor]
(NativeMethodAccessorImpl.java:?) - Connection error. Reconnect in 24
seconds.Reason:[Errno 10061] Connection refused

<2016-08-16 11:05:42,941> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:05:42,941>
[ERROR] [JobExecuterWorker-5:vCloudEventMonitor]
(NativeMethodAccessorImpl.java:?) - Connection error. Reconnect in 26
seconds.Reason:[Errno 10061] Connection refused

<2016-08-16 11:06:11,003> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:06:11,003>
[ERROR] [JobExecuterWorker-5:vCloudEventMonitor]
(NativeMethodAccessorImpl.java:?) - Connection error. Reconnect in 28
seconds.Reason:[Errno 10061] Connection refused

<2016-08-16 11:06:41,082> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:06:41,082>
```

```
[ERROR] [JobExecuterWorker-5:vCloudEventMonitor]
(NativeMethodAccessorImpl.java:?) - Connection error. Reconnect in 30
seconds.Reason:[Errno 10061] Connection refused

<2016-08-16 11:07:13,144> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:07:13,144>
[ERROR] [JobExecuterWorker-5:vCloudEventMonitor]
(NativeMethodAccessorImpl.java:?) - Connection error. Reconnect in 32
seconds.Reason:[Errno 10061] Connection refused

<2016-08-16 11:07:47,207> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:07:47,207>
[ERROR] [JobExecuterWorker-5:vCloudEventMonitor] (?:?) - Connection error.
Reconnect in 32 seconds. Reason:[Errno 10061] Connection refused

<2016-08-16 11:08:21,285> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:08:21,285>
[ERROR] [JobExecuterWorker-5:vCloudEventMonitor] (?:?) - Connection error.
Reconnect in 32 seconds. Reason:[Errno 10061] Connection refused

<2016-08-16 11:08:55,363> [DEBUG] [RemoteProcess.ConsoleInputStreamReader]
(RemoteProcess.java:85) - <2016-08-16 11:08:55,363>
[ERROR] [JobExecuterWorker-5:vCloudEventMonitor] (?:?) - Connection error.
Reconnect in 32 seconds. Reason:[Errno 10061] Connection refused
```

Limitations – VMware vCloud Event Discovery

This section describes limitations for the VMware vCloud Event Discovery.

- Because the **vCloud Event Monitor** job needs to monitor events from VMware vCloud continuously, this job will never stop. In the control panel, the status of this job is **Reached Probe** forever. In the communication log, the following message occurs:

  ```
  ...Incomplete communication log...
  ```

Part 2: Cloud and Virtualization > Virtualization

Chapter 9: Citrix Xen Discovery

This chapter includes:

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- Supported Versions 126
- Topology 127
- How to Discover Citrix Xen Topology 127
- Citrix Xen Connection Job 128
  - Introduction 128
  - Adapter Information 129
- Citrix Xen Topology Job 130
  - Introduction 130
  - Adapter Information 131

Overview

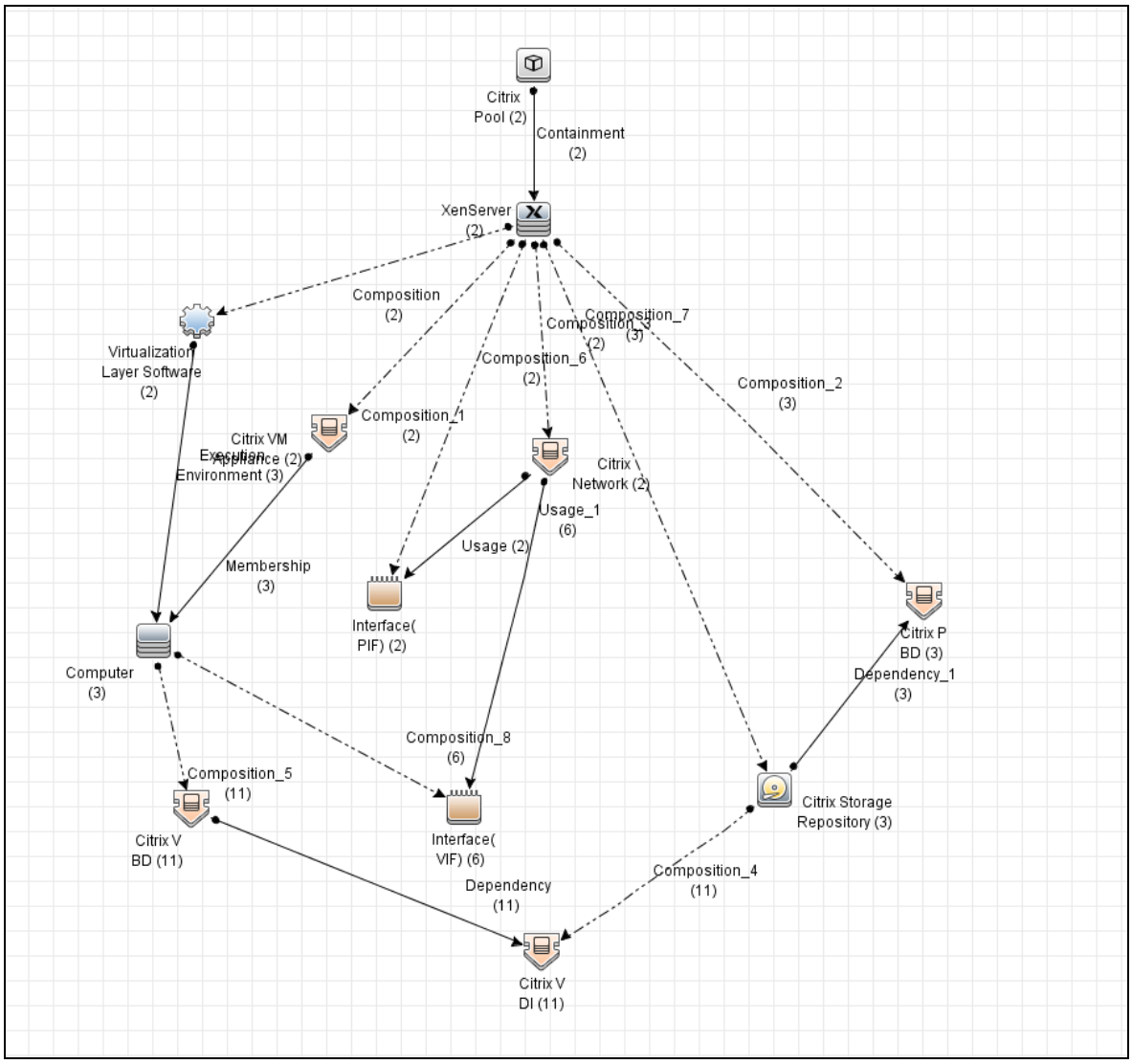
Citrix XenServer is a hypervisor platform that enables the creation and management of the virtual server infrastructure. It is developed by Citrix Systems and is based on the Xen virtual machine hypervisor.

Supported Versions

Citrix Xen Discovery supports Citrix XenServer versions: 6.2–6.5, and 7.0.

Topology

The following image displays the topology of the Citrix Xen discovery.



How to Discover Citrix Xen Topology

This section describes how to discover the topology managed by Citrix Xen.

Prerequisites

- Ensure that the target XenServer opens Citrix XenServer Management API.
- Set up the HTTP protocol. For more information on this, see the section explaining HTTP protocol credentials in *HPE UCMDB Discovery and Integrations Content Guide - Supported Content*.

Run the discovery

Run the Citrix Xen Topology discovery by executing the following jobs:

1. **Range IPs by ICMP** (discovers the target IPs)
2. **Citrix Xen Connection** (discovers the Citrix Xen Server)
3. **Citrix Xen Topology** (discovers the full topology of Citrix Xen Server)

Citrix Xen Connection Job

This section includes details about the job.

Introduction

This job discovers the XenServer by connecting triggered IP addresses via the HTTP XML-RPC protocol.

Trigger TQL

Node Name	Condition
IpAddress	NOT IP Probe Name Is null

Adapter Information

This job uses the **Citrix Xen Connection** adapter.

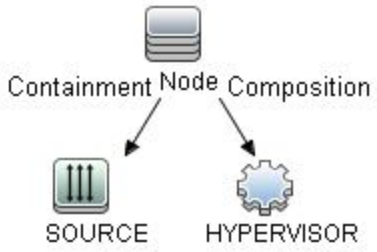
Adapter Type

Jython

Input CIT

IpAddress

Input TQL



Triggered CI Data

Name	Value
credentialId	${HYPERVISOR.credentials_id:}
ip_address	${SOURCE.name}

Used Scripts

- XenAPI.py
- citrix_xen_protocol.py

- citrix_xen_connection.py

Discovered CITs

- Composition (unix, virtualiztion_layer)
- Containment (unix, ip_address)
- IpAddress
- Unix
- Virtualization Layer Software

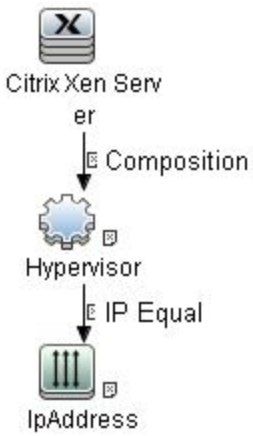
Citrix Xen Topology Job

This section includes details about the job.

Introduction

This job discovers the XenServer topology.

Trigger TQL



Node Name	Condition
Citrix Xen Server	Node Operating System Installation type Equal XenServer
Hypervisor	NOT Application IP Is null AND NOT Reference to the credentials dictionary entry Is null
IpAddress	NOT IP Probe Name Is null

Adapter Information

This job uses the **Citrix Xen Topology** adapter.

Adapter Type

Jython

Input CIT

Unix

Input TQL

Triggered CI Data

Name	Value
credentialId	${HYPERVISOR.credentials_id}
hypervisor_id	${HYPERVISOR.root_id}

Name	Value
ip_address	${HYPERVISOR.application_ip}

Used Scripts

- vendors.py
- XenAPI.py
- citrix_xen_models.py
- citrix_xen_protocol.py
- citrix_xen_topology.py

Discovered CITs

- Citrix Network
- Citrix PBD
- Citrix Pool
- Citrix Storage Repository
- Citrix VBD
- Citrix VDI
- Citrix VM Application
- Composition (citrix_storage_repository, citrix_vdi)
- Composition (host_node, citrix_vbd)
- Composition (host_node, interface)
- Composition (unix, citrix_network)
- Composition (unix, citrix_pbd)
- Composition (unix, citrix_pool)
- Composition (unix, citrix_storage_repository)
- Composition (unix, citrix_vm_appliance)
- Composition (unix, cpu)
- Composition (unix, interface)

- Composition (unix, virtualiztion_layer)
- Computer
- Containment (citrix_pool, unix)
- Containment (host_node, ip_address)
- Containment (interface, ip_address)
- Cpu
- Dependency (citrix_storage_repository, citrix_pbd)
- Dependency (citrix_vbd, citrix_vdi)
- ExecutionEnvironment (virtualization_layer, host_node)
- IpAddress
- Membership (citrix_vm_appliance, host_node)
- Unix
- Usage (citrix_network, interface)
- Virtualization Layer Software

Chapter 10: Docker Discovery

This chapter includes:

- Overview 135
- Supported Versions 135
- Topology 136
- How to Discover Docker 137
- Docker Discovery by Shell Job 138
  - Introduction 138
  - Adapter Information 139

Overview

Docker is an open-source platform for building, shipping and running distributed applications. It allows you to package an application with all of its dependencies into a standardized unit for software development.

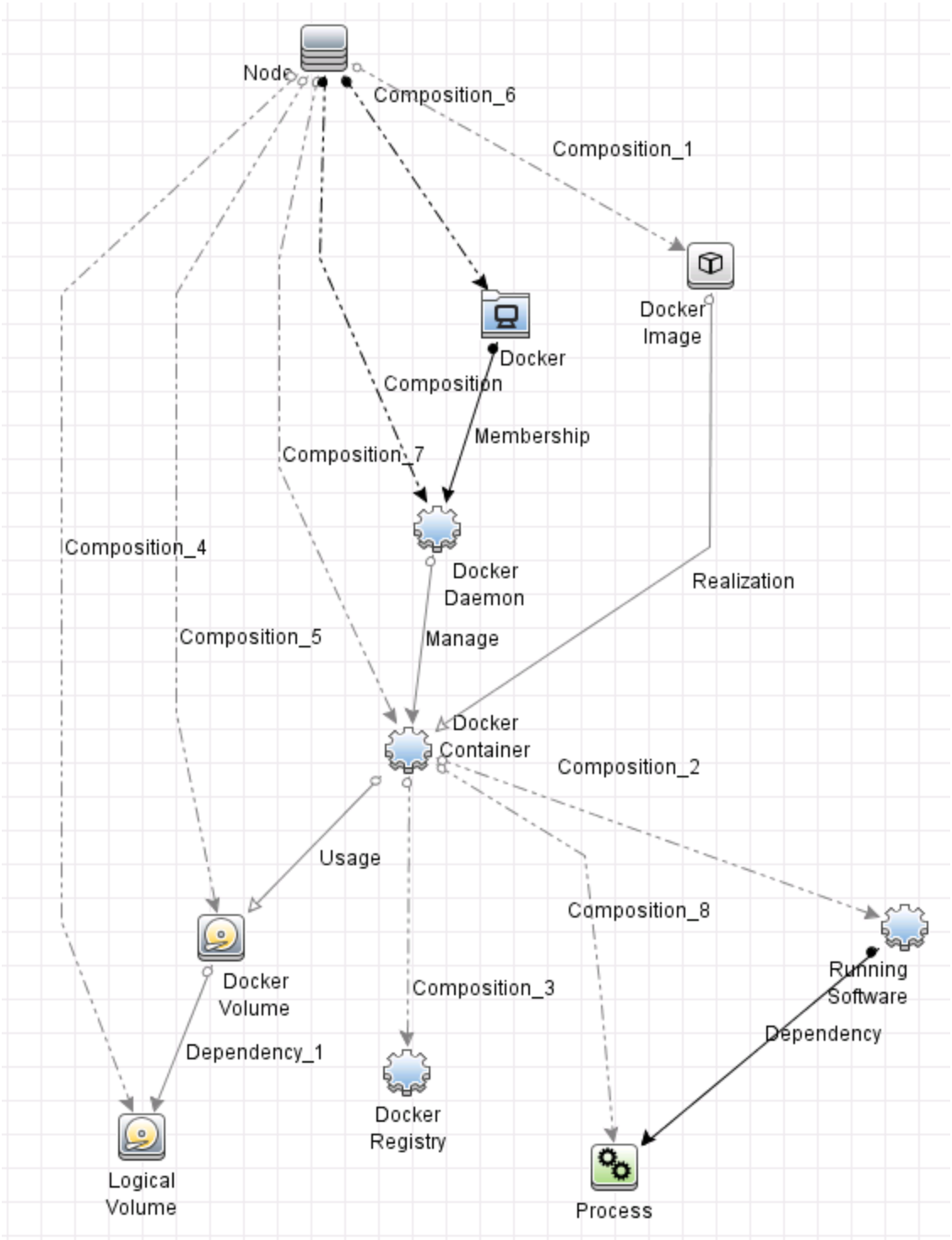
Supported Versions

Docker discovery supports the following Docker versions:

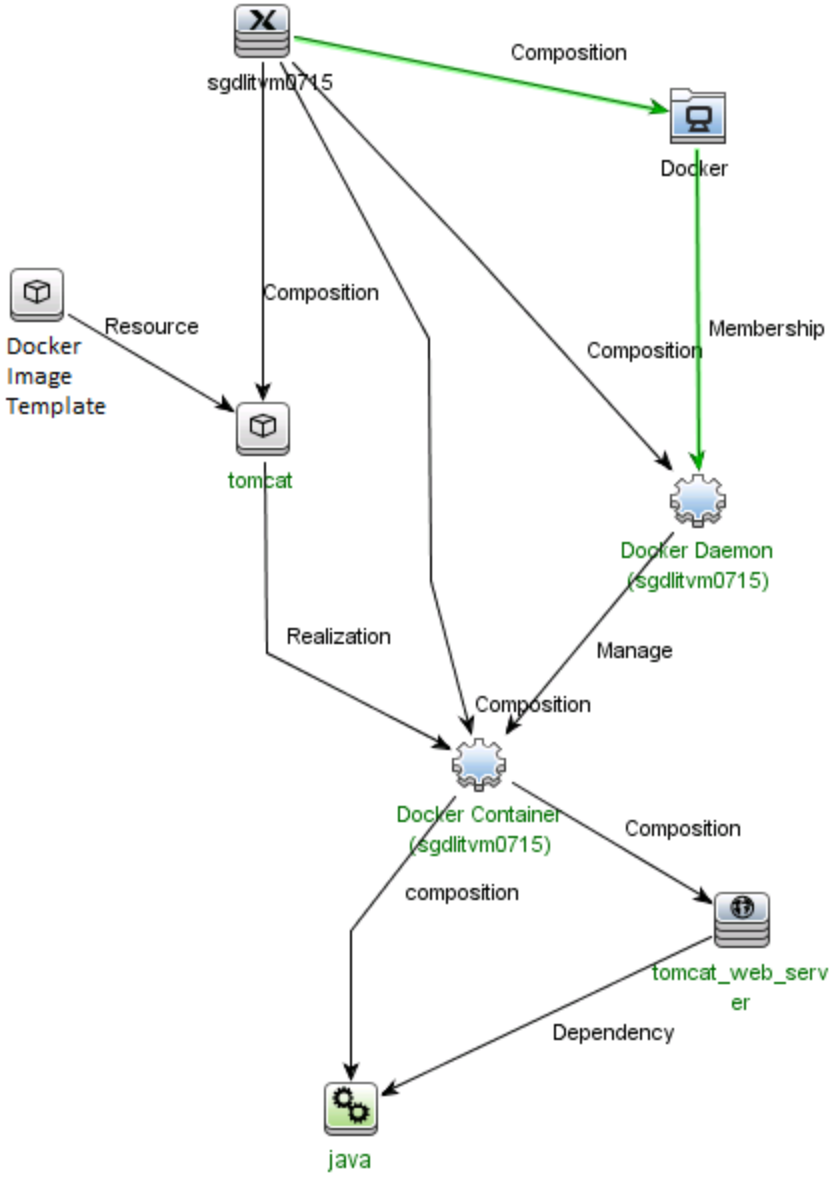
- 1.6.x
- 1.7.x
- 1.8.x
- 1.9.x
- 1.1x.x
- Community Edition (CE) 17.0x
- Enterprise Edition (EE) 17.03

Topology

The following image displays the topology of the Docker discovery.



For example,



How to Discover Docker

This task contains the following steps:

1. Prerequisites – Set up protocol credentials

   Docker discovery uses the SSH Protocol and Universal Discovery Protocol.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Run the discovery

   Run the following jobs in the following order:

   a. **Range IPs by ICMP**
   b. **Host Connection by Shell**
   c. **Host Applications by Shell**
   d. **Docker Discovery by Shell**

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

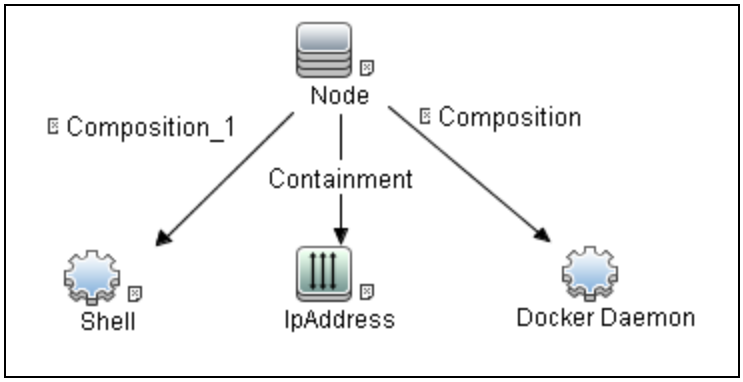
Docker Discovery by Shell Job

This section includes details about the job.

Introduction

This job discovers the Docker topology by connecting to the Docker Host.

Trigger TQL



CI	Attribute Value
Shell	NOT Reference to the credentials dictionary entry Is null AND NOT Application IP Is null
IpAddress	NOT IP Probe Name Is null
Docker Daemon	None

Adapter Information

This job uses the **Docker Discovery by Shell** adapter.

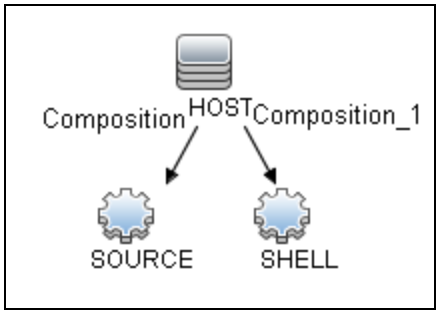
Adapter Type

Jython

Input CIT

Docker Daemon

Input TQL



Triggered CI Data

Name	Value
credentialsId	${SOURCE.credentials_id}
ip_address	${SOURCE.application_ip}
triggerId	${SOURCE.root_id}

Used Scripts

- docker_discovery_by_shell.py
- docker_simple_json.py

Discovered CITs

- Composition
- Dependency
- Docker
- Docker Container
- Docker Image
- Docker Image Template
- Docker Registry
- Docker Volume

- LogicalVolume
- Manage
- Membership
- Node
- Process
- Realization
- RunningSoftware
- Usage

Global Configuration Files

applicationsSignature.xml

Adapter Parameters

Parameter	Default Value	Description
discoverRunningSW	true	Indicates whether to discover running software in a Docker Container.

Chapter 11: Docker Swarm Discovery

This chapter includes:

- Overview 143
- Supported Versions 143
- Topology 144
- How to Discover Docker Swarm Topology by RESTful API 145
- How to Generate the Key Store File 146
- Docker Swarm Discovery by RESTful API Job 148
  - Introduction 148
  - Adapter Information 149

Overview

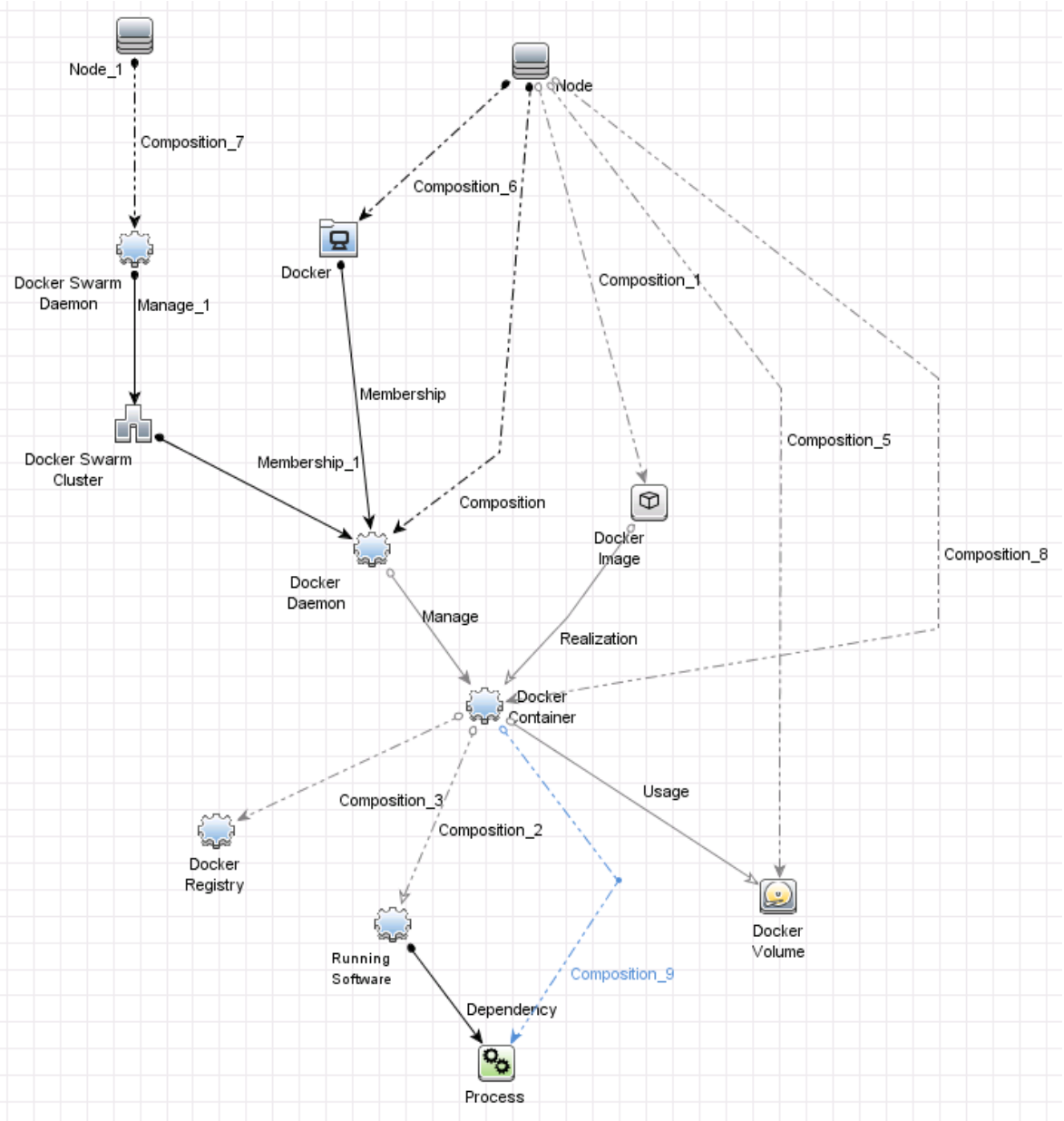
Docker Swarm is native clustering for Docker. It turns a pool of Docker hosts into a single, virtual Docker host. Because Docker Swarm serves the standard Docker API, any tool that already communicates with a Docker daemon can use Swarm to transparently scale to multiple hosts.

Supported Versions

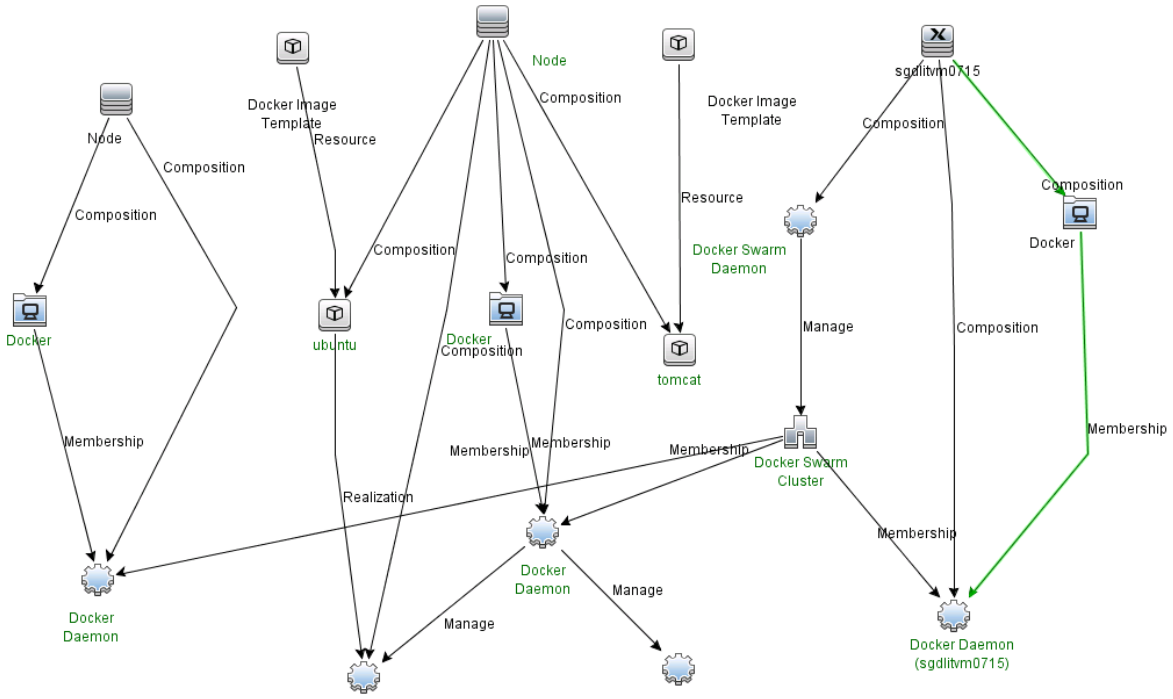
Docker Swarm: 1.1.x and API-version: v1.18.

Topology

The following image displays the topology of the Docker Swarm discovery.



For example,



How to Discover Docker Swarm Topology by RESTful API

This task describes how to discover Docker Swarm components using HTTP Protocol. This discovery process enables you to discover information about Docker Swarm Cluster and the topology of Docker managed by this cluster.

This task contains the following steps:

1. Prerequisites – Set up protocol credentials

   Docker Swarm discovery uses the HTTP Protocol.

   a. Create a new HTTP protocol.

      In the HTTP Protocol Parameters dialog box, select **https** in the **Protocol** field.

   b. Right-click the protocol that you just created and select **Edit using previous interface**.

   c. Configure the **Key Store Path**, **Key Store Password** (if needed), and **Key Password** (if needed).

- **Key Store Path**. Specify the full path of the Key Store file.
- **Key Store Password**. Specify the password for the Key Store.
- **Key Password**. Specify the password for the Key.

For details, see "How to Generate the Key Store File" below.

> **Note:** If you do not need the TLS verification in Docker Swarm, skip this step.

For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Configure the URI endpoint – Edit UriEndpointConfiguration.xml

   a. Go to **Data Flow Management > Adapter Management > Resources** pane.

   b. Click the **Find resource** button, enter **UriEndpointConfiguration.xml** in the **Name** field, and then click the **Find Next** button.

   c. In **UriEndpointConfiguration.xml**, set the proper Data Flow Probe name on which the trigger UriEndpoint runs and set the **url** and **type** as follows:

```
<dataflowprobe name="<Data Flow Probe name>">
  <uri-endpoint>
    <url>https://<IP address>:<port>/</url>
    <type>docker swarm</type>
  </uri-endpoint>
</dataflowprobe>
```

3. Run the discovery

   Run the following jobs in the following order:

   a. **Manual UriEndpoint Discovery** to discover Docker Swarm UriEndpoint.

   b. **Docker Swarm Discovery by RESTful API** to discover Docker Swarm Topology.

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

How to Generate the Key Store File

This task contains the following steps:

1. Configure Docker Swarm to enable the TLS verification

   For details, see Configure Docker Swarm for TLS.

   Retrieve the **cert.pem** and **key.pem**.

2. Convert the cert and key to the Key Store file used by UCMDB

   a. Generate the key in PKCS12 format

      i. Enter the following command in Linux Shell:

      ```
      openssl pkcs12 -export -in <your cert> -inkey <your key> -out
      <pkcs12 formated key>
      ```

      For example,

      ```
      openssl pkcs12 -export -in cert.pem -inkey key.pem -out sh.pk12
      ```

      - **cert.pem** is the cert that you retrieved from Step 1 to access Docker Swarm.
      - **key.pem** is the key that you retrieved from Step 1 to access Docker Swarm.
      - **sh.pk12** is the PKCS12 file that you want to generate.

      ii. The command will prompt you as follows:

      ```
      Enter Export Password:  (Type the Key Password that you want .This is the Key
      Password to be configured in UCMDB HTTP protocol.)
      Verifying - Enter Export Password:  (Confirm the above one)
      ```

      iii. Note down the PKCS12 file that is generated and the Key Password to be configured in UCMDB HTTP protocol.

   b. Convert the key into JKS format using keytool (from Java JDK)

      i. Enter the following command in Linux Shell:

      ```
      keytool -importkeystore -destkeystore <Java keystore file> -
      srcstoretype PKCS12 -srckeystore <pkcs12 formated key>
      ```

      For example,

      ```
      keytool -importkeystore -destkeystore keystore.jks -srcstoretype
      PKCS12 -srckeystore sh.pk12
      ```

- The **keystore.jks** file is the Key Store file to be used in UCMDB HTTP protocol.
- **sh.pk12** is the PKCS12 file that is generated in Step a.

ii. The command will prompt you as follows:

```
Enter destination keystore password:
```
(Type the Key Store Password that you want. This is the Key Store Password to be configured in UCMDB HTTP protocol.)
`Re-enter new password:` (Confirm the above one)
`Enter source keystore password:` (Type the Key Password that is entered in Step a)

iii. Note down the full path of the Key Store file that is generated and the Key Store Password to be configured in UCMDB HTTP protocol.

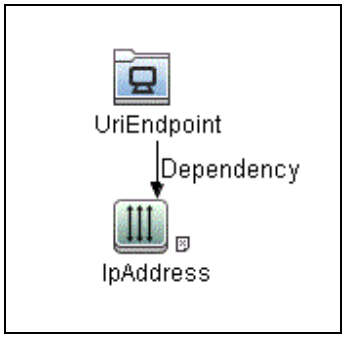
Docker Swarm Discovery by RESTful API Job

This section includes details about the job.

Introduction

This job discovers applications and services in Docker Swarm.

Trigger TQL



CI	Attribute Value
UriEndpoint	Type Equal docker swarm

Adapter Information

This job uses the **Docker Swarm Discovery by RESTful API** adapter.

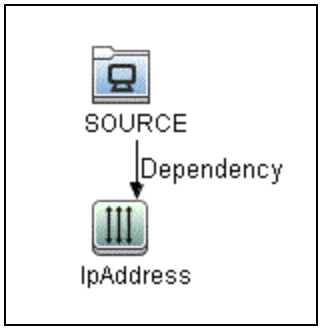
Adapter Type

Jython

Input CIT

UriEndpoint

Input TQL



Triggered CI Data

Name	Value
endpoint	${SOURCE.uri}
ip_address	${IpAddress.name}

Used Scripts

- docker.py
- docker_reporter.py
- docker_restful_client.py
- docker_swarm_reporter.py

- docker_discovery_by_restful_api.py
- docker_swarm_discovery_by_restful_api.py
- docker_swarm_topology_by_restful_api.py

Discovered CITs

- Composition
- Dependency
- Docker
- Docker Container
- Docker Daemon
- Docker Image
- Docker Image Template
- Docker Registry
- Docker Swarm Cluster
- Docker Swarm Daemon
- Docker Volume
- Manage
- Membership
- Node
- Process
- Realization
- RunningSoftware
- Usage

Adapter Parameters

Name	Default Value	Description
discoverRunningSW	false	Indicates whether to discover Running Software.

Chapter 12: Docker Swarm Event Discovery

This chapter includes:

- Overview 152
- Event Types 152
- Supported Versions 152
- Topology 153
- How to Use Docker Swarm Event Discovery 153
- Docker Swarm Event Monitor Job 154
  - Introduction 155
  - Adapter Information 155
- Troubleshooting and Limitations – Docker Swarm Event Discovery 157
  - Troubleshooting – Docker Swarm Event Discovery 157
  - Limitations – Docker Swarm Event Discovery 158

Overview

Docker Swarm is native clustering for Docker. By accessing the endpoint **events** in the Docker Swarm API, the events in the Docker Swarm cluster are retrieved in real time via streaming. The events are in JSON format.

For details about the event based discovery, see the *Event Based Discovery* section in the *HPE UCMDB Discovery and Integrations Content Guide - General Reference*.

> **Note:** This discovery requires UCMDB 10.22 or later.

Event Types

Docker Swarm Event Discovery handles the following Events:

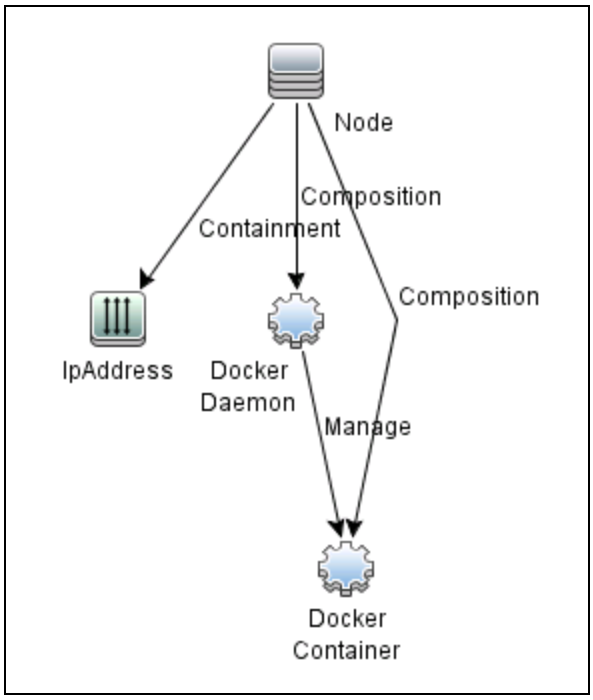
Name	Description	Operation in UCMDB
start	Signals the start of a container	Create Docker Container CI
die	Signals the stop of a container	Delete Docker Container CI

Supported Versions

Docker Swarm 1.1.x with API-version v1.18.

Topology

The following image displays the topology of the Docker Swarm event discovery.



How to Use Docker Swarm Event Discovery

This task contains the following steps:

1. Prerequisites – Set up protocol credentials

   Docker Swarm discovery uses the HTTP Protocol.

   a. Create a new HTTP protocol.

      In the HTTP Protocol Parameters dialog box, select **https** in the **Protocol** field.

   b. Right-click the protocol that you just created and select **Edit using previous interface**.

   c. Configure the **Key Store Path**, **Key Store Password** (if needed), and **Key Password** (if needed).

- **Key Store Path**. Specify the full path of the Key Store file.
- **Key Store Password**. Specify the password for the Key Store.
- **Key Password**. Specify the password for the Key.

For details, see "How to Generate the Key Store File" on page 146.

> **Note:** If you do not need the TLS verification in Docker Swarm, skip this step.

For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Configure the URI endpoint – Edit UriEndpointConfiguration.xml

   a. Go to **Data Flow Management > Adapter Management > Resources** pane.

   b. Click the **Find resource** button, enter **UriEndpointConfiguration.xml** in the **Name** field, and then click the **Find Next** button.

   c. In **UriEndpointConfiguration.xml**, set the proper Data Flow Probe name on which the trigger UriEndpoint runs and set the **url** and **type** as follows:

```
<dataflowprobe name="<Data Flow Probe name>">
  <uri-endpoint>
    <url>https://<IP address>:<port>/</url>
    <type>docker swarm</type>
  </uri-endpoint>
</dataflowprobe>
```

3. Run the discovery

   a. Run **Manual UriEndpoint Discovery** to discover Docker Swarm UriEndpoint.

   b. Run **Docker Swarm Discovery by RESTful API** to discover Docker Swarm Topology.

   c. Run **Docker Swarm Event Monitor** to monitor Docker Swarm events.

   d. Wait for the Docker Swarm events.

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

Docker Swarm Event Monitor Job

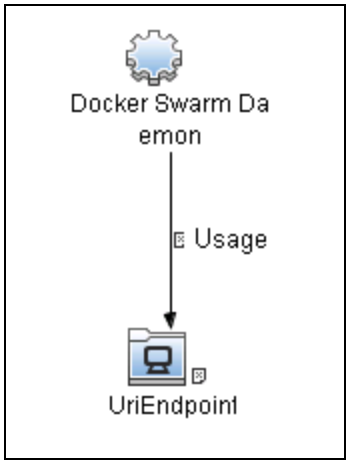
This section includes details about the job.

Introduction

This job is to monitor Docker Swarm events of the Docker container (the start or die event) to create or delete Docker Container CI in UCMDB.

On the start event, a Docker Container CI is created with its related Node and Docker Daemon. On the die event, the Docker Container CI is deleted.

Trigger TQL



Adapter Information

This job uses the **Docker Swarm Event Monitor** adapter.

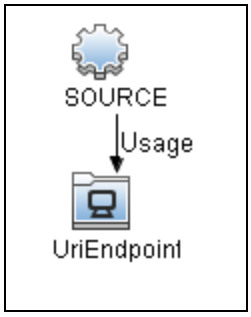
Adapter Type

Jython

Input CIT

Docker Swarm Daemon

Input TQL



Triggered CI Data

Name	Value
credentialId	${SOURCE.credentials_id}
endpoint	${UriEndpoint.uri}

Used Scripts

- json_stream.py
- rest_requests.py
- docker_restful_client.py
- docker_swarm_event_monitor.py

Discovered CITs

- Composition
- Containment
- Docker Container
- Docker Daemon
- IpAddress
- Manage
- Node

Troubleshooting and Limitations – Docker Swarm Event Discovery

This section includes:

Troubleshooting – Docker Swarm Event Discovery 157
Limitations – Docker Swarm Event Discovery 158

Troubleshooting – Docker Swarm Event Discovery

This section describes troubleshooting for the Docker Swarm Event Discovery.

- Check whether the **Docker Swarm Event Monitor** job is started successfully

  In the communication log, if the following information occurs, the connection between Data Flow Probe and Docker Swarm is established:

```
<2016-08-24 14:34:02,085> [INFO ] [JobExecuterWorker-0:Docker Swarm Event
Monitor] - Start Docker Swarm event source...
<2016-08-24 14:34:02,208> [DEBUG] [JobExecuterWorker-0:Docker Swarm Event
Monitor] - Request: http://<docker swarm url>/v1.18/events
```

- Check whether the **Docker Swarm Event Monitor** job can receive events successfully

  In **probeMgr-adaptersDebug.log** of Data Flow Probe on which the **Docker Swarm Event Monitor** job runs, if the following information occurs, the job can receive events from the target Docker Swarm:

```
<2016-08-24 14:36:49,507> [DEBUG] [JobExecuterWorker-0:Docker Swarm Event
Monitor:Event Hub Worker:Thread-4] - Filter event type:start:True

<2016-08-24 14:36:49,513> [DEBUG] [JobExecuterWorker-0:Docker Swarm Event
Monitor:Event Hub Worker:Thread-4] - handle event {...}

<2016-08-24 14:36:49,514> [DEBUG] [JobExecuterWorker-0:Docker Swarm Event
Monitor:Event Hub Worker:Thread-4] - Event type:start

<2016-08-24 14:36:49,682> [DEBUG] [JobExecuterWorker-0:Docker Swarm Event
Monitor:Event Hub Worker:Thread-4] - Added CIs[...]
```

```
<2016-08-24 14:37:10,622> [DEBUG] [JobExecuterWorker-0:Docker Swarm Event
Monitor:Event Hub Worker:Thread-6] - Filter event type:die:True

<2016-08-24 14:37:10,623> [DEBUG] [JobExecuterWorker-0:Docker Swarm Event
Monitor:Event Hub Worker:Thread-6] - handle event {...}

<2016-08-24 14:37:10,623> [DEBUG] [JobExecuterWorker-0:Docker Swarm Event
Monitor:Event Hub Worker:Thread-6] - Event type:die

<2016-08-24 14:37:10,623> [DEBUG] [JobExecuterWorker-0:Docker Swarm Event
Monitor:Event Hub Worker:Thread-6] - Delete Docker
Container:7d1e32186da41705578399db6532e4154c924a9de906a5101b62b54f9e05bd66

<2016-08-24 14:37:10,648> [DEBUG] [JobExecuterWorker-0:Docker Swarm Event
Monitor:Event Hub Worker:Thread-6] - Deleted CI[...]
```

- Check whether the **Docker Swarm Event Monitor** job works continuously

  In the communication log, if the following information is printed out every 30 seconds to indicate the monitor is working, the connection between Data Flow Probe and Docker Swarm is established:

  ```
  <2016-08-24 14:34:02,208> [DEBUG] [JobExecuterWorker-0:Docker Swarm Event
  Monitor] - Request: http://<docker swarm url>/v1.18/events
  ```

- Check whether connection issues occur between Data Flow Probe and Docker Swarm

  In the communication log, if the following information occurs, the connection between Data Flow Probe and Docker Swarmcannot be established:

  ```
  <2016-08-24 15:06:12,624> [DEBUG] [JobExecuterWorker-0:Docker Swarm Event
  Monitor] - Connection to swarm lost.

  <2016-08-24 15:06:12,624> [DEBUG] [JobExecuterWorker-0:Docker Swarm Event
  Monitor] - Wait 2 seconds.
  ```

  > **Note:** The waiting time will increase two seconds each time until it reaches 30 seconds.

Limitations – Docker Swarm Event Discovery

This section describes limitations for the Docker Swarm Event Discovery.

Because the **Docker Swarm Event Monitor** job needs to monitor events from Docker Swarm continuously, this job will never stop. In the control panel, the status of this job is **Reached Probe** forever. In the communication log, the following message occurs:

```
...Incomplete communication log...
```

Chapter 13: HP IVM Discovery

This chapter includes:

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Supported Versions 161

Topology 162

How to Discover HP IVM Topology 162

HP IVM by Shell Job 163

HP Integrity Virtual Machine by Shell Adapter 164

Overview

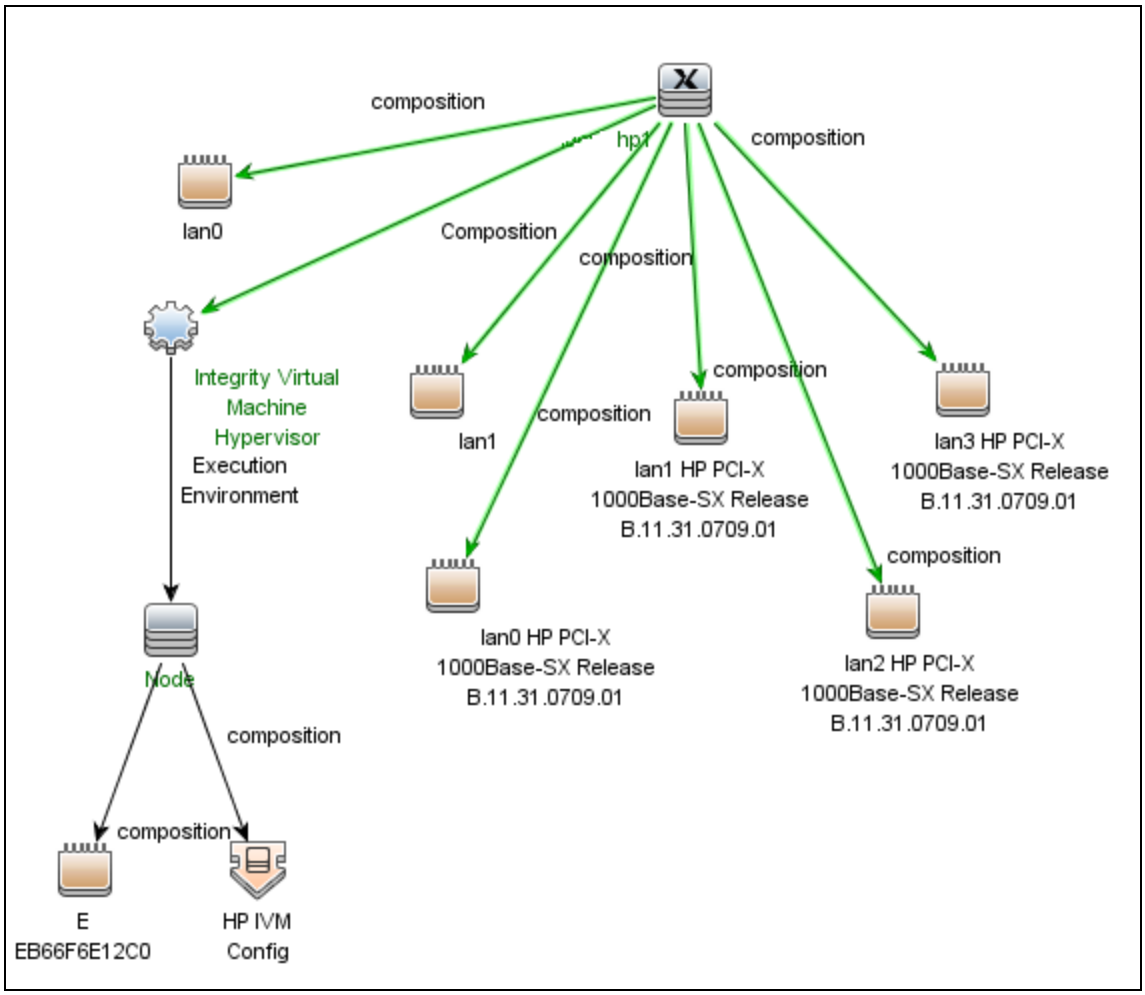
Integrity Virtual Machines (IVM) is HPE software that allows multiple virtual machines (such as the HPE Integrity line) to run concurrently on any Itanium server running HP-UX. HPE IVM is part of HPE's Virtual Server Environment suite.

Supported Versions

HP IVM Discovery supports HPE IVM version B.06.10.05.

Topology

The HP IVM topology is shown below.



How to Discover HP IVM Topology

This section describes how to discover the topology managed by HPE IVM.

Prerequisites

- Ensure that there is shell connectivity with a running IVM machine.
- Set up SSH protocol credentials. For more information on this, see the section explaining SSH protocol credentials in *HPE UCMDB Discovery and Integrations Content Guide - Supported Content*.

Run HP IVM Topology Discovery

Run HP IVM Topology Discovery by executing the following jobs:

1. **Range IPs by ICMP** (discover the target IPs)
2. **Host Connection by Shell** (discovers the target host, and shell connectivity to it)
3. **HP IVM by Shell** (discovers the virtualization environment managed by HP IVM)

HP IVM by Shell Job

This job discovers the HP IVM topology.

Adapter

ID: HP Integrity Virtual Machine by Shell

Display Name: HP Integrity Virtual Machine by Shell

Trigger TQL

CIT Name	Condition
Computer	ExtendedOsFamily Equal hp_ux
IpAddress	Not Ip Probe Name Is Null
Shell	NOT Reference to credentials dictionary entry is Null

Discovery Flow

The discovery flow for the HP IVM by Shell Job is as follows:

1. Get the current status of the running virtual machines using the command **hpvmstatus -V**.
2. Get VM configuration data using the command **hpvmstatus -d -P <vm_name>**.
3. Get version related information using the command **hpvminfo -v**.

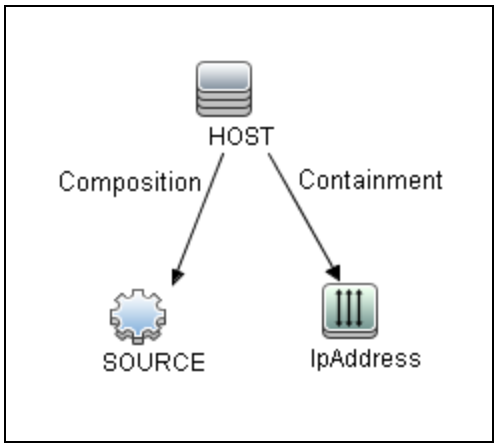
HP Integrity Virtual Machine by Shell Adapter

This section includes details about the adapter.

Input CIT

Shell

Input TQL



CIT Name	Condition
HOST	NOT CI Type Equal nt

Triggered CI Data

Name	Value
Protocol	SOURCE.root_class
credentialsId	SOURCE.credentials_id

Name	Value
hostId	HOST.root_id
ip_address	SOURCE.application_ip

Used Scripts

- ivm.py
- ivm_by_shell.py
- ivm_discoverer.py

Discovered CITs

- Composition
- ExecutionEnvironment
- HP IVM Config
- Node
- Virtualization Layer Software

> **Note:** To view the topology, see "Topology" on page 162.

Parameters

```
reportHostNameAsVmName = false
```

Chapter 14: HP Partitioning Solution Discovery

This chapter includes:

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Supported Versions 167

Topology 168

How to Discover HP vPars and nPars 171

HP nPars and vPars by Shell Job 172

Discovery Mechanism 176

Troubleshooting and Limitations – HP Partitioning Solution Discovery 198

Overview

- **HP nPartitions**

  Cell-based HP servers enable you to configure a single server complex as one large system or as multiple smaller systems by configuring **nPartitions**. Each nPartition defines a subset of server hardware resources to be used as an independent system environment. An nPartition includes one or more cells assigned to it (with processors and memory) and all I/O chassis connected to those cells. All processors, memory, and I/O in an nPartition are used exclusively by software running in the nPartition. Thus, each nPartition has its own system boot interface, and each nPartition boots and reboots independently. Each nPartition provides both hardware and software isolation, so that hardware or software faults in one nPartition do not affect other nPartitions within the same server complex. You can reconfigure nPartition definitions for a server without physically modifying the server hardware configuration by using the HP software-based nPartition management tools.

- **HP vPartitions**

  vPars is a Virtual Partitions product that enables you to run multiple instances of HP-UX simultaneously on one hard partition by dividing that hard partition further into virtual partitions. Each virtual partition is assigned its own subset of hardware, runs a separate instance of HP-UX, and hosts its own set of applications. Because each instance of HP-UX is isolated from all other instances, vPars provides application and Operating System (OS) fault isolation. Each instance of HP-UX can have different patches and a different kernel.

Supported Versions

This discovery supports vPars A.03.xx, A.04.xx, and A.05.xx versions.

This package has been verified on cellular systems with vPars running an HP-UX operating system.

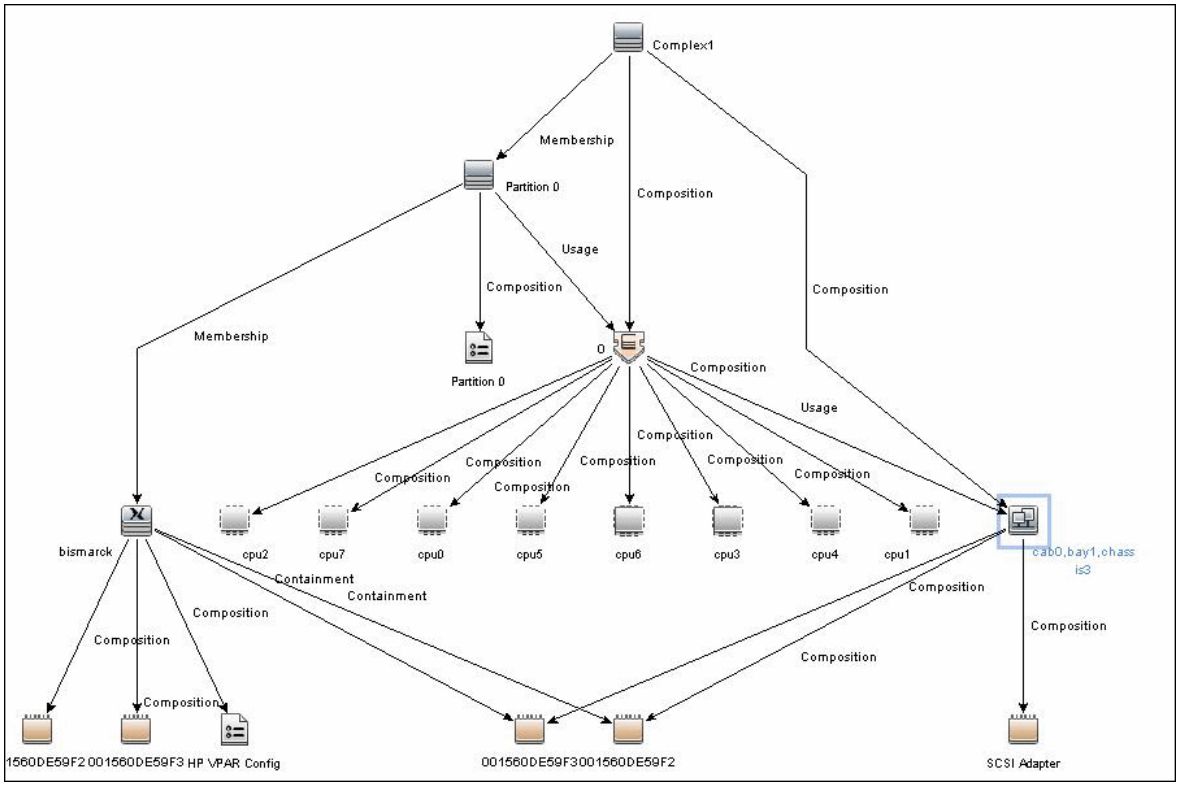
This discovery supports HP Blade based complexes.

Topology

This section includes:

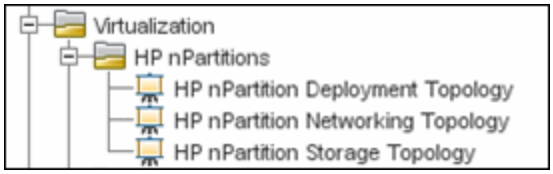
- "HP vPars and nPars Topology" below
- "HP nPartitions Topology Views" below

HP vPars and nPars Topology

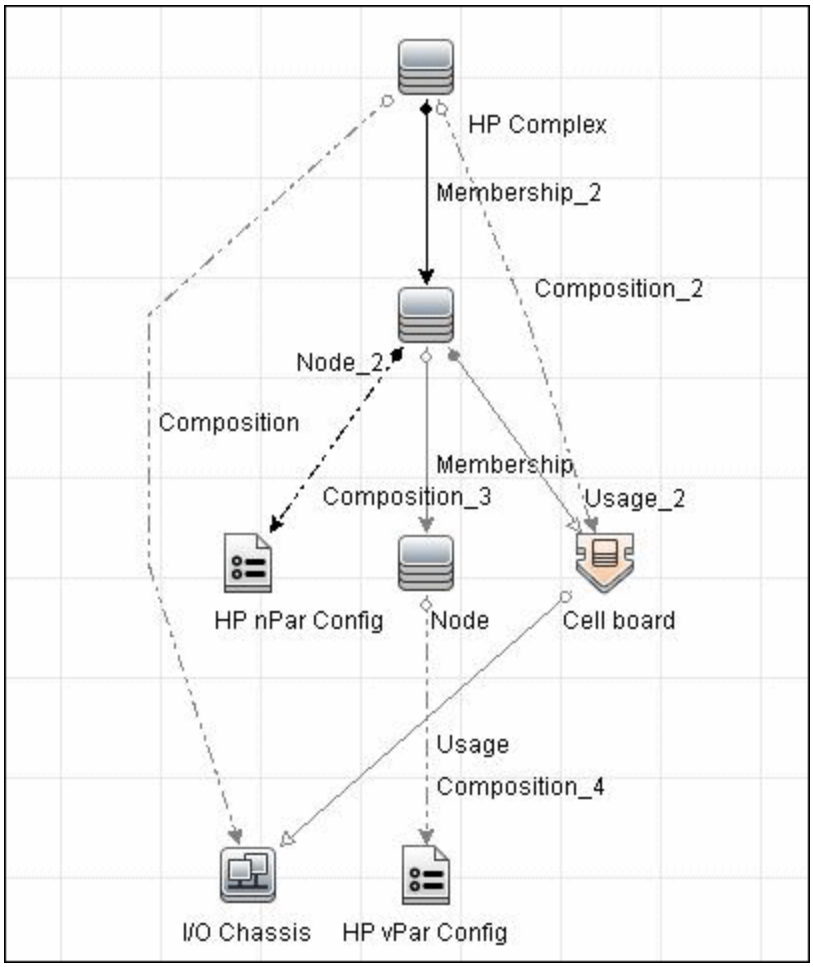


HP nPartitions Topology Views

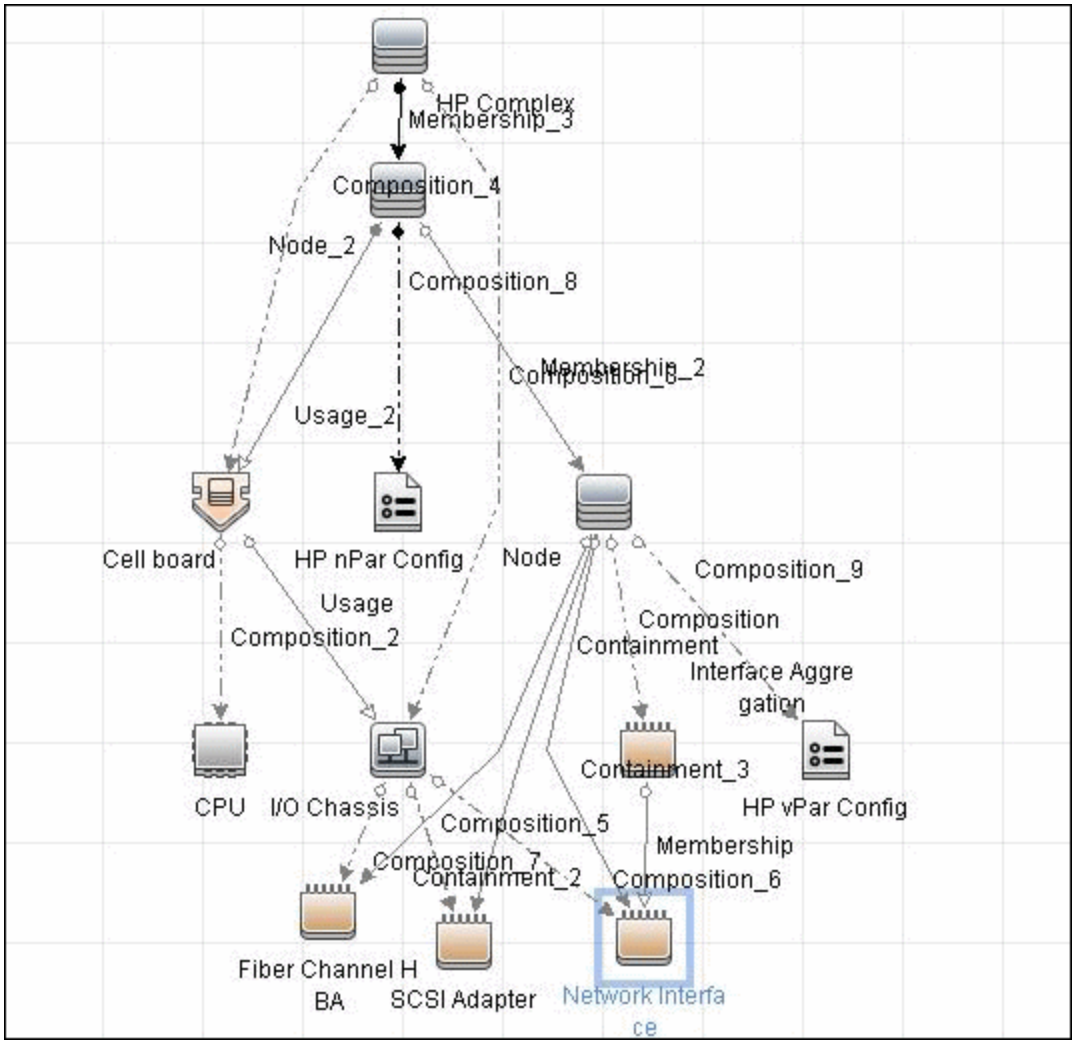
HP nPartitions topology is represented by the following views under the Virtualization module:



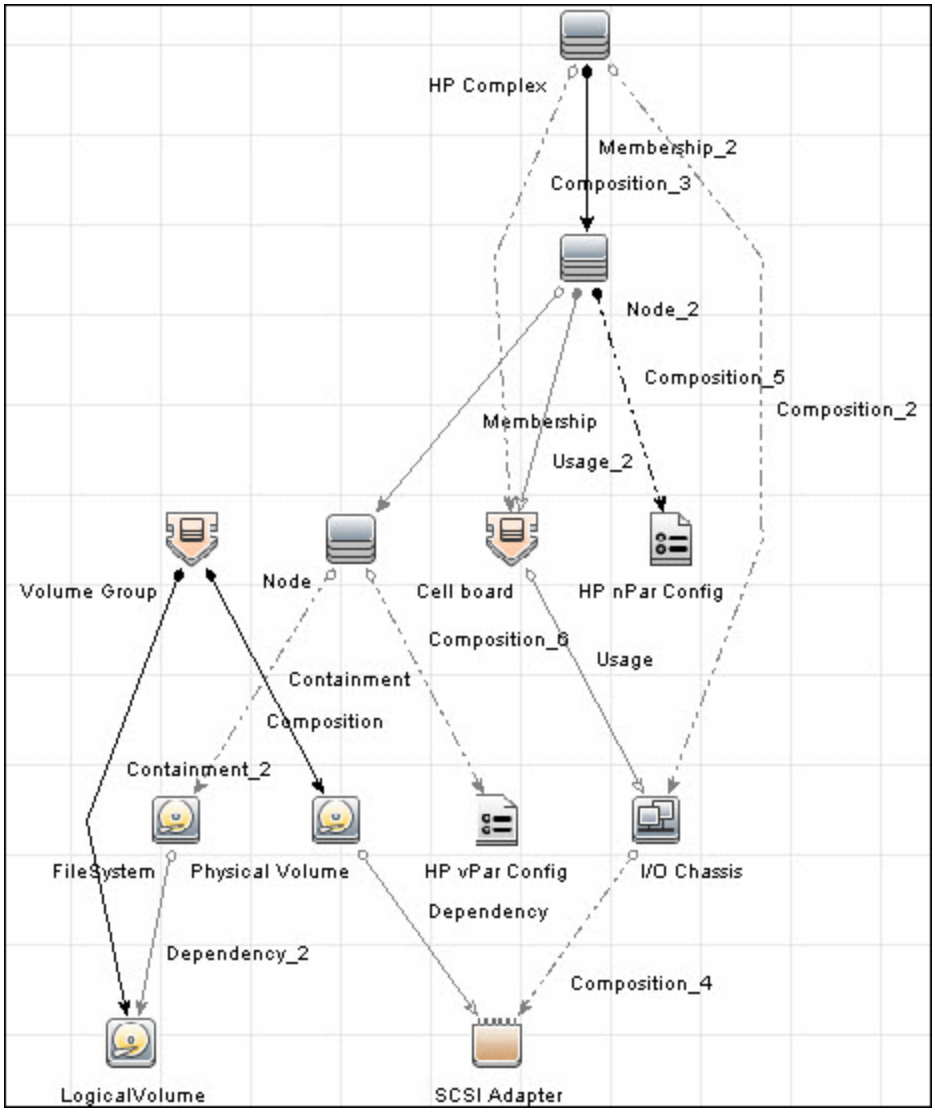
- **HP nPartition Deployment Topology View**
  This view represents the basic virtualization deployment, containing nPars, vPars, cells, and I/O chassis only.



- **HP nPartition Networking Topology View**
  This view represents the Networking aspect of the nPartition deployment including the relations between I/O devices of vPars and their physical locations on the I/O chassis.



- **HP nPartition Storage Topology View**
  This view reflects the storage aspect of the HP nPartitions system including the relations between file systems and logical volumes.



How to Discover HP vPars and nPars

This task includes the following steps:

1. Prerequisite - Set up protocol credentials

   Confirm that Shell credentials are set up on the Probe.

For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Run the discovery

To discover HP vPars and nPars:

a. Run the **Range IPs by ICMP** job.

b. Run the **Host Connection by Shell** job.

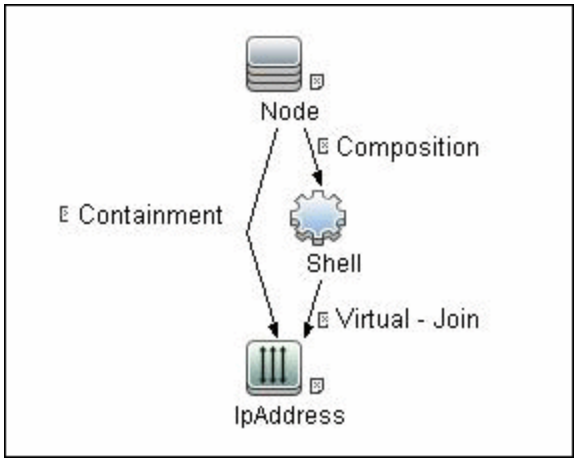
c. Run the **HP nPars and vPars by Shell** job.

For details on running jobs, see "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

HP nPars and vPars by Shell Job

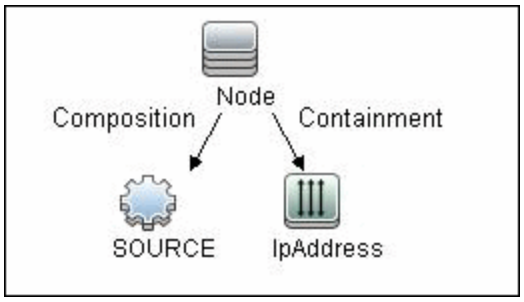
This section includes details about the job.

Trigger Query



Adapter

- The Input Query for the hp_npar_by_shell Adapter



Created/Changed Entities

New Classes

- hp_complex
- cell_board
- io_chassis
- hp_npar_config
- hp_vpar_config

End1	Relationship Type	End2
node	containment	fchba
node	containment	interface
node	containment	scsi_adapter
cell_board	composition	cpu
cell_board	composition	memory
hp_complex	composition	io_chassis
io_chassis	composition	fchba
io_chassis	composition	interface
io_chassis	composition	scsi_adapter
cell_board	usage	io_chassis
node	usage	cell_board

End1	Relationship Type	End2
node	usage	fchba
node	usage	interface

Used Scripts

- vendors.py
- storage_topology.py
- npar_by_shell.py

Discovered CITs

- CellBoard
- Composition
- Containment
- Cpu
- Dependency
- Fibre Channel HBA
- FileSystem
- HP Complex
- HP nPar Config
- HP vPar Config
- I/O Chassis
- Interface
- Interface Aggregation
- LogicalVolume
- Membership

- Node
- Physical Volume
- SCSI Adapter
- Usage
- Volume Group

Discovery Mechanism

This section includes the following commands:

- "Verify Discovery on the vPartition" on the next page
- "Verify Discovery on the nPartition" on the next page
- "Get Information about Complex" on the next page
- "List General Information About All Cells" on page 178
- "List Detailed Information About Each Cell" on page 179
- "Get Information About I/O Chassis" on page 184
- "Get the List of Names of the nPartitions on the System" on page 185
- "Get Detailed Information About nPartition" on page 185
- "Get the Name of the Current vPartition" on page 189
- "Get Detailed Information About vPartition" on page 189
- "Get Fibre Channel Adapters" on page 191
- "Get Disk Devices" on page 192
- "Get Network Interfaces" on page 193
- "Get File Systems" on page 194
- "Get Logical Volumes, Volume Groups, and Physical Volumes" on page 194
- "Get Network Interfaces" on page 196
- "Get Information About Link Aggregation Interfaces" on page 197
- "Get MAC Addresses of the Aggregated Interfaces" on page 197
- "Get Hardware Paths of the Aggregated Interfaces" on page 197
- "Get IP Addresses of the Aggregated Interfaces" on page 197

Verify Discovery on the vPartition

Goal	1. To verify if discovery has connected to the vPartition. 2. To verify that further commands produce supported output.
Command	vparstatus -V
Output	Version 2.0
Values taken	1. 2.0. The version of the **vparstatus** executable 2. Return code
Comment	Supported versions of output are 2.0 and 1.3

Verify Discovery on the nPartition

Goal	To understand if discovery has connected to the partitionable server.
Command	parstatus -s
Output	None
Values taken	Return code
Comment	If return code is **0**, discovery has connected to the partitionable system

Get Information about Complex

Goal	To retrieve properties of the **HP Complex** CIT.
Command	parstatus -X
Output rp8420	[Complex] Complex Name : Complex 01 Complex Capacity Compute Cabinet (4 cell capable) : 1 Active GSP Location : cabinet 0 Model : 9000/800/rp8420 Serial Number : DEH45419K0 Current Product Number : A6912A Original Product Number : A6912A Complex Profile Revision : 1.0

	The total number of Partitions Present : 2
Output rx8640	[Complex] Complex Name : Complex 01 Complex Capacity Compute Cabinet (4 cell capable) : 1 Active MP Location : cabinet 0 Original Product Name : server rx8640 Original Serial Number : DEH4831H1Y Current Product Order Number : AB297A OEM Manufacturer : Complex Profile Revision : 1.0 The total number of partitions present : 1
Output sx3000	[Complex] Complex Name: Complex 1 Complex UUID: ab111111-2222-3333-4444-555555555555 Complex Capacity Compute Enclosure: 1 IO Enclosure: 8 Monarch OA Location: 1 Model: N/A Original Serial Number: AB11111111 Current Product Order Number: CD2222 OEM Manufacturer: N/A Total number of partitions present: 2
Values taken	• Complex Name > name • Serial number/Original Serial Number > serialnumber, hostkey
Comment	HP Complex CIT derives from the Host CIT

List General Information About All Cells

Goal	To retrieve the list of names of all Cells of all Cabinets in the Complex.
Command	parstatus -C -M
Output rp8420	cell:cab0,cell0:active core :8/0/8 :48.0/ 0.0:cab0,bay0,chassis0 :yes :yes :0

	cell:cab0,cell1:active core :4/0/8 :32.0/ 0.0:cab0,bay0,chassis1 :yes :yes :1 cell:cab0,cell2:active base :8/0/8 :40.0/ 0.0:- :no :yes :0 cell:cab0,cell3:active base :4/0/8 :32.0/ 0.0:- :no :yes :1
Output rx8640	cell:cab0,cell0:Active Core :8/0/8 :80.0/0.0 :cab0,bay0,chassis0 :yes :yes :0 cell:cab0,cell1:Active Base :8/0/8 :80.0/0.0 :cab0,bay0,chassis1 :yes :yes :0 cell:cab0,cell2:Active Base :4/0/8 :64.0/0.0 :- :no :yes :0 cell:cab0,cell3:Absent :- :- :- :- :-
Values taken	The names of the cells
Comment	The cell names are then used to retrieve detailed information about each cell.

List Detailed Information About Each Cell

Goal	To retrieve the properties of the Cell CIs and corresponding CPU and Memory CIs.
Command	parstatus -v -c <cell_number>
Output rp8420	[Cell] Hardware Location : cab0,cell0 Global Cell Number : 0 Actual Usage : active core Normal Usage : base Connected To : cab0,bay0,chassis0 Core Cell Capable : yes Firmware Revision : 24.1 Failure Usage : activate Use On Next Boot : yes Partition Number : 0 Partition Name : db01_ap02_db03_db04 [CPU Details] Type : 88E0 Speed : 1100 MHz

	CPU Status === ====== 0 ok 1 ok 2 ok 3 ok 4 ok 5 ok 6 ok 7 ok CPUs ========== OK : 8 Deconf : 0 Max : 8 [Memory Details] DIMM Size (MB) Status ==== ========= ========= 0A 4096 ok 4A 4096 ok 0B 4096 ok 4B 4096 ok 1A 4096 ok 5A 4096 ok 1B 4096 ok 5B 4096 ok 2A 4096 ok 2B 4096 ok 3A 4096 ok 3B 4096 ok Memory

	======================== DIMM OK : 12 DIMM Deconf : 0 Max DIMMs : 16 Memory OK : 48.00 GB Memory Deconf : 0.00 GB
Output rx8640	[Cell] Hardware Location : cab0,cell0 Global Cell Number : 0 Actual Usage : Active Core Normal Usage : Base Connected To : cab0,bay0,chassis0 Core Cell Capable : yes Firmware Revision : 9.48 Failure Usage : Normal Use On Next Boot : yes Partition Number : 0 Partition Name : db10_ap13_ap14_db15_db16_ap17_ap18_ap20 Requested CLM value : 0.0 GB Allocated CLM value : 0.0 GB Cell Architecture Type : Itanium(R)-based CPU Compatibility : CDH-640 Hyperthreading Capable : yes [CPU Details] Type : FFFF Speed : 1598 MHz CPU Status === ====== 0 OK 1 OK 2 OK

	3 OK 4 OK 5 OK 6 OK 7 OK CPUs ========== OK : 8 Deconf : 0 Max : 8 [Memory Details] DIMM Size (MB) Status ==== ========= ========= 3A 8192 OK 3B 8192 OK 1A 8192 OK 1B 8192 OK 4A 8192 OK 4B 8192 OK 0A 8192 OK 0B 8192 OK 2A 8192 OK 2B 8192 OK Memory ======================== DIMM OK : 10 DIMM Deconf : 0 Max DIMMs : 16 Memory OK : 80.00 GB Memory Deconf : 0.00 GB

Values taken	Global Cell Number > name	
	Hardware Location > hardware_path	
	Actual Usage > is_core	If value of **Actual Usage** contains the word **Core**
	Core Cell Capable > core_capable	Convert **yes/no** to Boolean
	Requested CLM value > requested_clm_value	• This parameter does not exist for rp8420 servers • Need to convert GB to MB
	Allocated CLM value > allocated_clm_memory	• This parameter does not exist for rp8420 servers • Need to convert GB to MB
	Use On Next Boot > use_on_next_boot	Convert **yes/no** to Boolean
	Failure Usage > failure_usage	
	Firmware Revision > firmware_revision	
	Cell Architecture Type > architecture_type	This value does not exist for rp8420 servers
	CPU Compatibility > cpu_compatibility	This value does not exist for rp8420 servers
	Hyperthreading Capable > is_hyperthreading_capable	Convert **yes/no** to Boolean

Values taken *(cont'd)*	CPUs ========== OK : 8 Deconf : 0 Max : 8	deconf_cpu_number: 0 max_cpu_number: 8	
	Memory ============= DIMM OK : 10 DIMM Deconf : 0 Max DIMMs : 16	memory_amount: 80.00 GB deconf_memory: 0.00 GB max_dimms:16 deconfigured_dimms: 0	Need to convert GB to MB

	Memory OK : 80.00 GB Memory Deconf : 0.00 GB		
Comment	The Memory CI is not created for UCMDB 9.x since there is no such CIT. The partition number is used to connect the cell to the nPartition (represented as a host).		

Get Information About I/O Chassis

Goal	To retrieve the data of all I/O chassis in the Complex (including I/O extension cabinets).	
Command	parstatus -I -M	
Output rp8420	chassis:cab0,bay0,chassis0 :active :yes :cab0,cell0:0 chassis:cab0,bay0,chassis1 :active :yes :cab0,cell1:1	
Output rx8640	chassis:cab0,bay0,chassis0 :Active :yes :cab0,cell0:0 chassis:cab0,bay0,chassis1 :Active :yes :cab0,cell1:0	
Values taken	name: cab0,bay0,chassis0	
	usage: Active	
	is_core: yes	To convert to Boolean values.
Comment	The Cell hardware path is used to connect the chassis to the Cell.	

Get the List of Names of the nPartitions on the System

Goal	To retrieve the list of the nPartition numbers configured on the system.
Command	parstatus -P -M
Output rp8420	`partition: 0 :active : 2 : 1 :cab0,cell0:db01_ap02_db03_db04` `partition: 1 :active : 2 : 1 :cab0,cell1:wdb1_wdb4`
Output rx8640	`partition:0 :Active :3 :2 :cab0,cell0:db10_ap13_ap14_db15_db16_ ap17_`
Values taken	The list of nPartition numbers
Comment	These numbers are used to retrieve detailed information about each nPartition.

Get Detailed Information About nPartition

Goal	To retrieve detailed information for each nPartition and create a Host, connected to the Cells and to the **HP nPar Config** CI.
Command	parstatus -v -p <npartition_number>

Output rp8420	`[Partition]`
	`Partition Number : 0`
	`Partition Name : db01_ap02_db03_db04`
	`Status : active`
	`IP address : 0.0.0.0`
	`Primary Boot Path : 0/0/0/2/0.6.0`
	`Alternate Boot Path : 0/0/0/2/1.2.0`
	`HA Alternate Boot Path : 0/0/0/3/0.6.0`
	`PDC Revision : 24.1`
	`IODCH Version : 88E0`
	`CPU Speed : 1100 MHz`
	`Core Cell : cab0,cell0`
	`[Cell]`
	` CPU Memory Use`
	` OK/ (GB) Core On`
	`Hardware Actual Deconf/ OK/ Cell Next Par`

	Location Usage Max Deconf Connected To Capable Boot Num ========== ============ ======= === cab0,cell0 active core 8/0/8 48.0/ 0.0 cab0,bay0,chassis0 yes yes 0 cab0,cell2 active base 8/0/8 40.0/ 0.0 - no yes 0 [Chassis] Core Connected Par Hardware Location Usage IO To Num ================== ============ == === cab0,bay0,chassis0 active yes cab0,cell0 0
Output rx8640	[Partition] Partition Number : 0 Partition Name : db10_ap13_ap14_db15_db16_ap17_ap18_ap20 Status : Active IP Address : Primary Boot Path : 0/0/8/1/0/4/0.8.0.255.0.12.0 Alternate Boot Path : 0/0/8/1/0/4/1.8.0.255.0.13.0 HA Alternate Boot Path : PDC Revision : 9.48 IODCH Version : ffff Cell Architecture : Itanium(R)-based CPU Compatibility : CDH-640 CPU Speed : 1598 MHz Core Cell : cab0,cell0 Core Cell Choice [0] : cab0,cell0 Total Good Memory Size : 224.0 GB Total Interleave Memory: 224.0 GB Total Requested CLM : 0.0 GB Total Allocated CLM : 0.0 GB Hyperthreading Enabled : no [Cell]

	CPU Memory Use OK/ (GB) Core On Hardware Actual Deconf/ OK/ Cell Next Par Location Usage Max Deconf Connected To Capable Boot Num ========== ============ ======= ======== cab0,cell0 Active Core 8/0/8 80.0/0.0 cab0,bay0,chassis0 yes yes 0 cab0,cell1 Active Base 8/0/8 80.0/0.0 cab0,bay0,chassis1 yes yes 0 cab0,cell2 Active Base 4/0/8 64.0/0.0 - no yes 0 Notes: * = Cell has no interleaved memory. [Chassis] Core Connected Par Hardware Location Usage IO To Num ================== ============ ==== cab0,bay0,chassis0 Active yes cab0,cell0 0 [Chassis] Core Connected Par Hardware Location Usage IO To Num ================== ============ ==== ========== === cab0,bay0,chassis1 Active yes cab0,cell1 0

Values taken	Host (nPartition)	
	hostkey	Host key is composed of nPartition name and Complex Serial number
	Partition Name > tname	
	HP nPar Config	
	Constant "nPar Config" > name	
	Partition Name > npar_name	
	Status > npar_status	
	PDC Revision > pdc_revision	
	Hyperthreading Enabled > hyperthreading_mode	This value does not exist on the rp8420 servers
	Partition Number > partition_number	
	Primary Boot Path > primary_boot_ path	
	Alternate Boot Path > alternate_boot_ path	

Get the Name of the Current vPartition

Goal	To retrieve the name of the current vPartition.
Command	vparstatus -w -M
Output	`doidb01`
Values taken	The name of the vPartition that discovery has connected to.
Comment	The list includes detailed information for the current vPartition only. It is possible to retrieve detailed information about all vPartitions on the nPartition, but it is not possible to retrieve their IP addresses and/or lower MAC address to create a host in UCMDB.

Get Detailed Information About vPartition

Goal	To retrieve detailed information about vPartition and create **Host** and **HP vPar Config** CIs.
Command	vparstatus -v -p <vpartition_name>

Output rp8420	`[Virtual Partition Details]`
	`Name: doidb01`
	`State: Up`
	`Attributes: Dynamic,Autoboot,Nosearch`
	`Kernel Path: /stand/vmunix`
	`Boot Opts: -lq`
	`[CPU Details]`
	`Min/Max: 3/16`
	`Bound by User [Path]: 0.15`
	`0.16`
	`0.17`
	`Bound by Monitor [Path]:`
	`Unbound [Path]: 2.14`
	`2.15`
	`[IO Details]`
	`0.0.12`
	`0.0.14`

	0.0.12.1.0.4.0.8.0.255.0.0.0 0.0.14.1.0.4.0.8.0.255.0.1.0 0.0.12.1.0.4.0.111.128.19.4.0.0 0.0.12.1.0.4.0.111.88.19.5.0.0 BOOT 0.0.14.1.0.4.0.112.88.19.5.0.0, ALTBOOT [Memory Details] Specified [Base /Range]: (bytes) (MB) Total Memory (MB): 24448
Output rx8640	[Virtual Partition Details] Name: doiap17 State: Up Attributes: Dynamic,Autoboot,Nosearch Kernel Path: /stand/vmunix Boot Opts: -lq [CPU Details] Min/Max: 1/12 User assigned [Path]: Boot processor [Path]: 1.122 Monitor assigned [Path]: Non-cell-specific: User assigned [Count]: 1 Monitor assigned [Count]: 0 Cell-specific [Count]: Cell ID/Count <none> [IO Details] 0.0.8 0.0.8.1.0.4.0.8.0.255.0.13.0 0.0.8.1.0.4.0.8.0.255.0.12.0 BOOT 0.0.8.1.0.4.1.8.0.255.0.13.0,ALTBOOT [Memory Details]

	ILM, user-assigned [Base /Range]: (bytes) (MB) ILM, monitor-assigned [Base /Range]: 0x11c0000000/8192 (bytes) (MB) ILM Total (MB): 8192 ILM Granularity (MB): 512 CLM, user-assigned [CellID Base /Range]: (bytes) (MB) CLM, monitor-assigned [CellID Base /Range]: (bytes) (MB) CLM (CellID MB): CLM Granularity (MB): 128	
Values taken	Const "HP vPar Config" > name	
	Name > vpar_name	
	Boot Opts > boot_options	
	Boot processor [Path] > boot_processor_path	This value does not exist for rp8420 servers
	State > vpar_status	
	Attributes: Dynamic, Autoboot, Nosearch	• autoboot_mode: Autoboot • autosearch_mode: Nosearch • modification_mode: Dynamic
	Bound by User [Path]/User assigned [Path] > cpus_bound_by_user	Actual parameter is different between server versions
	Unbound [Path] > unbound_cpus	
Comment	For the attribute format of attributes such as **cpus_bound_by_user**, refer to the Data Model specification.	

Get Fibre Channel Adapters

Goal	To model Fibre Channel adapters
Command	ioscan -FnkCfc
Output	pci:wsio:F:T:F:-1:50:4294967295:fc:fcd:

	0/0/12/1/0/4/0:16 119 35 18 0 0 0 0 :0: root.cell.sba.lba.PCItoPCI.fcd:fcd: CLAIMED:INTERFACE:HP AB465-60001 PCI/PCI-X Fibre Channel 2-port 2Gb FC /2-port 1000B-T Combo Adapter (FC Port 1):0 /dev/fcd0 pci:wsio:F:T:F:-1:50:4294967295:fc:fcd: 0/0/12/1/0/4/1:16 119 35 18 0 0 0 0 :1: root.cell.sba.lba.PCItoPCI.fcd:fcd: CLAIMED:INTERFACE:HP AB465-60001 PCI/PCI-X Fibre Channel 2-port 2Gb FC/2-port 1000B-T Combo Adapter (FC Port 2):1 /dev/fcd1 pci:wsio:F:T:F:-1:50:4294967295:fc:fcd: 0/0/14/1/0/4/0:16 119 35 18 0 0 0 0 : 2:root.cell.sba.lba.PCItoPCI.fcd:fcd: CLAIMED:INTERFACE:HP AB465-60001 PCI/PCI-X Fibre Channel 2-port 2Gb FC/2-port 1000B-T Combo Adapter (FC Port 1):2 /dev/fcd2 pci:wsio:F:T:F:-1:50:4294967295:fc:fcd: 0/0/14/1/0/4/1:16 119 35 18 0 0 0 0 :3: root.cell.sba.lba.PCItoPCI.fcd:fcd: CLAIMED:INTERFACE:HP AB465-60001 PCI/PCI-X Fibre Channel 2-port 2Gb FC/2-port 1000B-T Combo Adapter (FC Port 2):3 /dev/fcd3	
Values taken	name	/dev/fcd0
	data_description	HP AB465-60001 PCI/PCI-X Fibre Channel 2-port 2Gb FC/2-port 1000B-T Combo Adapter (FC Port 2)
Comment	The hardware path serves to locate the Cell and use it as a container for FC HBA. Example value: `0/0/14/1/0/4/0`. The first integer value is the Global ID of the Cell; the second value is the ID of the I/O chassis.	

Get Disk Devices

Goal	To retrieve information about the dependency between I/O chassis, physical disk, and SCSI adapter.
Command	ioscan -FnkCdisk
Output	scsi:wsio:T:T:F:31:188:2031616: disk:sdisk:0/0/12/1/0/4/0.

	111.88.19.5.0.0:0 0 4 50 0 0 0 0 51 248 164 14 99 72 178 210 :3:root.cell.sba.lba.PCItoPCI.fcd.fcd_fcp.fcd_vbus.tgt.sdisk: sdisk:CLAIMED:DEVICE:EMC SYMMETRIX:31 /dev/dsk/c31t0d0 /dev/rdsk/c31t0d0 scsi:wsio:T:T:F:31:188:2031872: disk:sdisk:0/0/12/1/0/4/0. 111.88.19.5.0.1:0 0 4 50 0 0 0 0 51 248 164 14 76 238 217 30 :59:root.cell.sba.lba. PCItoPCI.fcd.fcd_fcp.fcd_vbus.tgt. sdisk:sdisk:CLAIMED:DEVICE:EMC SYMMETRIX:31 /dev/dsk/c31t0d1 /dev/rdsk/c31t0d1 scsi:wsio:T:T:F:31:188:2032128: disk:sdisk:0/0/12/1/0/4/0. 111.88.19.5.0.2:0 0 4 50 0 0 0 0 51 248 164 14 101 17 172 238 :61:root.cell.sba.lba. PCItoPCI.fcd.fcd_fcp.fcd_vbus.tgt.sdisk:sdisk: CLAIMED:DEVICE:EMC SYMMETRIX:31 /dev/dsk/c31t0d2 /dev/rdsk/c31t0d2	
Values taken	slot_number	0/0/12/1/0/4/0.111.88.19.5.0.0
	name	/dev/dsk/c31t0d2
	Cell ID	0/0/12/1/0/4/0.111.88.19.5.0.0
	IO chassis ID	0/0/12/1/0/4/0.111.88.19.5.0.0

Get Network Interfaces

Goal	To retrieve information about the dependency between network interfaces and the I/O chassis.
Command	ioscan -FnkClan
Output	pci:wsio:F:F:F:-1:-1:4294967295:lan: igelan:0/0/12/1/0/6/0:20 228 22 72 0 0 0 0 :0: root.cell.sba.lba.PCItoPCI.igelan:igelan: CLAIMED:INTERFACE:HP AB465-60001 PCI/PCI-X 1000Base-T 2-port 2Gb FC/2-port 1000B-T Combo Adapter:0 pci:wsio:F:F:F:-1:-1:4294967295:lan: igelan:0/0/12/1/0/6/1:20 228 22 72 0 0 0 0 :1: root.cell.sba.lba.PCItoPCI.igelan:igelan: CLAIMED:INTERFACE:HP AB465-60001 PCI/PCI-X 1000Base-T 2-port 2Gb FC/2-port 1000B-T Combo Adapter:1

	pci:wsio:F:F:F:-1:-1:4294967295:lan: igelan:0/0/14/1/0/6/0:20 228 22 72 0 0 0 0 :2: root.cell.sba.lba.PCItoPCI.igelan:igelan: CLAIMED:INTERFACE:HP AB465-60001 PCI/PCI-X 1000Base-T 2-port 2Gb FC/2-port 1000B-T Combo Adapter:2 pci:wsio:F:F:F:-1:-1:4294967295:lan: igelan:0/0/14/1/0/6/1:20 228 22 72 0 0 0 0 :3: root.cell.sba.lba.PCItoPCI.igelan:igelan: CLAIMED:INTERFACE:HP AB465-60001 PCI/PCI-X 1000Base-T 2-port 2Gb FC/2-port 1000B-T Combo Adapter:3
Values taken	The hardware path which reflects the Cell and I/O chassis that this interface belongs to.

Get File Systems

Goal	To retrieve information about the file systems and corresponding logical volumes.
Command	df -P
Output	Filesystem 512-blocks Used Available Capacity Mounted on /dev/vg01/lv106 9837710 115094 9722616 2% /usr/vw/rvs /dev/vg01/lv124 7915344 814616 7100728 11% /home/kdov12 /dev/vg01/lv125 10222640 6275190 3947450 62% /home/ebrev /dev/vg01/lv123 20829536 2796208 18033328 14% /home/temp /dev/vg01/lv110 2080832 4608 2076224 1% /oracle2/arch/inst_aebp
Values taken	name for FileSystem CIT: /usr/vw/rvs Name of the logical volume: /dev/vg01/lv106

Get Logical Volumes, Volume Groups, and Physical Volumes

Goal	To retrieve data for modeling Logical volumes, Volume groups, and Physical volumes.
Command	vgdisplay -v
Output	--- Volume groups --- VG Name /dev/vg00 VG Write Access read/write VG Status available

	Max LV 255 Cur LV 10 Open LV 10 Max PV 16 Cur PV 1 Act PV 1 Max PE per PV 4384 VGDA 2 PE Size (Mbytes) 16 Total PE 4315 Alloc PE 4156 Free PE 159 Total PVG 0 Total Spare PVs 0 Total Spare PVs in use 0 --- Logical volumes --- LV Name /dev/vg00/lvol1 LV Status available/syncd LV Size (Mbytes) 256 Current LE 16 Allocated PE 16 Used PV 1 --- Physical volumes --- PV Name /dev/dsk/c31t0d0 PV Name /dev/dsk/c32t0d0 Alternate Link PV Status available Total PE 4315 Free PE 159 Autoswitch On Proactive Polling On

Values taken	Volume group	
	VG Name > name VG Write Access > write_access	
	VG Status > vg_status PE Size (Mbytes)	This value is used to calculate the size of the physical volume
	Logical Volume	
	LV Name > name LV Status > lv_status	
	Physical Volume	
	PV Name > name	Alternate link may also be used. It depends on the output of the **ioscan FnkCdisk** command.
	PV Status > pv_status	
	Total PE > pv_size	This attribute is calculated on the PE Size (Mbytes) value.

Get Network Interfaces

Goal	To retrieve information about the network interfaces.
Command	lanscan

Output	`Hardware Station Crd Hdw Net-Interface NM MAC HP-DLPI DLPI`
	`Path Address In# State NamePPA ID Type Support Mjr#`
	`0/0/4/1/0/6/1 0x0014C254D9BD 1 UP lan1 snap1 2 ETHER Yes 119`
	`0/0/6/1/0/6/1 0x0014C254C961 3 UP lan3 snap3 4 ETHER Yes 119`
	`LinkAgg0 0x0014C254D9BC 900 UP lan900 snap900 6 ETHER Yes 119`
	`LinkAgg1 0x000000000000 901 DOWN lan901 snap901 7 ETHER Yes 119`
	`LinkAgg2 0x000000000000 902 DOWN lan902 snap902 8 ETHER Yes 119`
	`LinkAgg3 0x000000000000 903 DOWN lan903 snap903 9 ETHER Yes 119`
	`LinkAgg4 0x000000000000 904 DOWN lan904 snap904 10 ETHER Yes 119`

Values taken	• The hardware path to create the link between the network interface and I/O chassis. • The MAC address to create the network interface.

	• The MAC address of the Link aggregation interface, the indicator that the interface is up, and the device name.

Get Information About Link Aggregation Interfaces

Goal	To model the links between interfaces and link aggregation.
Command	lanscan -q
Output	1 3 900 0 2 901 902 903 904
Values taken	The interface number and IDs of the aggregated interfaces.

Get MAC Addresses of the Aggregated Interfaces

Goal	To retrieve the MAC addresses of the aggregated interfaces.
Command	lanadmin -a <interface_id>
Example	lanscan -a 0
Output	Station Address = 0x0014c254d9bc
Values taken	The MAC address of the aggregated interface

Get Hardware Paths of the Aggregated Interfaces

Goal	To retrieve the hardware path of the aggregated interfaces
Command	lanscan -v | grep -E <list_of_aggregated_interfaces>
Example	lanscan -v | grep -E "lan0|lan2"
Output	0/0/4/1/0/6/0 0 UP lan0 snap0 1 ETHER Yes 119 igelan 0/0/6/1/0/6/0 2 UP lan2 snap2 3 ETHER Yes 119 igelan
Values taken	The hardware path that allocates the I/O chassis that holds this interface.

Get IP Addresses of the Aggregated Interfaces

Goal	To get IP addresses of the interfaces
Command	netstat -rn
Output	Routing tables Destination Gateway Flags Refs Interface Pmtu 127.0.0.1 127.0.0.1 UH 0 lo0 4136 10.186.112.115 10.186.112.115 UH 0 lan0 4136 10.186.116.13 10.186.116.13 UH 0 lan1 4136 192.168.121.1 192.168.121.1 UH 0 lan2 4136 10.186.115.18 10.186.115.18 UH 0 lan3 4136 10.186.116.19 10.186.116.19 UH 0 lan1:1 4136 10.186.116.0 10.186.116.13 U 3 lan1 1500 10.186.116.0 10.186.116.19 U 3 lan1:1 1500 10.186.115.0 10.186.115.18 U 2 lan3 1500 10.186.112.0 10.186.112.115 U 2 lan0 1500 192.168.121.0 192.168.121.1 U 2 lan2 1500 10.186.86.0 10.186.115.1 UG 0 lan3 1500 127.0.0.0 127.0.0.1 U 0 lo0 4136 default 10.186.116.1 UG 0 lan1 1500
Values taken	The IP addresses of the interfaces. The **netstat** command does not require root privileges, in contrast to **ifconfig**.

Troubleshooting and Limitations – HP Partitioning Solution Discovery

- The destination host is not a part of the HP nPartition system.

  DFM considers the target host as not being a part of the HP partitionable system. The criteria are based on executing the **parstatus -s** command.

- Failed to discover vPartition details.

  The **vparstatus** command was not executed successfully. This command should be accessible

and DFM should have enough permissions to execute it. If this command requires **sudo** to be executed, configure the SSH credentials.

For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

- Failed to discover storage topology.

  The **vgdisplay** command was not executed successfully.

- Failed to link file systems and disks.

  The **df** command was not executed successfully.

- Failed to discover SCSI adapters, or Fibre Channel adapters, or Network cards.

  The **ioscan** command was not executed successfully.

Chapter 15: Hyper-V Discovery

This chapter includes:

- Overview 201
- Supported Versions 201
- Topology 201
- How to Discover Hyper-V 202
- Discovery Mechanism 203
  - Discovery Mechanism for \\root\virtualization Namespace 204
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Overview

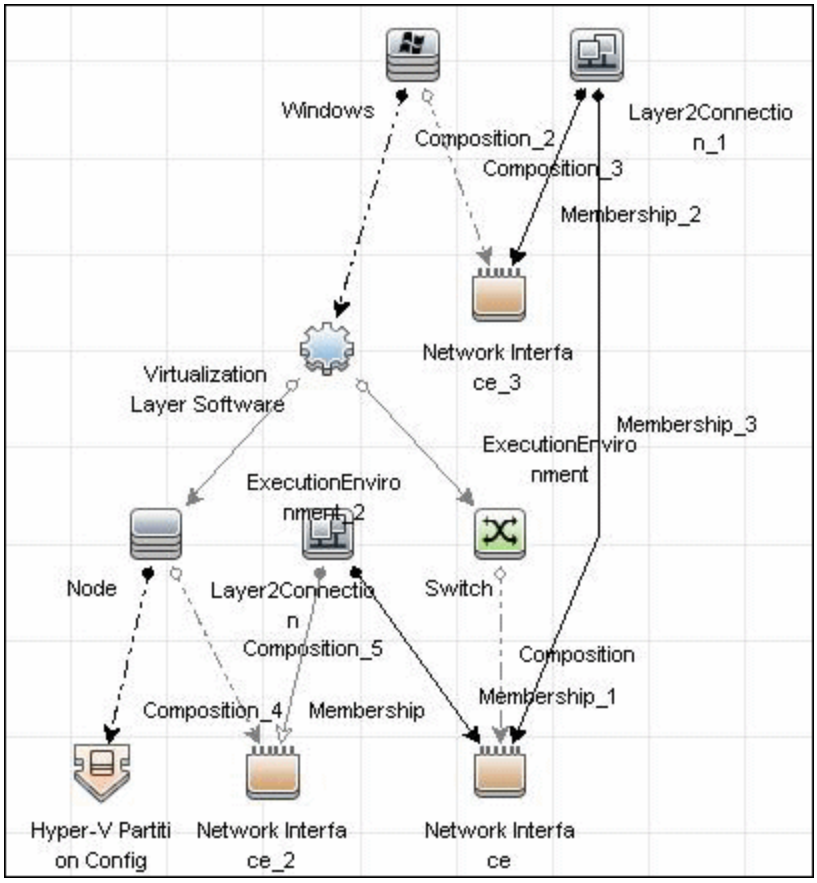
The **Hyper-V** package discovers the Hyper-V Aware Windows server through WMI and NTCMD. It discovers resource pools, virtual switches, virtual NICs, and virtual machines.

Supported Versions

The **Hyper-V** package supports Windows 2008, Windows 2008 R2, Windows Server 2012, Windows Server 2012 R2, and Windows Server 2016.

Topology

The following image displays the topology of the Hyper-V discovery:



How to Discover Hyper-V

This task includes the following steps:

1. Prerequisites - Set up protocol credentials

   This discovery uses the NTCMD and WMI protocols.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Prerequisites - Verification

   Verify that you can perform WMI queries in the **\\root\virtualization** namespace or the **\\root\virtualization/v2** namespace on the target machine, either through WMI or through the **wmic** command when connecting through a Shell protocol.

3. Run the Discovery

   To discover Hyper-V topology through Shell:

   a. Run the **Range IPs by ICMP** job to discover which of the machines in the IP range are up.

   b. Run the **Host Connection by Shell** job to discover Shell connectivity and basic information about the hosts.

   c. Run the **Host Applications by Shell** job to discover processes on target machines.

   d. Run the **Hyper-V Topology by Shell** job to discover the Hyper-V topology.

   To discover Hyper-V topology through WMI:

   a. Run the **Range IPs by ICMP** job to discover which of the machines in the IP range are up.

   b. Run the **Host Connection by WMI** job to discover WMI connectivity and basic information about the hosts.

   c. Run the **Host Applications by WMI** job to discover processes on target machines.

   d. Run the **Hyper-V Topology by WMI** job to discover Hyper-V topology.

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

Discovery Mechanism

Contains the enumeration of WMI classes and attributes for supported namespaces.

Discovery Mechanism for \\root\virtualization Namespace 204
Discovery Mechanism for \\root\virtualization\v2 Namespace 210

Discovery Mechanism for \\root\virtualization Namespace

This section includes the following commands:

- "Retrieve the Hyper-V Host Name" below
- "Retrieve the Virtual Machine" on the next page
- "Retrieve the Global Settings for Virtual Machines" on the next page
- "Retrieve the Settings for Virtual Machines" on the next page
- "Retrieve the References from Virtual Machines to Settings (VSSD)" on page 206
- "Retrieve the References from Virtual Machine Settings (VSSD) to Components" on page 206
- "Retrieve the Memory Settings for Virtual Machines" on page 206
- "Retrieve the Processor Settings for Virtual Machines" on page 207
- "Retrieve Virtual Switches" on page 207
- "Retrieve the Ports of Virtual Switches" on page 207
- "Retrieve the References from Virtual Switches to Ports" on page 208
- "Retrieve the Interfaces of Virtual Machines" on page 208
- "Retrieve the Interfaces of Management Partitions" on page 208
- "Retrieve the References from Virtual Machines to Interfaces" on page 209
- "Retrieve the References from Ports on Virtual Switches to Interfaces" on page 209

Retrieve the Hyper-V Host Name

Object queried	Msvm_ComputerSystem
Conditions	Description = 'Microsoft Hosting Computer System'
Properties queried	ElementName
Comments	Verifies that the Hyper-V namespace **\\root\virtualization** is accessible and obtains the name of the Hyper-V host.

Retrieve the Virtual Machine

Object queried	Msvm_ComputerSystem
Conditions	Description = 'Microsoft Virtual Machine'
Properties queried	• Name • ElementName • EnabledState • HealthState
Comments	Obtains virtual machines present in the Hyper-V host, and obtains GUID, name, health, and enabled states for each virtual machine.

Retrieve the Global Settings for Virtual Machines

Object queried	Msvm_VirtualSystemGlobalSettingData
Conditions	None
Properties queried	• SystemName • SnapshotDataRoot • ExternalDataRoot • AutomaticRecoveryAction • AutomaticShutdownAction • AutomaticStartupAction
Comments	Obtains global settings for all virtual machines.

Retrieve the Settings for Virtual Machines

Object queried	Msvm_VirtualSystemSettingData
Conditions	None
Properties queried	• InstanceID • BaseBoardSerialNumber • BIOSGUID • BIOSSerialNumber

	• ChassisAssetTag • ChassisSerialNumber
Comments	Obtains the **VirtualSystemSettingData** (VSSD) objects of the virtual machines that hold additional settings for virtual machines. The **BIOSGUID** property holds the BIOS UUID of the virtual machine. This property is stripped of leading and trailing curly brackets ({}).

Retrieve the References from Virtual Machines to Settings (VSSD)

Object queried	Msvm_SettingsDefineState
Conditions	None
Properties queried	• ManagedElement • SettingData
Comments	Associates virtual machines and their settings (**VirtualSystemSettingData**).

Retrieve the References from Virtual Machine Settings (VSSD) to Components

Object queried	Msvm_VirtualSystemSettingDataComponent
Conditions	None
Properties queried	• GroupComponent • PartComponent
Comments	Obtains references from the **VirtualSystemSettingData** object to its components.

Retrieve the Memory Settings for Virtual Machines

Object queried	Msvm_MemorySettingData
Conditions	None
Properties queried	• InstanceID • Limit • Reservation
Comments	Obtains memory settings for virtual machines (reservation and limit). The

	references retrieved during the previous step ("Discovery Mechanism" on page 203) enable the correct association of these settings to the relevant virtual machine.

Retrieve the Processor Settings for Virtual Machines

Object queried	Msvm_ProcessorSettingData
Conditions	None
Properties queried	• InstanceID • Limit • Reservation • Weight
Comments	Obtains processor settings for virtual machines (reservation, limit, weight). The references retrieved during a previous step ("Discovery Mechanism" on page 203) enable the correct association of these settings to the relevant virtual machine.

Retrieve Virtual Switches

Object queried	Msvm_VirtualSwitch
Conditions	None
Properties queried	• ElementName • Name
Comments	Obtains virtual switches configured on a Hyper-V host.

Retrieve the Ports of Virtual Switches

Object queried	Msvm_SwitchPort
Conditions	None
Properties queried	• ElementName • Name
Comments	Obtains the ports on virtual switches.

Retrieve the References from Virtual Switches to Ports

Object queried	Msvm_HostedAccessPoint
Conditions	None
Properties queried	• Antecedent • Dependent
Comments	Obtains references that enable associating virtual switches and their ports.

Retrieve the Interfaces of Virtual Machines

Object queried	Msvm_VmLANEndpoint
Conditions	None
Properties queried	• Name • ElementName • MACAddress
Comments	Obtains endpoints that are connected to interfaces of virtual machines. Although these endpoints are not interfaces themselves, they hold enough information to report interfaces.

Retrieve the Interfaces of Management Partitions

Object queried	Msvm_SwitchLANEndpoint
Conditions	None
Properties queried	• Name • ElementName • MACAddress
Comments	Obtains endpoints that are connected to interfaces of a Management Partition (on a Hyper-V host). Although these endpoints are not interfaces themselves, they hold enough information to report interfaces. They include both physical interfaces and virtual interfaces of the partition used for internal connections to virtual machines.

Retrieve the References from Virtual Machines to Interfaces

Object queried	Msvm_DeviceSAPImplementation
Conditions	None
Properties queried	• Antecedent • Dependent
Comments	Obtains references from virtual endpoints to virtual machines, thus enabling associations.

Retrieve the References from Ports on Virtual Switches to Interfaces

Object queried	Msvm_ActiveConnection
Conditions	None
Properties queried	• Antecedent • Dependent
Comments	Obtains references from a port on a virtual switch to endpoints that enable associations.

Discovery Mechanism for \\root\virtualization\v2 Namespace

This section includes the following commands:

- "Retrieve the Hyper-V Host Name" on the next page
- "Retrieve the Virtual Machine" on the next page
- "Retrieve the Global Settings for Virtual Machines" on the next page
- "Retrieve the Settings for Virtual Machines" on page 212
- "Retrieve the References from Virtual Machines to Settings (VSSD)" on page 212
- "Retrieve the References from Virtual Machine Settings (VSSD) to Components" on page 212
- "Retrieve the Memory Settings for Virtual Machines" on page 213
- "Retrieve the Processor Settings for Virtual Machines" on page 213
- "Retrieve Virtual Switches" on page 213
- "Retrieve the Ports of Virtual Switches" on page 214
- "Retrieve the Interfaces of Virtual Machines" on page 214
- "Discovery Mechanism for \\root\virtualization\v2 Namespace" above
- "Retrieve the References from Virtual Machines to Interfaces" on page 214
- "Retrieve the References from Ports on Virtual Switches to Interfaces" on page 214
- "Retrieve the Interfaces of Hyper-V Host" on page 215
- "Retrieve the Synthetic Ethernet Adapter" on page 215
- "Retrieve the Emulated Ethernet Adapter" on page 215
- "Retrieve the Internal Ethernet Adapter (network adapter)" on page 216
- "Retrieve the External Ethernet Adapter (network adapter)" on page 216
- "Retrieve the References from LAN Endpoints to a Global Ethernet Port" on page 216

Retrieve the Hyper-V Host Name

Object queried	Msvm_ComputerSystem
Conditions	Description = 'Microsoft Hosting Computer System'
Properties queried	ElementName
Comments	Verifies that the Hyper-V namespace **\\root\virtualization\v2** is accessible and obtains the name of the Hyper-V host.

Retrieve the Virtual Machine

Object queried	Msvm_ComputerSystem
Conditions	Description = 'Microsoft Virtual Machine'
Properties queried	• Name • ElementName • EnabledState • HealthState
Comments	Obtains virtual machines present in the Hyper-V host, and obtains GUID, name health, and enabled states for each virtual machine.

Retrieve the Global Settings for Virtual Machines

Object queried	Msvm_VirtualSystemSettingData
Conditions	None
Properties queried	• InstanceID • SnapshotDataRoot • ExternalDataRoot • AutomaticRecoveryAction • AutomaticShutdownAction • AutomaticStartupAction
Comments	Obtains global settings for all virtual machines.

Retrieve the Settings for Virtual Machines

Object queried	Msvm_VirtualSystemSettingData
Conditions	None
Properties queried	• InstanceID • BaseBoardSerialNumber • BIOSGUID • BIOSSerialNumber • ChassisAssetTag • ChassisSerialNumber
Comments	Obtains the **VirtualSystemSettingData** (VSSD) objects of the virtual machines that hold additional settings for virtual machines. The **BIOSGUID** property holds the BIOS UUID of the virtual machine. This property is stripped of leading and trailing curly brackets ({}).

Retrieve the References from Virtual Machines to Settings (VSSD)

Object queried	Msvm_SettingsDefineState
Conditions	None
Properties queried	• ManagedElement • SettingData
Comments	Associates virtual machines and their settings (**VirtualSystemSettingData**).

Retrieve the References from Virtual Machine Settings (VSSD) to Components

Object queried	Msvm_VirtualSystemSettingDataComponent
Conditions	None
Properties queried	• GroupComponent • PartComponent
Comments	Obtains references from the **VirtualSystemSettingData** object to its components.

Retrieve the Memory Settings for Virtual Machines

Object queried	Msvm_MemorySettingData
Conditions	None
Properties queried	• InstanceID • Limit • Reservation
Comments	Obtains memory settings for virtual machines (reservation and limit). The references retrieved during the previous step ("Discovery Mechanism" on page 203) enable the correct association of these settings to the relevant virtual machine.

Retrieve the Processor Settings for Virtual Machines

Object queried	Msvm_ProcessorSettingData
Conditions	None
Properties queried	• InstanceID • Limit • Reservation • Weight
Comments	Obtains processor settings for virtual machines (reservation, limit, weight). The references retrieved during a previous step ("Discovery Mechanism" on page 203) enable the correct association of these settings to the relevant virtual machine.

Retrieve Virtual Switches

Object queried	Msvm_VirtualEthernetSwitch
Conditions	None
Properties queried	• ElementName • Name
Comments	Obtains virtual switches configured on a Hyper-V host.

Retrieve the Ports of Virtual Switches

Object queried	Msvm_EthernetSwitchPort
Conditions	None
Properties queried	• ElementName • Name
Comments	Obtains the ports on virtual switches.

Retrieve the Interfaces of Virtual Machines

Object queried	Msvm_LANEndpoint
Conditions	None
Properties queried	• Name • ElementName • MACAddress
Comments	Obtains endpoints that are connected to interfaces of virtual machines. Although these endpoints are not interfaces themselves, they hold enough information to report interfaces.

Retrieve the References from Virtual Machines to Interfaces

Object queried	Msvm_DeviceSAPImplementation
Conditions	None
Properties queried	• Antecedent • Dependent
Comments	Obtains references from virtual endpoints to virtual machines, thus enabling associations.

Retrieve the References from Ports on Virtual Switches to Interfaces

Object queried	Msvm_ActiveConnection

Conditions	None
Properties queried	• Antecedent • Dependent
Comments	Obtains references from a port on a virtual switch to endpoints that enable associations.

Retrieve the Interfaces of Hyper-V Host

Object queried	Msvm_LANEndpoint
Conditions	None
Properties queried	• Name • ElementName • MACAddress
Comments	Obtains the interfaces of a Hyper-V host.

Retrieve the Synthetic Ethernet Adapter

Object queried	Msvm_SyntheticEthernetPort
Conditions	None
Properties queried	• DeviceID • ElementName • PermanentAddress • SystemName
Comments	Obtains the synthetic Ethernet interfaces.

Retrieve the Emulated Ethernet Adapter

Object queried	Msvm_EmulatedEthernetPort
Conditions	None
Properties queried	• DeviceID • ElementName

	• PermanentAddress • SystemName
Comments	Obtains the emulated Ethernet interfaces.

Retrieve the Internal Ethernet Adapter (network adapter)

Object queried	Msvm_InternalEthernetPort
Conditions	None
Properties queried	• DeviceID • ElementName • PermanentAddress • SystemName
Comments	Obtains the internal Ethernet interfaces.

Retrieve the External Ethernet Adapter (network adapter)

Object queried	Msvm_ExternalEthernetPort
Conditions	None
Properties queried	• DeviceID • ElementName • PermanentAddress • SystemName
Comments	Obtains the external Ethernet interfaces.

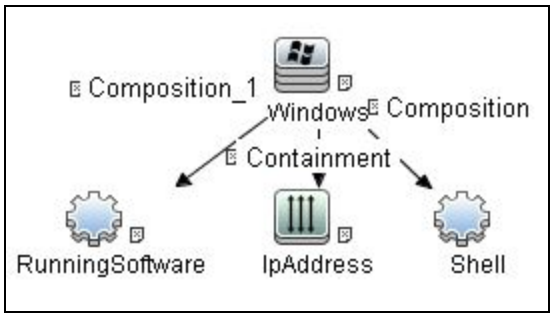
Retrieve the References from LAN Endpoints to a Global Ethernet Port

Object queried	Msvm_EthernetDeviceSAPImplementation
Conditions	None
Properties queried	• Antecedent • Dependent
Comments	Obtains references from LAN endpoints to a global Ethernet port.

Hyper-V Topology by Shell Job

This section includes information about the trigger query and adapter for this job.

Trigger Query



Node Name	Condition
RunningSoftware	DiscoveredProductName Equal Microsoft Hyper-V Hypervisor
IpAddress	NOT IP Probe Name Is null
Shell	CI Type Equal ntcmd OR CI Type Equal uda

Adapter

This job uses the **hyperv_topology_by_shell** adapter.

- Input Query

- Triggered CI Data

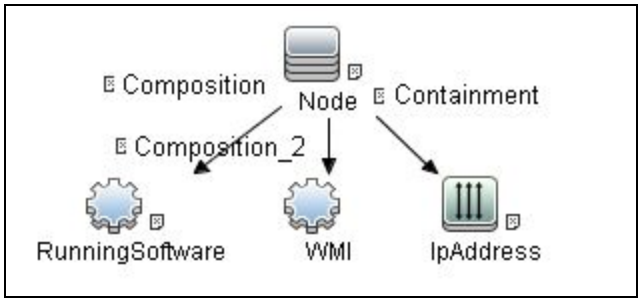
Name	Value
connected_os_credentials_id	${SOURCE.connected_os_credentials_id:NA}
credentialsId	${SOURCE.credentials_id}
ip_address	${SOURCE.application_ip}

- Used Scripts
  - vendors.py
  - hyperv.py
  - hyperv_topology_by_shell.py
- Discovered CITs
  - Composition
  - ExecutionEnvinroment
  - Hyper-V Partition Config
  - Interface
  - Layer2Connection
  - Membership
  - Node
  - Switch
  - Virtualization Layer Software

Hyper-V Topology by WMI Job

This section includes information about the trigger query and adapter for this job.

Trigger Query

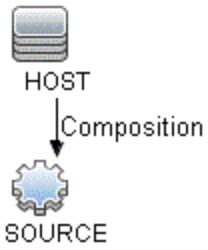


Node Name	Condition
RunningSoftware	DiscoveredProductName Equal Microsoft Hyper-V Hypervisor
WMI	NOT Reference to the credentials dictionary entry Is null
IpAddress	NOT IP Probe Name Is null

Adapter

This job uses the **hyperv_topology_by_wmi** adapter.

- Input Query



- Triggered CI Data

Name	Value
credentialsId	${SOURCE.credentials_id}
ip_address	${SOURCE.application_ip}

- Used Scripts

- vendors.py
- hyperv.py
- hyperv_topology_by_wmi.py

- Discovered CITs
  - Composition
  - ExecutionEnvinroment
  - Hyper-V Partition Config
  - Interface
  - Layer2Connection
  - Membership
  - Node
  - Switch
  - Virtualization Layer Software

Created/Changed Entities

Entity	New/Changed	Entity Name
CITs	New	Hyper-V Partition Config (hyperv_partition_config)
Valid links	New	None
Views	New	Hyper-V Topology
Scripts	New	• hyperv_topology_by_shell.py • hyperv_topology_by_wmi.py • hyperv.py
Adapters	New	• hyperv_topology_by_shell • hyperv_topology_by_wmi
Jobs	New	• Hyper-V Topology by Shell • Hyper-V Topology by WMI

Entity	New/Changed	Entity Name
Trigger Queries		• ntcmd_on_hyperv_host • wmi_on_hyperv_host

Troubleshooting and Limitations – Hyper-V Discovery

Virtual machines that are offline cannot be discovered, since the information about their MAC address is not available.

Chapter 16: IBM Virtualization Discovery

This chapter includes:

- Overview 223
- Supported Versions 223
- Topology 224
- How to Discover IBM Virtualization 231
- IBM Virtualization by Shell Job 233
  - Introduction 233
  - Adapter Information 234
- IBM LPAR and VIO Server Topology by Shell Job 236
  - Introduction 236
  - Adapter Information 237
- IBM PureFlex Topology by Shell Job 240
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  - Adapter Information 243
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- VIO Server Side Commands 259
- LPAR Side Commands 269
- WPAR Side Commands 270
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Overview

This chapter describes the usage and functionality of the IBM Virtualization discovery package. This package supports discovery of IBM Virtualization Topology based on one of the IBM virtualization managers Hardware Management Console (HMC), Integrity Virtual Machines (IVM), Flex System Manager (FSM), or Workload Partitions (WPARs) as data sources.

IBM HMC was invented by IBM for the purpose of providing a standard interface for configuring and operating partitioned (also known as an LPAR or virtualized system) and SMP systems such as IBM System I or IBM System p series.

IBM IVM is an easy-to-use, browser-based tool that allows clients to point, click, and consolidate multiple workloads into one IBM Power System.

IBM FSM is a systems management appliance that drives efficiency and cost savings in the data center. IBM FSM provides a pre-integrated and virtualized management environment across servers, storage, and networking that is easily managed from a single interface.

IBM WPARs are virtualized operating system environments within a single instance of the AIX operating system.

Supported Versions

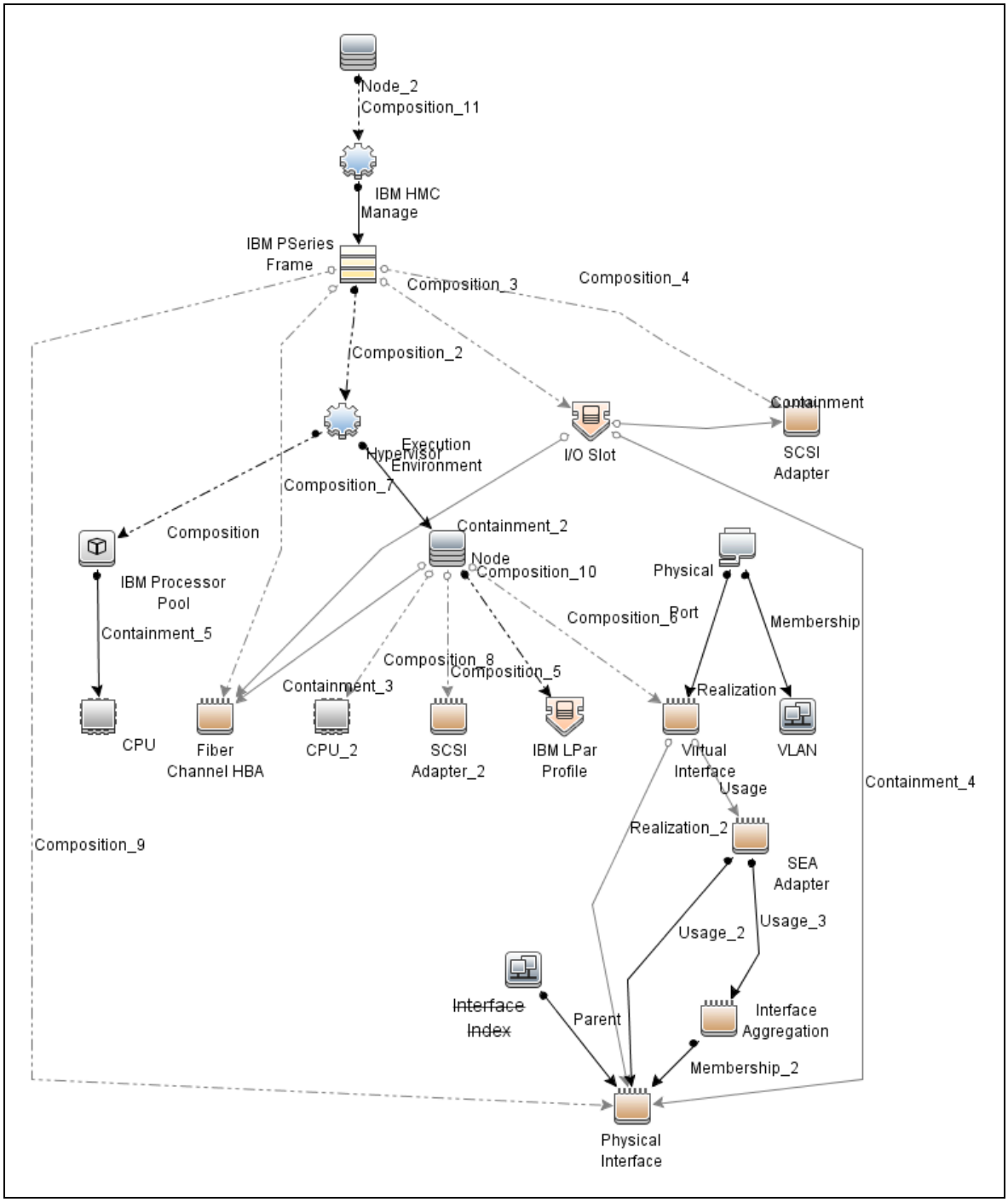
This discovery solution supports:

- IBM HMC versions 3.x, 5.x, 6.x, 7.x and 8 on AIX and Linux
- IBM FSM version 1.x
- IBM WPAR on AIX 7.x

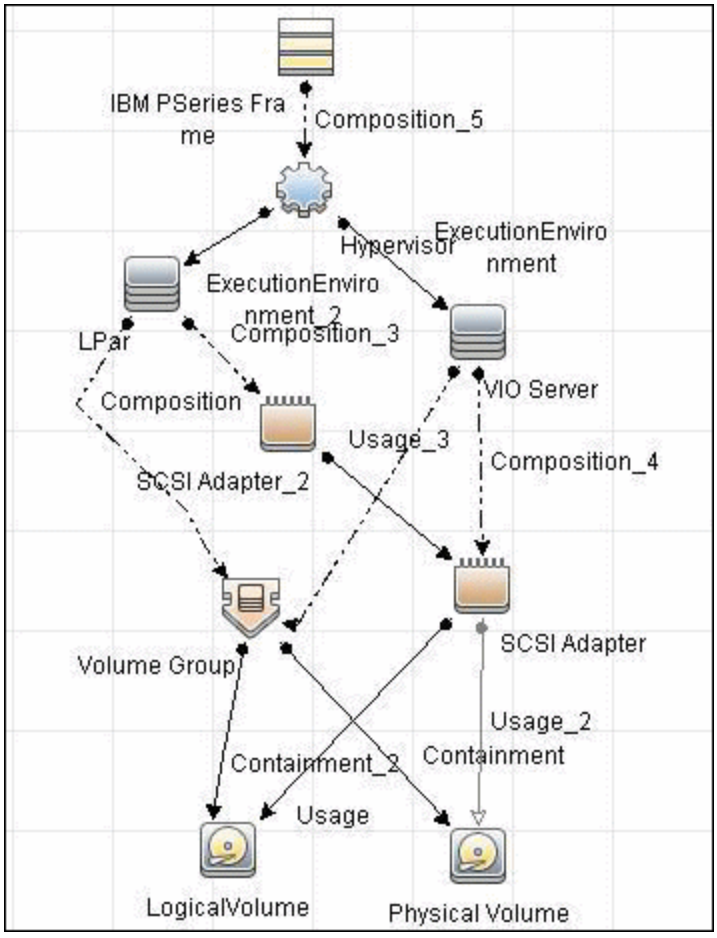
Topology

The following images display the topology of IBM Virtualization Discovery.

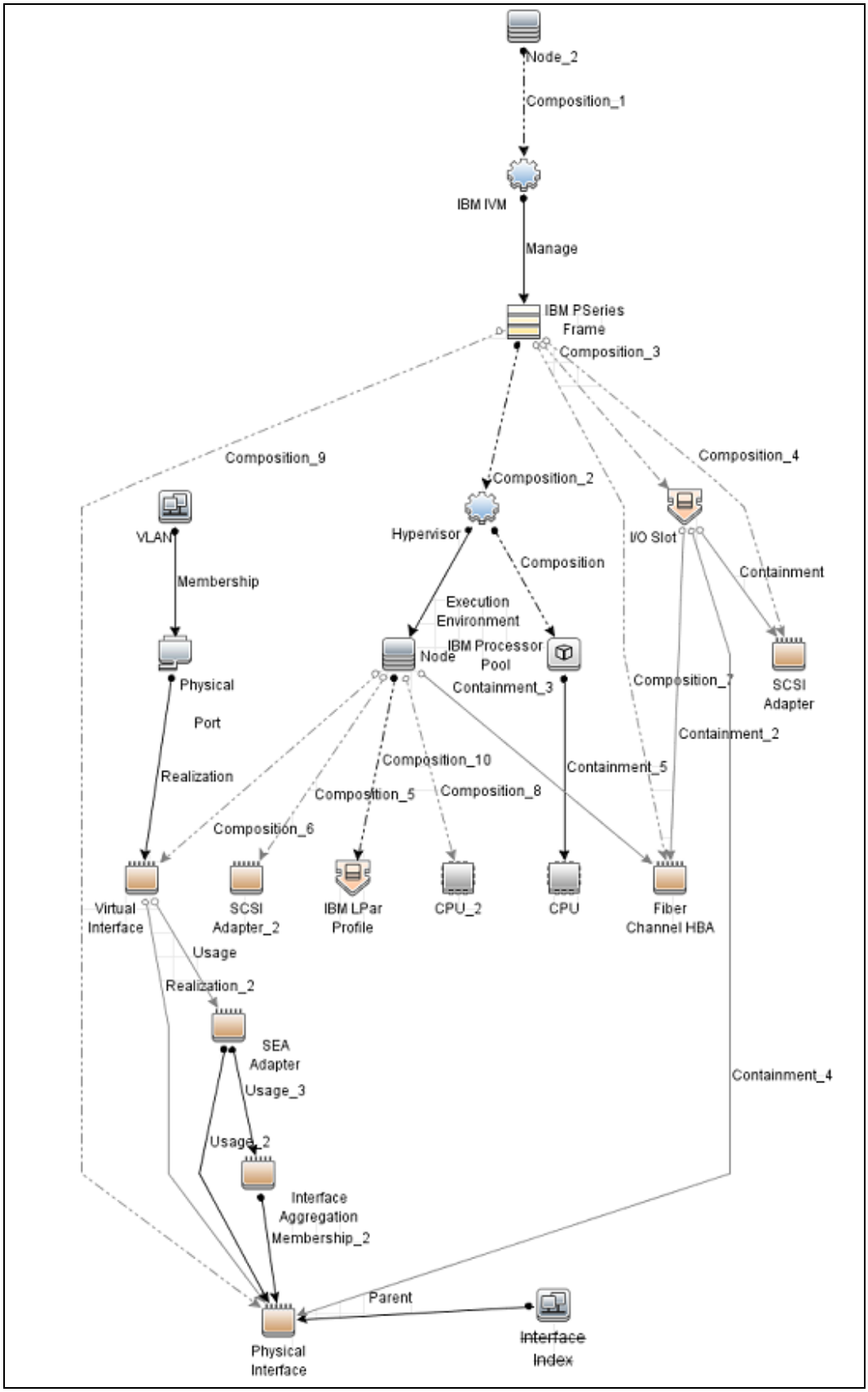
IBM Virtualization by Shell Topology



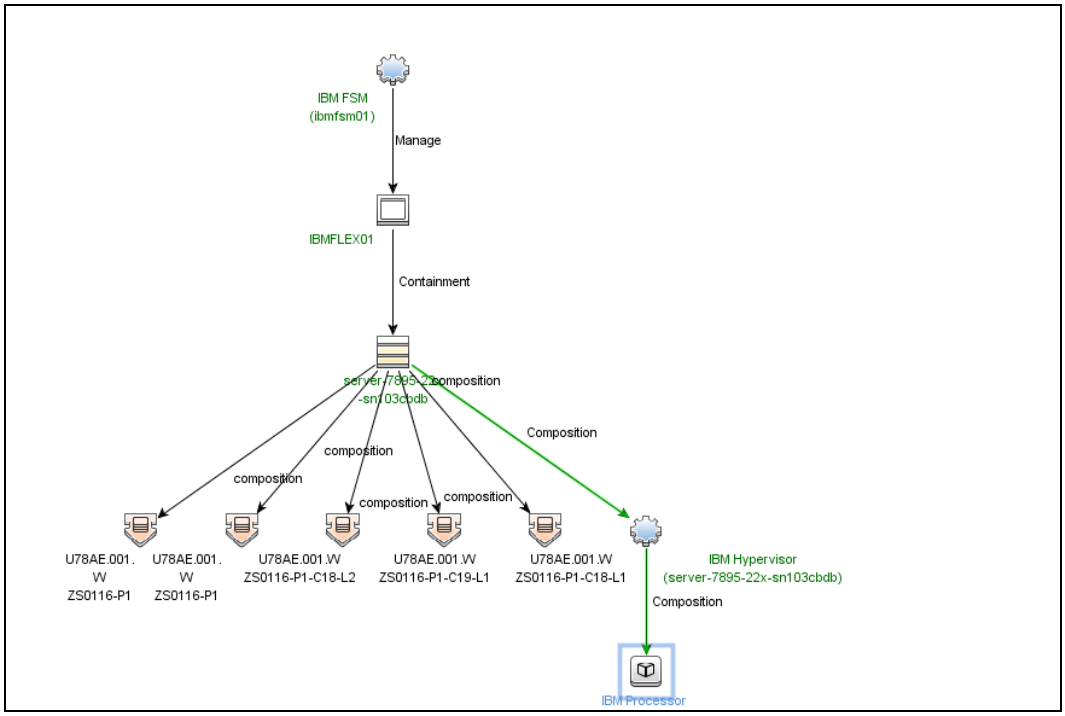
IBM Storage Topology



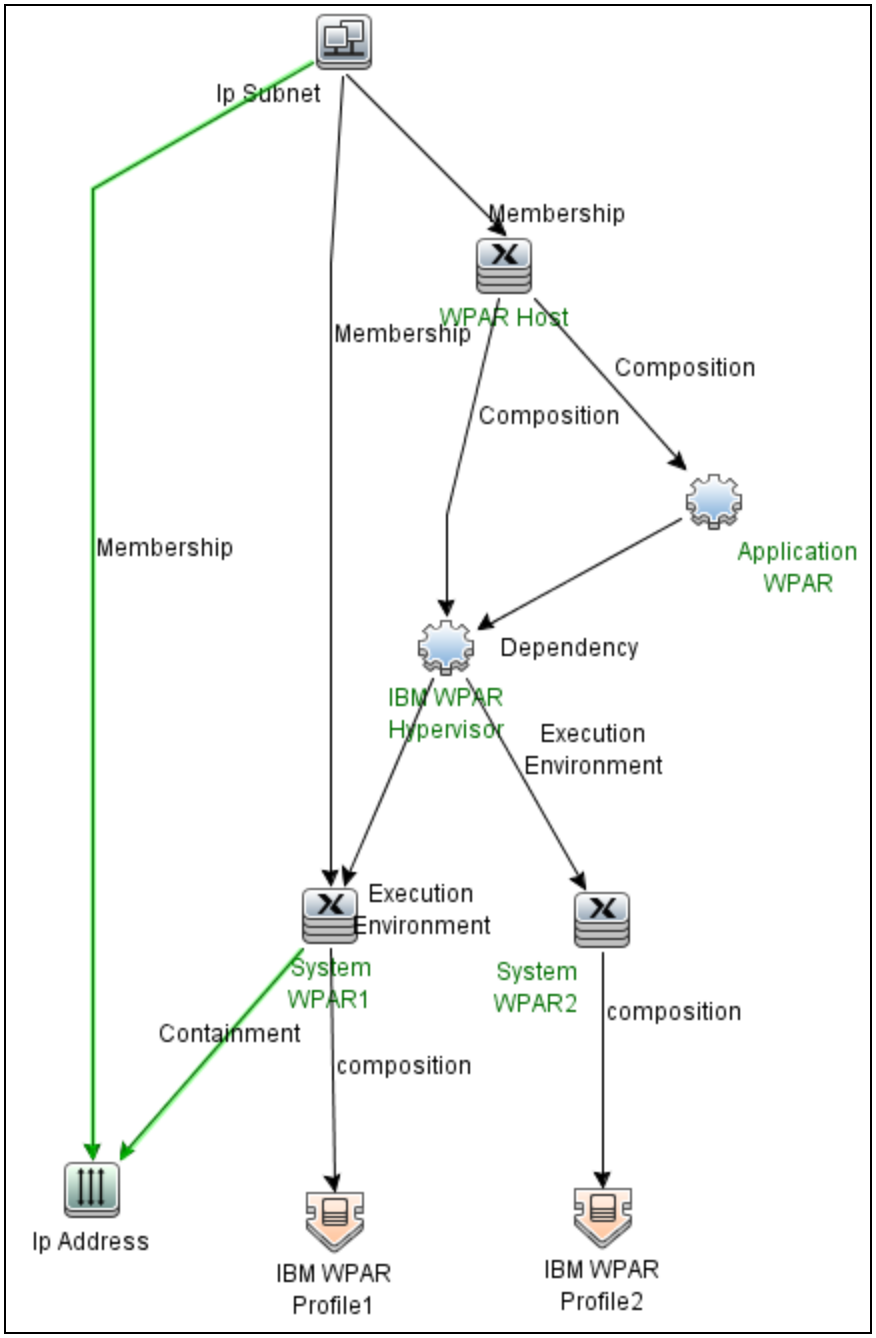
IBM IVM Topology


Node_2
Composition_1
IBM IVM
Manage
IBM PSeries Frame
Composition_3
Composition_9
Composition_2
Composition_4
VLAN
Hypervisor
I/O Slot
Membership
Composition
Containment
Execution Environment
Node
IBM Processor Pool
Physical Port
Containment_3
Composition_7
SCSI Adapter
Containment_2
Realization
Composition_10
Containment_5
Composition_5
Composition_8
Composition_6
Virtual Interface
SCSI Adapter_2
IBM LPar Profile
CPU_2
CPU
Fiber Channel HBA
Usage
Realization_2
SEA Adapter
Containment_4
Usage_3
Usage_2
Interface Aggregation Membership_2
Parent
Physical Interface
Interface Index

IBM PureFlex Topology



IBM WPAR Topology



How to Discover IBM Virtualization

This task includes the following steps:

1. Prerequisites - Set up protocol credentials

   This discovery uses the SSH, Telnet, and Universal Discovery protocols.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

   If some of the commands are configured to run with **sudo** on the target host, in the **Protocol Parameters** dialog box, fill in the following fields:

   - **Sudo paths**. Enter the full path to the sudo executable, together with the name of the executable. You can add more than one entry if executable files are placed in various places on the target operating systems.

     Example: `sudo,/usr/bin/sudo,/bin/sudo`

   - **Command List**. Enter a list of commands that are prefixed with **sudo**.

     Example: `lspath,ifconfig`

     For details, see "Protocol Parameter Dialog Box" in the *HPE Universal CMDB Data Flow Management Guide*.

2. Prerequisites - Set up permissions

   Before activating discovery, confirm that the discovery user has all the required permissions to run the following commands.

   > **Note:** For details about these commands, see:
   > - "IBM Virtualization Commands" on page 247
   > - "VIO Server Side Commands" on page 259
   > - "LPAR Side Commands" on page 269
   > - "WPAR Side Commands" on page 270

   - hostname
   - lscfg
   - lsdev -dev <Device>

- lshmc -b
- lshmc -n
- lshmc -v
- lshmc -V
- lshwres -r io --rsubtype slot -m <pSeriesName>
- lshwres -r mem --level lpar -m <pSeriesName>
- lshwres -r mem --level sys -m <pSeriesName>
- lshwres -r proc --level lpar -m <pSeriesName>
- lshwres -r proc --level pool -m <pSeriesName>
- lshwres -r proc --level sys -m <pSeriesName>
- lshwres -r virtualio --rsubtype eth --level lpar -m <pSeriesName>
- lshwres -r virtualio --rsubtype scsi -m <pSeriesName>
- lsivm
- lslv
- lslv -v <Logical Volume Name>
- lsmap -all
- lsmap -all -net
- lspartition
- lspath
- lspv
- lssyscfg -r lpar -m <pSeriesName>
- lssyscfg -r prof -m <pSeriesName> --filter <lparName>
- lssyscfg -r sys
- lstcpip
- lsvg
- lsvg -l <Volume Group Name>
- lsvio -e
- lsvio -s
- lvdisplay

- pvdisplay
- vgdisplay

3. Run the discovery

   - To discover IBM HMC, IVM software and related virtualization pSeries solutions, VIO Servers, or any IBM LPAR running systems, run the following jobs in the following order:
     i. Run the **Range IPs by ICMP** job.
     ii. Run the **Host Connection by Shell** job.
     iii. Run the **IBM Virtualization by Shell** job.
     iv. Run the **IBM LPAR and VIO Server Topology by Shell** job.
   - To discover IBM PureFlex topology, run the following jobs in the following order:
     i. Run the **Range IPs by ICMP** job.
     ii. Run the **Host Connection by Shell** job.
     iii. Run the **IBM PureFlex Topology by Shell** job.
   - To discover IBM WPAR topology, run the following jobs in the following order:
     i. Run the **Range IPs by ICMP** job.
     ii. Run the **Host Connection by Shell** job.
     iii. Run the **IBM Virtualization by Shell** job.
     iv. Run the **IBM WPAR Topology by Shell** job.

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

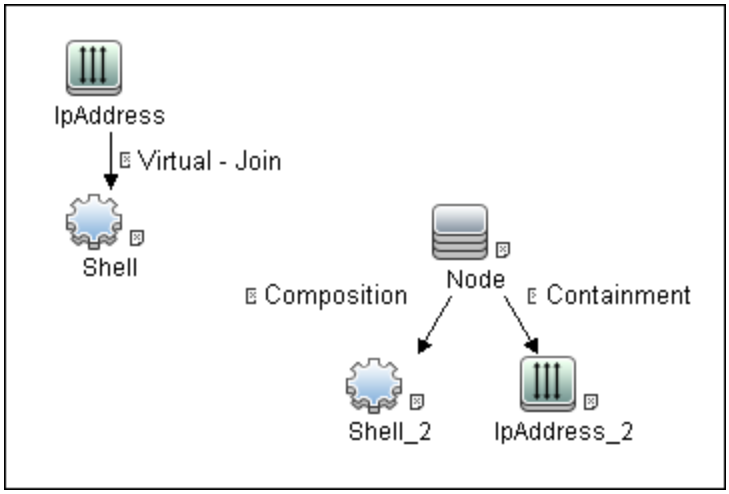
IBM Virtualization by Shell Job

This section includes details about the job.

Introduction

This job discovers IBM HMC or IVM software and related virtualization pSeries solutions.

Trigger Query



Adapter Information

This job uses the **IBM Virtualization by Shell** adapter.

Adapter Type

Jython

Input CIT

IpAddress

Input Query

Triggered CI Data

Name	Value
ip_address	${SOURCE.name}
ip_domain	${SOURCE.routing_domain}

Used Scripts

- ibm_hmc_lib.py
- storage_topology.py
- ibm_hmc_discoverer.py
- ibm_hmc_by_shell.py

Discovered CITs

- Composition
- Containment
- Cpu
- ExecutionEnvironment
- I/O Slot
- IBM Frame
- IBM HMC
- IBM IVM
- IBM LPar Profile
- IBM Processor Pool
- Interface
- IpAddress
- Manage
- Membership

- Node
- PhysicalPort
- Realization
- SCSI Adapter
- Shell
- Usage
- Virtualization Layer Software
- Vlan

Note: To view the topology, see "IBM Virtualization by Shell Topology" on page 225.

Adapter Parameters

Parameter	Default Value	Description
reportCPUs	true	Indicates whether to report CPU CIs.
reportLparNameAsHostName	false	Indicates whether to report virtual host names as LPAR names.

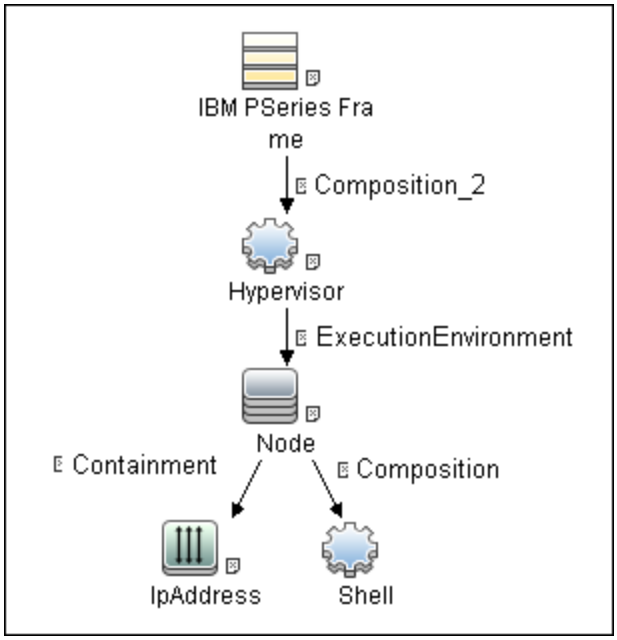
IBM LPAR and VIO Server Topology by Shell Job

This section includes details about the job.

Introduction

This job discovers IBM VIO Servers or any IBM LPAR running systems.

Trigger Query



Adapter Information

This job uses the **IBM LPar And VIO Server by Shell** adapter.

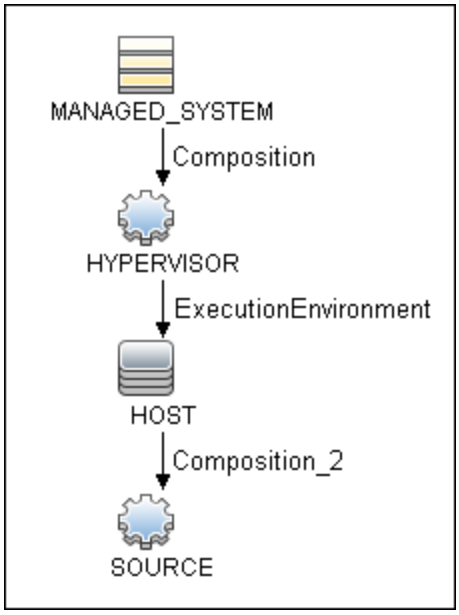
Adapter Type

Jython

Input CIT

Shell

Input Query



Triggered CI Data

Name	Value
Protocol	${SOURCE.root_class}
connected_os_credentials_id	${SOURCE.connected_os_credentials_id:NA}
credentialsId	${SOURCE.credentials_id}
hostId	${SOURCE.root_container}
ip_address	${SOURCE.application_ip}
managedSystemId	${MANAGED_SYSTEM.root_id}
osType	${HOST.discovered_os_name}

Used Scripts

- hostresource.py
- host_win.py
- networking.py

- hostresource_win.py
- networking_win_shell.py
- hostresource_win_wmi.py
- host_win_shell.py
- host_discoverer.py
- host_win_wmi.py
- vendors.py
- ibm_hmc_lib.py
- TTY_HR_CPU_Lib.py
- storage_topology.py
- ibm_lpar_or_vio_by_shell.py

Discovered CITs

- Composition
- Containment
- Dependency
- Fibre Channel HBA
- FileSystem
- I/O Slot
- Interface
- Interface Aggregation
- IpAddress
- LogicalVolume
- Membership
- Node
- Parent
- Physical Volume

- Realization
- SCSI Adapter
- SEA Adapter
- Usage
- Volume Group

Note: To view the topology, see "Topology" on page 224.

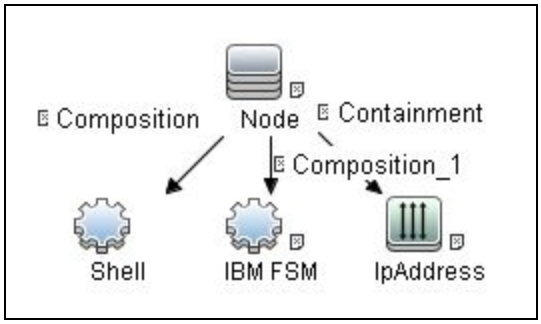
IBM PureFlex Topology by Shell Job

This section includes details about the job.

Introduction

This job discovers IBM FSM-managed resources and topology.

Trigger Query



Adapter Information

This job uses the **PureFlex Discovery** adapter.

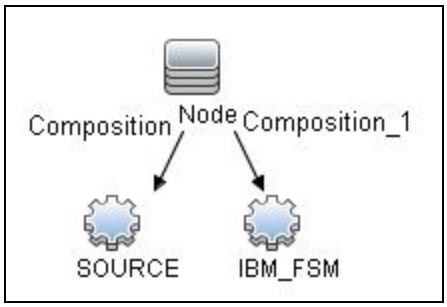
Adapter Type

Jython

Input CIT

Shell

Input Query



Triggered CI Data

Name	Value
Protocol	${SOURCE.root_class}
credentialsId	${SOURCE.credentials_id}
fsmId	${IBM_FSM.root_id}
hostId	${SOURCE.root_container}
ip_address	${SOURCE.application_ip}

Used Scripts

- storage_topology.py
- ibm_hmc_lib.py
- ibm_fsm.py
- ibm_fsm_discoverer.py

- ibm_fsm_by_shell.py

Discovered CITs

- Chassis
- Composition
- Containment
- IBM CMM
- IBM FSM
- IBM Frame
- Interface
- IpAddress
- Management
- Node
- Realization
- Storage Array
- Switch

> **Note:** To view the topology, see IBM PureFlex Topology.

Adapter Parameters

Parameter	Default Value	Description
reportLparNameAsHostName	false	Indicates whether to report virtual host names as LPAR names.

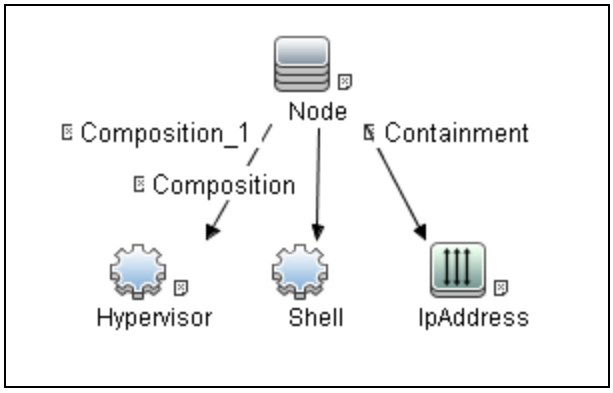
IBM WPAR Topology by Shell Job

This section includes details about the job.

Introduction

This job discovers IBM WPAR topology.

Trigger Query



CI	Attribute Value
Hypervisor	Name Equal IBM WPAR Hypervisor
Shell	NOT Reference to the credentials dictionary entry Is null
IpAddress	NOT IP Probe Name Is null

Adapter Information

This job uses the **IBM WPar by Shell** adapter.

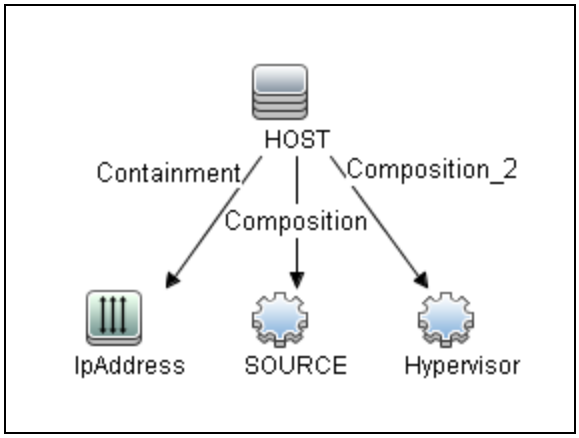
Adapter Type

Jython

Input CIT

Shell

Input Query



CI	Attribute Value
Hypervisor	Name Equal IBM WPAR Hypervisor
SOURCE	NOT Reference to the credentials dictionary entry Is null
IpAddress	NOT IP Probe Name Is null

Triggered CI Data

Name	Value
Protocol	${SOURCE.root_class}
connected_os_credentials_id	${SOURCE.connected_os_credentials_id:NA}
credentialsId	${SOURCE.credentials_id}
hostId	${SOURCE.root_container}
hypervisorId	${Hypervisor.root_id}
ip_address	${SOURCE.application_ip}
osType	${HOST.discovered_os_name}

Used Scripts

- hostresource.py

- host_win.py
- networking.py
- hostresource_win.py
- networking_win_shell.py
- hostresource_win_wmi.py
- host_win_shell.py
- host_discoverer.py
- vendors.py
- ibm_hmc_lib.py
- TTY_HR_CPU_Lib.py
- storage_topology.py
- ibm_wpar_by_shell.py

Discovered CITs

- Composition
- Containment
- Dependency
- Fibre Channel HBA
- FileSystem
- Hypervisor
- I/O Slot
- Interface
- Interface Aggregation
- IpAddress
- IpSubnet
- LogicalVolume
- Membership
- Node

- Parent
- Physical Volume
- Realization
- SCSI Adapter
- SEA Adapter
- Usage
- Volume Group

> **Note:** To view the topology, see IBM WPAR Topology.

Adapter Parameters

Parameter	Default Value	Description
reportWparNameAsHostName	true	Indicates whether to report virtual host names as WPAR names.

IBM Virtualization Commands

This section includes the following commands:

- "lshmc -V" below
- "lshmc -v" on the next page
- "lshmc -b" on the next page
- "lshmc -n" on the next page
- "lspartition -c <TYPE>_<VERSION> -i" on page 249
- "lssyscfg -r sys" on page 250
- "lshwres -r proc --level sys -m '<Managed System Name>'" on page 251
- "lshwres -r proc --level pool -m '<Managed System Name>'" on page 252
- "lssyscfg -r lpar -m '<Managed System Name>'" on page 253
- "lssyscfg -r prof -m '<Managed System Name>'" on page 253
- "lshwres -r virtualio --rsubtype eth --level lpar -m '<Managed System Name>'" on page 255
- "lshwres -r virtualio --rsubtype scsi -m '<Managed System Name>'" on page 256
- "lshwres -r proc --level lpar -m '<Managed System Name>'" on page 257
- "lshwres -r io --rsubtype slot -m '<Managed System Name>'" on page 257

lshmc -V

Output

```
version= Version: 7 Release: 3.5.0 Service Pack: 0 HMC Build level 20091201.1
MH01195: Required fix for HMC V7R3.5.0 (10-16-2009) MH01197: Fix for HMC V7R3.5.0
(11-12-2009) MH01204: Fix for HMC V7R3.5.0 (12-11-2009) ","base_version=V7R3.5.0 "
```

Mapping

The output of this command is used to fill in the attributes of the **IBM HMC** CI:

CMD Output Attribute	CI Name	CI Attribute
Version	IBM HMC	Version_number

CMD Output Attribute	CI Name	CI Attribute
Base_version	IBM HMC	Application_version_description

lshmc -v

Output

```
vpd=*FC ???????? *VC 20.0 *N2 Tue Apr 27 13:05:33 CEST 2010 *FC ???????? *DS
Hardware Management Console *TM eserver xSeries 335 -[XXXXCR2]- *SE XXXXXXX *MN IBM
*PN Unknown *SZ 1059495936 *OS Embedded Operating Systems *NA 192.168.1.10 *FC
???????? *DS Platform Firmware *RM V7R3.5.0.0
```

Mapping

The output of this command is used to fill in the attributes of the **IBM HMC** CI:

CMD Output Attribute	CI Name	CI Attribute
SE	IBM HMC	HMC Serial Number
TM	IBM HMC	HMC TYPE

lshmc -b

Output

```
bios=T2E139AUS-1.15
```

Mapping

The output of this command is used to fill in the attributes of the **IBM HMC** CI:

CMD Output Attribute	CI Name	CI Attribute
Bios	IBM HMC	HMC BIOS

lshmc -n

Output

```
hostname=hmc01,domain=somedomain.com,
"ipaddr=192.168.1.10,0.0.0.0,192.168.128.1",
"networkmask=255.255.254.0,255.255.255.0,255.255.128.0",
gateway=192.168.1.1,nameserver=,domainsuffix=,
slipipaddr=192.168.1.1,slipnetmask=255.255.0.0,
"ipaddrlpar=192.168.80.1,192.168.128.1",
"networkmasklpar=255.255.254.0,255.255.128.0",
```

```
clients=,ipv6addrlpar=,ipv4addr_eth0=192.168.1.10,
ipv4netmask_eth0=255.255.254.0,ipv4dhcp_eth0=off,ipv6addr_eth0=,
ipv6auto_eth0=off,ipv6privacy_eth0=off,ipv6dhcp_eth0=off,
lparcomm_eth0=off,jumboframe_eth0=off,speed_eth0=100,
duplex_eth0=full,tso_eth0=off,ipv4addr_eth1=0.0.0.0,
ipv4netmask_eth1=255.255.255.0,ipv4dhcp_eth1=off,
ipv6addr_eth1=,ipv6auto_eth1=off,ipv6privacy_
eth1=off,ipv6dhcp_eth1=off,lparcomm_eth1=off,jumboframe_
eth1=off,speed_eth1=auto,duplex_eth1=auto,tso_
eth1=off,ipv4addr_eth2=192.168.128.1,ipv4netmask_
eth2=255.255.128.0,ipv4dhcp_eth2=off,ipv6addr_
eth2=,ipv6auto_eth2=off,ipv6privacy_eth2=off,ipv6dhcp_
eth2=off,lparcomm_eth2=off,jumboframe_eth2=off,speed_
eth2=auto,duplex_eth2=auto,tso_eth2=off
```

Mapping

The output of this command is used to fill in the network information for a particular HMC machine. A host with HMC running on it is always reported as an incomplete host, since there is no information regarding the interface MAC addresses and the default UNIX command does not work in this environment.

CMD Output Attribute	CI Name	CI Attribute
constant AIX	Unix	Host Operating System
Hostname	Unix	Host Name
Hostname	Unix	Name
Domain	Unix	OS Domain Name
Ipv4addr_eth<0..N>	IpAddress	Ip Address

lspartition -c <TYPE>_<VERSION> -i

Output

```
2,192.168.80.52,3;1,192.168.80.62,3;3,192.168.80.53,3
```

Mapping

Each block in the output is separated by the semicolon character (;). The first value is the LPAR ID and the second value is the LPAR IP address. By matching the ID of the LPAR with output from other commands an incomplete host is created and reported with an assigned LPAR Profile CI.

lssyscfg -r sys

Output

```
name=XXXXXXX-XXXX-XXX-XXXXXXXXX-XX,type_model=XXXX-XXX, serial_
num=XXXXXX,ipaddr=192.168.1,10,state=Operating,sys_time=04/27/2010 12:55:23,power_
off_policy=1,active_lpar_mobility_capable=0,inactive_lpar_mobility_
capable=0,active_lpar_share_idle_procs_capable=0,active_mem_sharing_capable=0,bsr_
capable=0,cod_mem_capable=0,cod_proc_capable=1,electronic_err_reporting_
capable=0,firmware_power_saver_capable=0,hardware_power_saver_capable=0,hardware_
discovery_capable=0,addr_broadcast_perf_policy_capable=0,hca_capable=1,huge_page_
mem_capable=1,lhea_capable=0,lpar_avail_priority_capable=0,lpar_proc_compat_mode_
capable=0,micro_lpar_capable=1,os400_capable=0,5250_application_
capable=0,redundant_err_path_reporting_capable=1,shared_eth_failover_capable=1,sni_
msg_passing_capable=0,sp_failover_capable=1,vet_activation_capable=1,virtual_fc_
capable=0,virtual_io_server_capable=1,virtual_switch_capable=0,assign_5250_cpw_
percent=0,max_lpars=40,max_power_ctrl_lpars=1,hca_bandwidth_
capabilities=null,service_lpar_id=none,curr_sys_keylock=norm,pend_sys_
keylock=norm,curr_power_on_side=temp,pend_power_on_side=temp,curr_power_on_
speed=fast,pend_power_on_speed=fast,curr_power_on_speed_override=none,pend_power_
on_speed_override=none,power_on_type=power on,power_on_option=standby,power_on_
lpar_start_policy=userinit,pend_power_on_option=standby,pend_power_on_lpar_start_
policy=userinit,power_on_method=02,power_on_attr=0000,sp_boot_attr=0000,sp_boot_
major_type=08,sp_boot_minor_type=01,sp_version=00030030,mfg_default_config=0,curr_
mfg_default_ipl_source=a,pend_mfg_default_ipl_source=a,curr_mfg_default_boot_
mode=norm,pend_mfg_default_boot_mode=norm
```

Mapping

For each detected IBM Pseries Frame, a Hypervisor CI is created with the set name attribute IBM Hypervisor.

The output of this command is used to fill in the attributes of the **IBM PSeries Frame** CI:

CMD Output Attribute	CI Name	CI Attribute
Name	IBM PSeries Frame	Name
serial_number	IBM PSeries Frame	Host Key
cod_proc_capable	IBM PSeries Frame	CPU Capacity on Demand Capable
cod_mem_capable	IBM PSeries Frame	Memory Capacity on Demand Capable
huge_page_mem_capable	IBM PSeries Frame	Huge Memory Page Capable
max_lpars	IBM PSeries Frame	Max LPARs
Status	IBM PSeries Frame	Frame State

CMD Output Attribute	CI Name	CI Attribute
micro_lpar_capable	IBM PSeries Frame	Micro LPAR Capable
service_lpar_id	IBM PSeries Frame	Service LPAR ID
service_lpar_name	IBM PSeries Frame	Service LPAR Name

lshwres -r proc --level sys -m '<Managed System Name>'

Output

```
configurable_sys_proc_units=4.0,curr_avail_sys_proc_units=1.4, pend_avail_sys_proc_
units=1.4,installed_sys_proc_units=4.0, max_capacity_sys_proc_
units=deprecated,deconfig_sys_proc_units=0, min_proc_units_per_virtual_
proc=0.1,max_virtual_procs_per_lpar=64,max_procs_per_lpar=4,max_curr_virtual_procs_
per_aixlinux_lpar=64,max_curr_virtual_procs_per_vios_lpar=64, max_curr_virtual_
procs_per_os400_lpar=64,max_curr_procs_per_aixlinux_lpar=4, max_curr_procs_per_
vios_lpar=4,max_curr_procs_per_os400_lpar=4, max_shared_proc_pools=1
```

Mapping

The output of this command is used to fill in the attributes of the **IBM PSeries Frame** CI:

CMD Output Attribute	CI Name	CI Attribute
min_proc_units_per_virtual_proc	IBM PSeries Frame	Min CPU Units per Virtual CPU
curr_avail_sys_proc_units	IBM PSeries Frame	Current Available CPU Units
max_shared_proc_pools	IBM PSeries Frame	Max Shared CPU Pools
configurable_sys_proc_units	IBM PSeries Frame	Configurable CPU Units
installed_sys_proc_units	IBM PSeries Frame	Installed CPU Units
pend_avail_sys_proc_units	IBM PSeries Frame	Pending Available CPU Units
max_procs_per_lpar	IBM PSeries Frame	Max CPUs per LPAR
max_virtual_procs_per_lpar	IBM PSeries Frame	Max Virtual CPUs per LPAR

lshwres -r mem --level sys -m '<Managed System Name>'

Output

```
configurable_sys_mem=32768,curr_avail_sys_mem=1344,pend_avail_sys_mem=1344,
installed_sys_mem=32768,max_capacity_sys_mem=deprecated,deconfig_sys_mem=0, sys_
firmware_mem=704,mem_region_size=64,configurable_num_sys_huge_pages=0, curr_avail_
```

```
num_sys_huge_pages=0,pend_avail_num_sys_huge_pages=0, max_num_sys_huge_
pages=1,requested_num_sys_huge_pages=0,huge_page_size=16384, max_mem_pools=0
```

Mapping

The output of this command is used to fill in the attributes of the **IBM PSeries Frame** CI:

CMD Output Attribute	CI Name	CI Attribute
configurable_sys_mem	IBM PSeries Frame	Configurable System Memory
max_num_sys_huge_pages	IBM PSeries Frame	Max Number of Huge Pages
huge_page_size	IBM PSeries Frame	Huge Page Size
sys_firmware_mem	IBM PSeries Frame	Firmware Memory
mem_region_size	IBM PSeries Frame	Memory Region Size
curr_avail_sys_mem	IBM PSeries Frame	Current Available Memory
installed_sys_mem	IBM PSeries Frame	Installed Memory
requested_num_sys_huge_pages	IBM PSeries Frame	Requested Number of Huge Pages
pend_avail_sys_mem	IBM PSeries Frame	Pending Available Memory

lshwres -r proc --level pool -m '<Managed System Name>'

Output

```
configurable_pool_proc_units=4.0,curr_avail_pool_proc_units=1.4,pend_avail_pool_
proc_units=1.4
```

Mapping

If there are no user-defined pools, the **pool_id** parameter does not appear in the output (**pool_id** is considered by the system to be zero by default).

The output of this command is used to fill in the attributes of the **IBM Processor Pool** CI:

CMD Output Attribute	CI Name	CI Attribute
curr_avail_pool_proc_units	IBM Processor Pool	CPU Pool Available Physical CPUs
configurable_pool_proc_units	IBM Processor Pool	CPU Pool Configurable Physical CPUs
pend_avail_pool_proc_units	IBM Processor Pool	CPU Pool Pending Available Physical CPUs
pool_id	IBM Processor Pool	Name

lssyscfg -r lpar -m '<Managed System Name>'

Output

```
name=somelparname1,lpar_id=5,lpar_env=aixlinux,state=Running,resource_config=1,os_
version=Unknown,logical_serial_num=65B922G5,default_
profile=somedefaultprofilename1,curr_profile=somelparprofilename1,work_group_
id=none,shared_proc_pool_util_auth=1,allow_perf_collection=1,power_ctrl_lpar_
ids=none,boot_mode=sms,lpar_keylock=norm,auto_start=0,redundant_err_path_
reporting=0
```

Mapping

The output of this command is used to fill in the attributes of the **IBM LPAR Profile** CI:

CMD Output Attribute	CI Name	CI Attribute
logical_serial_num	IBM LPAR Profile	LPAR Serial Number
boot_mode	IBM LPAR Profile	LPAR Profile Boot Mode
auto_start	IBM LPAR Profile	LPAR Profile Auto Start
work_group_id	IBM LPAR Profile	LPAR Profile Workgroup ID
default_profile	IBM LPAR Profile	LPAR default profile name
curr_profile	IBM LPAR Profile	LPAR profile name
power_ctrl_lpar_ids	IBM LPAR Profile	LPAR power control ids
State	IBM LPAR Profile	Lpar state
lpar_env	IBM LPAR Profile	Lpar type
lpar_id	IBM LPAR Profile	LPAR ID
Name	IBM LPAR Profile	LPAR Name

lssyscfg -r prof -m '<Managed System Name>'

Output

```
name=name1,lpar_name=name2,lpar_id=5,lpar_env=aixlinux,
all_resources=0,min_mem=4096,desired_mem=8192,max_mem=8192,
min_num_huge_pages=0,desired_num_huge_pages=0,
max_num_huge_pages=0,proc_mode=shared,min_proc_units=0.3,
desired_proc_units=0.5,max_proc_units=1.0,min_procs=1,
desired_procs=2,max_procs=2,sharing_mode=uncap,
uncap_weight=128,io_slots=none,lpar_io_pool_ids=none,
max_virtual_slots=10,"virtual_serial_adapters=0/server/1/
```

```
any//any/1,1/server/1/any//any/1","virtual_scsi_adapters=5/
client/1/l11s12vio1/13/1,6/client/1/l11s12vio1/14/1,7/client
/1/l11s12vio1/15/1",virtual_eth_adapters=2/0/1//0/1,
hca_adapters=none,boot_mode=norm,conn_monitoring=1,auto_start=0,
power_ctrl_lpar_ids=none,work_group_id=none,redundant_err_path_reporting=0
name=name3,lpar_name=name4,lpar_id=4,lpar_env=aixlinux,all_resources=0,
min_mem=4096,desired_mem=10240,max_mem=10240,min_num_huge_pages=0,
desired_num_huge_pages=0,max_num_huge_pages=0,proc_mode=shared,
min_proc_units=0.3,desired_proc_units=0.7,max_proc_units=1.0,
min_procs=1,desired_procs=2,max_procs=2,sharing_mode=uncap,
uncap_weight=128,io_slots=none,lpar_io_pool_ids=none,
max_virtual_slots=10,"virtual_serial_adapters=0/server
/1/any//any/1,1/server/1/any//any/1",
"virtual_scsi_adapters=5/client/1/l11s12vio1/10/1,6/
client/1/l11s12vio1/11/1,7/client/1/l11s12vio1/12/1",
virtual_eth_adapters=2/0/2//0/1,hca_adapters=none,boot_mode=norm,
conn_monitoring=1,auto_start=0,power_ctrl_lpar_ids=none,
work_group_id=none,redundant_err_path_reporting=0
```

Mapping

The output of this command is used to fill in the attributes of the **IBM LPAR Profile** CI:

CMD Output Attribute	CI Name	CI Attribute
sharing_mode	IBM LPAR Profile	LPAR Profile Sharing Mode
proc_mode	IBM LPAR Profile	LPAR Profile CPU Mode
uncap_weight	IBM LPAR Profile	LPAR Profile Uncapped Weight
desired_num_huge_pages	IBM LPAR Profile	LPAR Profile Desired Number of Huge Memory Pages
min_num_huge_pages	IBM LPAR Profile	LPAR Profile Minimum Number of Huge Memory Pages
max_procs	IBM LPAR Profile	LPAR Profile Maximum Number of CPUs
desired_procs	IBM LPAR Profile	LPAR Profile Desired Number of CPUs
min_proc_units	IBM LPAR Profile	LPAR Profile Minimum Physical CPUs
max_mem	IBM LPAR Profile	LPAR Profile Maximum memory

CMD Output Attribute	CI Name	CI Attribute
conn_monitoring	IBM LPAR Profile	LPAR Profile Connection Monitoring Enabled
min_mem	IBM LPAR Profile	LPAR Profile Minimum Memory on this LPAR
max_virtual_slots	IBM LPAR Profile	LPAR Profile Maximum Number of Virtual Slots
redundant_err_path_ reporting	IBM LPAR Profile	LPAR Profile Redundant Error Path Reporting
max_num_huge_pages	IBM LPAR Profile	LPAR Profile Maximum Number of Huge Memory Pages
min_procs	IBM LPAR Profile	LPAR Profile Minimum Number of CPUs
max_proc_units	IBM LPAR Profile	LPAR Profile Maximum Physical CPUs
io_slots	IBM LPAR Profile	LPAR Profile IO Slots
lpar_io_pool_ids	IBM LPAR Profile	LPAR Profile IO Pool IDs
desired_proc_units	IBM LPAR Profile	LPAR Profile Desired Physical CPUs
desired_mem	IBM LPAR Profile	LPAR Profile Memory Requested by this LPAR
virtual_serial_adapters	IBM LPAR Profile	LPAR Profile Virtual Serial Adapters

lshwres -r virtualio --rsubtype eth --level lpar -m '<Managed System Name>'

Output

```
lpar_name=name1,lpar_id=1,slot_num=2,state=1,is_required=1,is_trunk=1,trunk_
priority=1, ieee_virtual_eth=0,port_vlan_id=1,addl_vlan_ids=,mac_addr=765920001002
lpar_name=l11s12vio1,lpar_id=1,slot_num=3,state=1,is_required=1,is_trunk=1,trunk_
priority=1, ieee_virtual_eth=0,port_vlan_id=2,addl_vlan_ids=,mac_addr=765920001003
lpar_name=name2,lpar_id=2,slot_num=2,state=1,is_required=1,is_trunk=0,ieee_virtual_
eth=0, port_vlan_id=1,addl_vlan_ids=,mac_addr=765920002002
lpar_name=name3,lpar_id=3,slot_num=2,state=1,is_required=1,is_trunk=0,ieee_virtual_
eth=0, port_vlan_id=1,addl_vlan_ids=,mac_addr=765920003002
lpar_name=name4,lpar_id=4,slot_num=2,state=1,is_required=1,is_trunk=0,ieee_virtual_
```

```
eth=0, port_vlan_id=2,addl_vlan_ids=,mac_addr=765920004002
lpar_name=name5,lpar_id=5,slot_num=2,state=1,is_required=1,is_trunk=0,ieee_virtual_
eth=0, port_vlan_id=1,addl_vlan_ids=,mac_addr=765920005002
```

Mapping

The mac_addr attribute is represented in the Dec form without leading zeros. This value is transformed to the Hex value and left padded with missing zeros, to assure a proper representation of the MAC address in the CMDB.

Based on the MAC address, the virtual NICs are created and attached to the corresponding LPAR or VIO server, and are described by **Lpar_name** or **Lpar_id**. The **Vlan** CI is created based on **vlan_id** or **addl_vlan_ids** and is linked to the ports of the interfaces. The root container for the VLAN is a specific IBM PSeries Frame (Managed System).

CMD Output Attribute	CI Name	CI Attribute
port_vlan_id/addl_vlan_ids	VLAN	Vlan Number
IBM PSeries Frame CMDB ID	VLAN	Root Container
mac_addr (converted to Hex if needed and normalized)	Interface	MAC Address

lshwres -r virtualio --rsubtype scsi -m '<Managed System Name>'

Output

```
lpar_name=vioname1,lpar_id=1,slot_num=15,state=1,is_required=0,adapter_
type=server,remote_lpar_id=5,remote_lpar_name=lparname1,remote_slot_num=7
lpar_name=vioname1,lpar_id=1,slot_num=14,state=1,is_required=0,adapter_
type=server,remote_lpar_id=5,remote_lpar_name=lparname2,remote_slot_num=6
lpar_name=vioname1,lpar_id=1,slot_num=13,state=1,is_required=0,adapter_
type=server,remote_lpar_id=5,remote_lpar_name=lparname2,remote_slot_num=5
```

Mapping

The lpar_name and lpar_id attributes are always the name and ID of the VIO server that creates and grants the Virtual SCSI to the LPARs. The SCSI Adapter on the LPAR is identified by its slot number and the LPAR name it belongs to.

CMD Output Attribute	CI Name	CI Attribute
Slot_num/remote_slot_num	SCSI	Slot Number
Host ID with name <lpar_name> or <Remote LPAR Name>	SCSI	Root Container

lshwres -r proc --level lpar -m '<Managed System Name>'

Output

```
lpar_name=name1,lpar_id=5,curr_shared_proc_pool_id=0,curr_proc_mode=shared,curr_
min_proc_units=0.3,curr_proc_units=0.5,curr_max_proc_units=1.0,curr_min_
procs=1,curr_procs=2,curr_max_procs=2,curr_sharing_mode=uncap,curr_uncap_
weight=128,pend_shared_proc_pool_id=0,pend_proc_mode=shared,pend_min_proc_
units=0.3,pend_proc_units=0.5,pend_max_proc_units=1.0,pend_min_procs=1,pend_
procs=2,pend_max_procs=2,pend_sharing_mode=uncap,pend_uncap_weight=128,run_proc_
units=0.5,run_procs=2,run_uncap_weight=128
```

Mapping

Using the "lpar_name"/"lpar_id" along with the "curr_shared_proc_pool_id" from the output we can create corresponding links to the particular Shared Processor Pool ("IBM Processor Pool") the LPar uses. In case of the dedicated ("ded") CPU we will create links to the spare processors.

lshwres -r io --rsubtype slot -m '<Managed System Name>'

Output

```
unit_phys_loc=XXXXX.XXX.XXXXXXX,bus_id=2,phys_loc=C3,drc_index=21010002,lpar_
name=name1,lpar_id=1,slot_io_pool_id=none,description=RAID Controller,feature_
codes=none,pci_vendor_id=1069,pci_device_id=B166,pci_subs_vendor_id=1014,pci_subs_
device_id=0278,pci_class=0104,pci_revision_id=04,bus_grouping=0,iop=0,parent_slot_
drc_index=none,drc_name=XXXXX.XXX.XXXXXXX-XX-XX
```

Mapping

The output of this command is used to create the **I/O Slot** CI. Using the name and ID of the LPAR, discovery creates the relationship to the particular LPAR that is using the slot.

CMD Output Attribute	CI Name	CI Attribute
Description	I/O Slot	Name of the Slot
bus_id	I/O Slot	Slot Bus ID
phys_loc	I/O Slot	Slot Physical Location on Bus
pci_revision_id	I/O Slot	Slot PCI Revision ID
bus_grouping	I/O Slot	Slot Bus Grouping
pci_device_id	I/O Slot	Slot PCI Device ID

CMD Output Attribute	CI Name	CI Attribute
unit_phys_loc	I/O Slot	Slot Physical Location
parent_slot_drc_index	I/O Slot	Slot Parent Slot DRC Index
drc_index	I/O Slot	Slot DRC Index
pci_subs_vendor_id	I/O Slot	Slot PCI Subslot Vendor ID
pci_class	I/O Slot	Slot PCI Class
slot_io_pool_id	I/O Slot	Slot IO Pool ID
pci_vendor_id	I/O Slot	Slot PCI Vendor ID
drc_name	I/O Slot	Slot DRC Name
feature_codes	I/O Slot	Slot Feature Codes
pci_subs_device_id	I/O Slot	Slot PCI Subslot Device ID

VIO Server Side Commands

This section includes the following commands:

- "/usr/ios/cli/ioscli lsdev -dev 'ent*' -field name physloc -fmt" below
- "ioscli entstat -all '<Interface Name>' | grep -E "ETHERNET STATISTICS|Device Type|Hardware Address" on the next page
- "ioscli lsdev -dev '<Interface Name>' -attr" on page 261
- "ioscli lsmap -all -net" on page 261
- "ioscli lsdev -dev fcs* -field name physloc description -fmt" on page 262
- "ioscli lsdev | grep proc" on page 263
- "ioscli lsdev -dev sysplanar0 -vpd | grep PROC" on page 263
- "ioscli lsdev -dev proc<index> -attr" on page 263
- "lspv" on page 264
- "lsvg" on page 264
- "lsvg <Volume Group Name>" on page 264
- "lsvg -lv <Volume Group Name>" on page 265
- "lsvg -pv <Logical Volume Group>" on page 266
- "lslv <Logical Volume Name>" on page 266
- "ioscli lsmap -all" on page 267

/usr/ios/cli/ioscli lsdev -dev 'ent*' -field name physloc -fmt

Output

```
ent0: U100C.001.DQDE777-P1-C4-T1
ent1:U100C.001.DQDE777-P1-C4-T2
ent2:U100C.001.DQDE777-P1-C4-T3
ent16:
ent17:
ent18:
ent19:
ent20:
```

Mapping

The interface names and physical location of the particular interface are the output of this command. The output is split at the colon character (**:**) line by line; the first part is the interface name and the last is the physical location. A physical location is not always present, for example, it is not set for the SEA and Link Aggregation Interface. The physical location value is used to create a link from the physical NIC to the I/O slot.

ioscli entstat -all '<Interface Name>' | grep -E "ETHERNET STATISTICS|Device Type|Hardware Address

Example: ioscli entstat -all 'ent16'| grep -E "ETHERNET STATISTICS|Device Type|Hardware Address

Output

```
ETHERNET STATISTICS (ent16) :
Device Type: Shared Ethernet Adapter
Hardware Address: 00:1B:64:91:74:55
ETHERNET STATISTICS (ent14) :
Device Type: EtherChannel
Hardware Address: 00:1B:64:91:74:55
ETHERNET STATISTICS (ent0) :
Device Type: 2-Port 10/100/1000 Base-TX PCI-X Adapter (14108902)
Hardware Address: 00:1a:64:91:74:44
ETHERNET STATISTICS (ent2) :
Device Type: 2-Port 10/100/1000 Base-TX PCI-X Adapter (14108902)
Hardware Address: 00:1B:64:91:74:55
ETHERNET STATISTICS (ent4) :
Device Type: Virtual I/O Ethernet Adapter (l-lan)
Hardware Address: 46:61:fa:d4:bf:0b
```

Mapping

UCMDB Version 8.0x: There cannot be two interfaces with the same MAC on a single machine. In this case the MAC Address attribute for the first interface only takes the value of the MAC address, while the other interfaces contain an underscore (_) and interface index. For example, for the above output interface **ent0** is reported with MAC Address set to **00:1B:64:91:74:55** while interface **ent2** is reported with MAC Address set to **00:1B:64:91:74:55_2**.

UCMDB Version 9.0x: This limitation is not relevant so the topology is reported as is.

CMD Output Attribute	CI Name	CI Attribute
ETHERNET STATISTICS line	Interface	Name
Hardware Address	Interface	Mac Address
Device Type	Interface	Description
ETHERNET STATISTICS line when Device Type value is EtherChannel	Interface Aggregation	Name
ETHERNET STATISTICS line when Device Type value is Shared Ethernet Adapter	IBM SEA	Name

ioscli lsdev -dev '<Interface Name>' -attr

Example: ioscli lsdev -dev 'ent16' -attr

Output

```
attribute value description user_settable
adapter_names ent0,ent4 EtherChannel Adapters True
alt_addr 0x000000000000 Alternate EtherChannel Address True
auto_recovery yes Enable automatic recovery after failover True
backup_adapter NONE Adapter used when whole channel fails True
hash_mode default Determines how outgoing adapter is chosen True
mode standard EtherChannel mode of operation True
netaddr 0 Address to ping True
noloss_failover yes Enable lossless failover after ping failure True
num_retries 3 Times to retry ping before failing True retry_time 1 Wait time (in
seconds) between pings True
use_alt_addr no Enable Alternate EtherChannel Address True
use_jumbo_frame no Enable Gigabit Ethernet Jumbo Frames True
```

Mapping

The adapter_names attribute value is used to create links to the back-up devices.

The value of Media Speed represents both Duplex and the connection Speed.

CMD Output Attribute	CI Name	CI Attribute
media_speed	Interface Index	Speed

ioscli lsmap -all -net

Output

```
SVEA Physloc
------ --------------------------------------------
ent4 U1000.E4A.06FB0D1-V1-C11-T1
SEA ent16
Backing device ent14
Status Available
Physloc
SVEA Physloc
------ --------------------------------------------
ent9 U1000.E4A.06FB0D1-V1-C16-T1
SEA ent21
Backing device ent12
Status Available
Physloc U1000.001.DQD3693-P1-C7-T3
```

Mapping

This command is used to determine the relation between the interfaces and to identify their types.

CMD Output Attribute	CI Name	CI Attribute
SEA	SEA Adapter	Name
Backing Device	Link Aggregation / Interface	Name
SVEA	Interface (virtual)	Name

ioscli lsdev -dev fcs* -field name physloc description -fmt

Output

```
fcs0:U1000.001.DQDE996-P1-C1-T1:4Gb FC PCI Express Adapter (df1000fe)
fcs1:U1000.001.DQDE996-P1-C1-T2:4Gb FC PCI Express Adapter (df1000fe)
fcs2:U1000.001.DQDE996-P1-C2-T1:4Gb FC PCI Express Adapter (df1000fe)
fcs3:U1000.001.DQDE996-P1-C2-T2:4Gb FC PCI Express Adapter (df1000fe)
```

Mapping

The output of this command represents the Fibre Channel Host Adapters on the VIO server. This output retrieves the FC Name and FC Physical Path, which are used to create a link to the I/O slot on the PFrame, and an FC Interface Description.

CMD Output Attribute	CI Name	CI Attribute
First token	Fibre Channel HBA	Name
Third token	Fibre Channel HBA	Description

ioscli lsdev | grep proc

Output

```
proc0   Available   Processor
proc2   Available   Processor
proc4   Available   Processor
proc6   Available   Processor
```

Mapping

The output of this command shows discovered CPU indices. In this case 0, 2, 4, and 6.

ioscli lsdev -dev sysplanar0 -vpd | grep PROC

Output

```
2-WAY PROC CUOD :
2-WAY PROC CUOD :
2-WAY PROC CUOD :
2-WAY PROC CUOD :
```

Mapping

The output of this command shows the number of cores discovered. The "2" in the output indicates 2 CPU cores.

ioscli lsdev -dev proc<index> -attr

Output

```
attribute   value          description           user_settable
frequency   1654344000     Processor Speed       False
smt_enabled true           Processor SMT enabled False
smt_threads 2              Processor SMT threads False
state       enable         Processor state       False
type        PowerPC_POWER5 Processor type        False
```

Mapping

CMD Output Attribute	CI Name	CI Attribute
frequency	CPU	speed
type	CPU	model

lspv

Output

```
NAME PVID VG STATUS
hdisk0 001fb2d15d794e0d rootvg active
hdisk1 001fb2d18f1f7f0c clientvg active
```

Mapping

This command retrieves the relation between the Physical Volume and the Volume Group, then a link is created from the Volume Group to the Physical Volume.

CMD Output Attribute	CI Name	CI Attribute
VG	Physical Volume	Name
VG	Fibre Channel HBA	Name

lsvg

Output

```
rootvg clientvg
```

Mapping

This command retrieves the list of all volume groups that are present on the VIO server.

lsvg <Volume Group Name>

Output

```
VOLUME GROUP: rootvg
VG IDENTIFIER: 001fb2d10005d9000000011a5d795185
VG STATE: active
PP SIZE: 256 megabyte(s)
VG PERMISSION: read/write
TOTAL PPs: 520 (133120 megabytes)
MAX LVs: 256
FREE PPs: 372 (95232 megabytes)
LVs: 13
USED PPs: 148 (37888 megabytes)
OPEN LVs: 11
QUORUM: 2 (Enabled)
TOTAL PVs: 1
VG DESCRIPTORS: 2
```

```
STALE PVs: 0
STALE PPs: 0
ACTIVE PVs: 1
AUTO ON: yes
MAX PPs per VG: 32512
MAX PPs per PV: 1016
MAX PVs: 32
LTG size (Dynamic): 256 kilobyte(s)
AUTO SYNC: no
HOT SPARE: no
BB POLICY: relocatable
```

Mapping

This command retrieves the values for the Volume Group CI attributes.

CMD Output Attribute	CI Name	CI Attribute
VOLUME GROUP	Volume Group	Name
STATE	Volume Group	Volume Group State
VG IDENTIFIER	Volume Group	Volume Group ID

lsvg -lv <Volume Group Name>

Output

```
rootvg:
LV NAME TYPE LPs PPs PVs LV STATE MOUNT POINT
hd5 boot 1 1 1 closed/syncd N/A
hd6 paging 2 2 1 open/syncd N/A
paging00 paging 4 4 1 open/syncd N/A
hd8 jfs2log 1 1 1 open/syncd N/A
hd4 jfs2 1 1 1 open/syncd /
hd2 jfs2 10 10 1 open/syncd /usr
hd9var jfs2 3 3 1 open/syncd /var
hd3 jfs2 10 10 1 open/syncd /tmp
hd1 jfs2 40 40 1 open/syncd /home
hd10opt jfs2 4 4 1 open/syncd /opt
lg_dumplv sysdump 4 4 1 open/syncd N/A
VMLib_LV jfs2 56 56 1 open/syncd /var/vio/VMLib
Ilv jfs2 12 12 1 closed/syncd /export/lbm
```

Mapping

This command retrieves the list of all Logical Volumes that are part of the particular Volume Group, as well as the mount points if any exist. This information enables the creation of a link from the Volume Group to the Logical Volume.

CMD Output Attribute	CI Name	CI Attribute
LV Name	Logical Volume	Name
Mount Point	Disk (FS)	Name
Type	Disk	Type

lsvg -pv <Logical Volume Group>

Output

```
rootvg:
PV_NAME PV STATE TOTAL PPs FREE PPs FREE DISTRIBUTION
hdisk0 active 520 372 103..30..31..104..104
```

Mapping

This command retrieves the list of the Physical Volumes in the Volume Group. This information enables the creation of a link between the Physical Volume and the Volume Group.

lslv <Logical Volume Name>

Output

```
LOGICAL VOLUME: lv1
VOLUME GROUP: clientvg
LV IDENTIFIER: 000fb1d10230d9000000011b8f1f8187.1
PERMISSION: read/write
VG STATE: active/complete
LV STATE: opened/syncd
TYPE: jfs
WRITE VERIFY: off
MAX LPs: 32512
PP SIZE: 512 megabyte(s)
COPIES: 1
SCHED POLICY: parallel
LPs: 70
PPs: 70
STALE PPs: 0
BB POLICY: non-relocatable
INTER-POLICY: minimum
RELOCATABLE: yes
```

```
INTRA-POLICY: middle
UPPER BOUND: 1024
MOUNT POINT: N/A
LABEL: None
MIRROR WRITE
CONSISTENCY: on/ACTIVE
EACH LP COPY ON A SEPARATE PV ?: yes
Serialize IO ?: NO
DEVICESUBTYPE : DS_LVZ
```

Mapping

This command retrieves information about the Logical Volume parameters, which are mapped to the attributes of the Logical Volume CI.

CMD Output Attribute	CI Name	CI Attribute
LOGICAL VOLUME	Logical Volume	Name
LV IDENTIFIER	Logical Volume	Logical Volume ID
LV STATE	Logical Volume	Logical Volume Status
Type	Logical Volume	Logical Volume File System Type

ioscli lsmap -all

Output

```
SVSA Physloc Client Partition ID
--------------- -------------------------------------------- ------------------
vhost0 U1000.E4A.06FB0D1-V1-C21 0x00000002
VTD vtopt0
Status Available
LUN 0x8100000000000000
Backing device /var/vio/VMLib/bootcd_rh5
Physloc
SVSA Physloc Client Partition ID
--------------- -------------------------------------------- ------------------
vhost3 U1000.E4A.06FB0D1-V1-C31 0x00000002
VTD vtscsi0
Status Available
LUN 0x8100000000000000
Backing device os_ lv1
Physloc
VTD vtscsi1
Status Available
LUN 0x8200000000000000
Backing device p01_lv1
```

```
Physloc
VTD vtscsi8
Status Available
LUN 0x8300000000000000
Backing device p01_lv2
Physloc
```

Mapping

This command retrieves the relation from the vSCSI to the exact backing device, which is usually a Volume or a Volume Group.

CMD Output Attribute	CI Name	CI Attribute
SVSA	SCSI	Name
C<Number>	SCSI	Slot Number
Backing Device	LV/PV/FS	Name

LPAR Side Commands

This section includes the following command:

lscfg

Output

```
INSTALLED RESOURCE LISTThe following resources are
installed on the machine.+/- = Added or deleted from
Resource List.* = Diagnostic support not available.
Model Architecture: chrp
Model Implementation: Multiple Processor, PCI bus + sys0
System Object+ sysplanar0 System Planar* vio0
Virtual I/O Bus* vsa0 U1000.505.062136A-V1-C0
LPAR Virtual Serial Adapter* vty0 U1000.505.062136A-V1-C0-L0
Asynchronous Terminal* pci2 U1000.001.AAA0757-P1
PCI Bus* pci1 U1000.001.AAA0757-P1
PCI Bus* pci0 U1000.001.AAA0757-P1
PCI Bus* pci3 U1000.001.AAA0757-P1
PCI Bus+ ent0 U1000.001.AAA0757-P1-T1
2-Port 10/100/1000 Base-TX PCI-X Adapter (14108902)+ ent1
U1000.001.AAA0757-P1-T2
2-Port 10/100/1000 Base-TX PCI-X Adapter (14108902)* pci4
U1000.001.AAA0757-P1
PCI Bus+ usbhc0 U1000.001.AAA0757-P1
USB Host Controller (33103500)+ usbhc1 U1000.001.AAA0757-P1
USB Host Controller (33103500)* pci5   U1000.001.AAA0757-P1
PCI Bus* ide0  U1000.001.AAA0757-P1-T10
ATA/IDE Controller Device+ cd0 U1000.001.AAA0757-P1-D3
IDE DVD-ROM Drive* pci6  U1000.001.AAA0757-P1
PCI Bus+ sisscsia0 U1000.001.AAA0757-P1
PCI-X Dual Channel Ultra320
SCSI Adapter+ scsi0   U1000.001.AAA0757-P1-T5
PCI-X Dual Channel Ultra320
SCSI Adapter bus+ scsi1 U1000.001.AAA0757-P1-T9
PCI-X Dual Channel Ultra320
SCSI Adapter bus+ hdisk0 U1000.001.AAA0757-P1-T9-L5-L0 16 Bit LVD
SCSI Disk Drive (146800 MB)+ hdisk1 U1000.001.AAA0757-P1-T9-L8-L0
16 Bit LVD
SCSI Disk Drive (146800 MB)+
ses0  U1000.001.AAA0757-P1-T9-L15-L0
SCSI Enclosure Services Device+
L2cache0 L2 Cache+ mem0 Memory+ proc0 Processor
```

WPAR Side Commands

This section includes the following commands:

lswpar -N

Output

```
Name      Interface  Address(6)      Mask/Prefix    Broadcast
------------------------------------------------------------------
ddmiwpar  en0        16.155.192.233  255.255.248.0  16.155.199.255
lswpar: 0960-538 prod01 has no network configuration.
```

lswpar -G

Output

```
==============================================================
ddmiwpar - Active
==============================================================
Type:                    S
RootVG WPAR:             no
Owner:                   root
Hostname:                ddmiwpar
WPAR-Specific Routing:   no
Virtual IP WPAR:
Directory:               /wpars/ddmiwpar
Start/Stop Script:
Auto:                    no
Private /usr:            no
Checkpointable:          no
Application:
OStype:                  0
Cross-WPAR IPC:          no
Architecture:            none
UUID:                    01bf8e6c-4d4b-44fa-980a-286ceb023723
```

lswpar -R

Output

```
==============================================================
ddmiwpar - Active
==============================================================
```

```
Active:                              yes
Resource Set:
CPU Shares:                          unlimited
CPU Limits:                          0%-100%,100%
Memory Shares:                       unlimited
Memory Limits:                       0%-100%,100%
Per-Process Virtual Memory Limit:    unlimited
Total Virtual Memory Limit:          unlimited
Total Processes:                     unlimited
Total Threads:                       unlimited
Total PTYs:                          unlimited
Total Large Pages:                   unlimited
Max Message Queue IDs:               100%
Max Semaphore IDs:                   100%
Max Shared Memory IDs:               100%
Max Pinned Memory:                   100%
```

Created/Changed Entities

Entity Name	Entity Type	Entity Description
IBM HMC	CI Type	HMC software
IBM LPar Profile	CI Type	LPar configuration
IBM Processor Pool	CI Type	Shared Processor Pool
IBM PSeries Frame	CI Type	PSeries Frame/Managed System
Interface Aggregation	CI Type	Link Aggregation
I/O Slot	CI Type	I/O Slot on the Frame
SEA Adapter	CI Type	Virtual Eth interface on a VIO Server
IBM Processor Pool > containment > CPU	Valid Link	
I/O Slot > containment > Fibre Channel HBA	Valid Link	
I/O Slot> containment > Network Interface	Valid Link	
I/O Slot > containment > SCSI Adapter	Valid Link	
IBM HMC > manage > IBM PSeries Frame	Valid Link	
Interface Aggregation > membership > Network Interface	Valid Link	
Network Interface > realization > Network Interface	Valid Link	
Network Interface > usage > SEA Adapter	Valid Link	
SEA Adapter > usage > Network Interface	Valid Link	
IBM Virtualization by Shell	Job	Performs Virtualization based discovery
IBM LPAR and VIO Server Topology by Shell	Job	Performs LPAR and VIO Server side discovery

Entity Name	Entity Type	Entity Description
IBM_VIRTUALIZATION_BY_SHELL_PATTERN	Adapter	Adapter for the IBM Virtualization by Shell job
IBM_LPAR_VIO_BY_SHELL	Adapter	Adapter for the IBM LPAR and VIO Server Topology by Shell job
ibm_hmc_by_shell	Script	General HMC side discovery script
ibm_hmc_lib	Script	Common Data Objects and Procedures for both new Jobs
ibm_lpar_or_vio_by_shell	Script	General VIO Server and LPAR discovery script
ibm_hmc_by_shell.xml	query	Trigger query for the IBM Virtualization by Shell job
ibm_lpar_or_vio_trigger_tql.xml	query	Trigger query for the IBM LPAR and VIO Server Topology by Shell job
IBM HMC Topology.xml	query	Query (TQL) for the IBM HMC Topology view
IBM Storage Topology.xml	query	Query (TQL) for the IBM Storage Topology view
IBM HMC Topology.xml	View	
IBM Storage Topology.xml	View	
lpar_boot_mode	Type	Supported boot modes
lpar_cpu_mode	Type	CPU Sharing modes
lpar_sharing_mode	Type	LPAR cap/uncap sharing modes
lpar_state	Type	Possible LPAR states
lpar_type	Type	Possible LPAR types

Troubleshooting and Limitations – IBM Virtualization Discovery

This section describes troubleshooting and limitations for IBM Virtualization Discovery.

- It is possible to configure the Partition Migration of an LPAR to the PFrame. This is supported only in Power Series v6, and is presently not supported by IBM Virtualization Discovery.
- VIO Server on Linux OS is not supported.

Chapter 17: Oracle VM Server for SPARC Technology Discovery

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Troubleshooting and Limitations – Oracle VM Server for SPARC Technology Discovery 289

Overview

The Oracle VM Server for SPARC Technology Discovery allows the discovery of Oracle LDOM (Logical Domains) or Oracle VM Server for SPARC technology.

Supported Versions

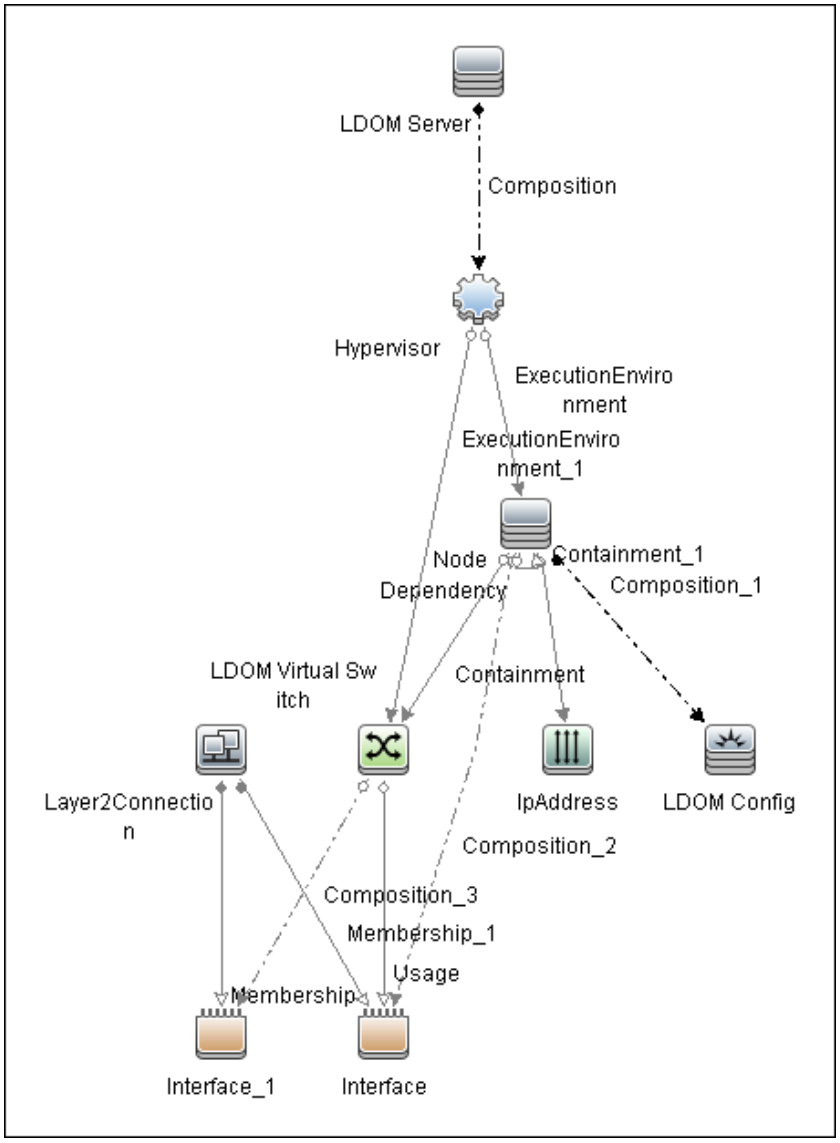
Oracle VM Server for SPARC Technology Discovery supports LDOM versions 1.x, and Oracle VM Server for SPARC versions 2.x, and 3.x.

Topology

This section displays the following topology maps:

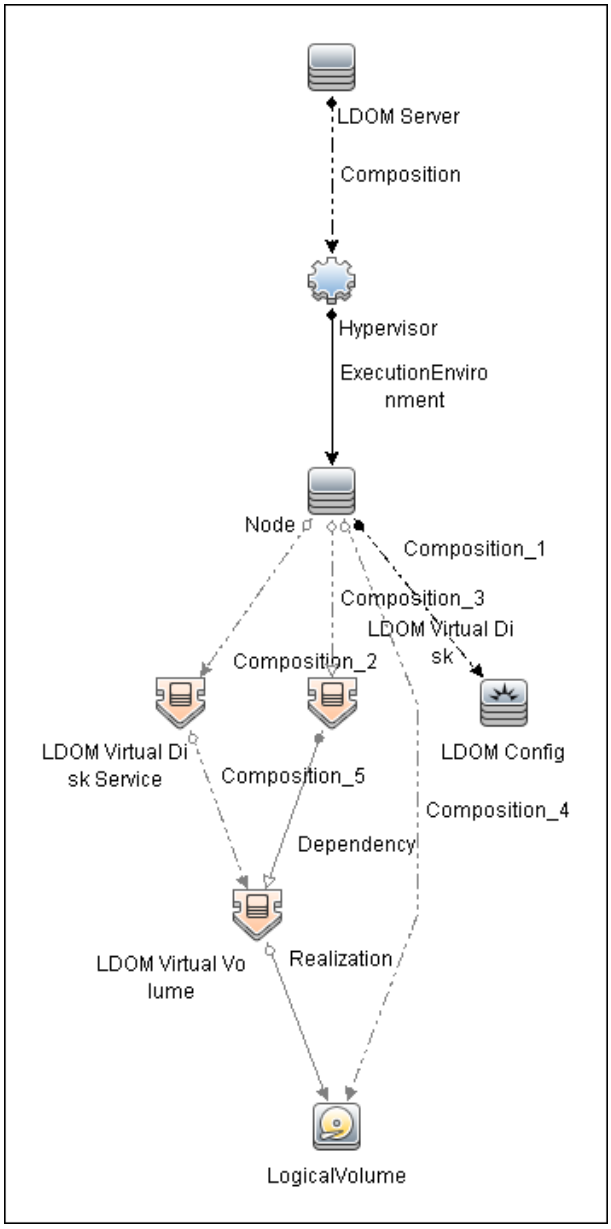
- "LDOM Networking and General Topology" below
- "LDOM Storage Topology" on the next page

LDOM Networking and General Topology



Note: For a list of discovered CITs, see "Discovered CITs" on page 282.

LDOM Storage Topology



Note: For a list of discovered CITs, see"Discovered CITs" on page 282.

How to Discover Oracle VM Server for SPARC Technology

1. **Prerequisites - General**

   a. Shell connectivity to the control domain.

   b. If required, configure **sudo** on each target host to allow execution of the following commands.

   ```
   /opt/SUNWldm/bin/ldm list*
   /usr/sbin/ldm list*
   ```

   The path is dependent on where the ldm command is located.

2. **Prerequisites - Setup protocol credentials**

   Set up one of the following protocols:

   - SSH
   - Telnet

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

3. **Run the discovery**

   - Run the **Range IPs by ICMP** job to discover the target IPs.
   - Run the **Host Connection by Shell** job to discover the target host and shell connectivity to it.
   - Run **Host Applications by Shell** job to discover applications of the target host, including the **Logical Domains Manager** application.
   - Run **Oracle VM Server for SPARC Technology by Shell** job in order to discover the topology of the target LDOM server.

Oracle VM Server for SPARC Technology by Shell Adapter

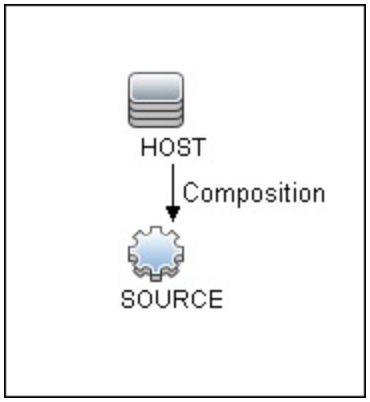
This section includes the following information:

- "Input CIT" below
- "Input Query" below
- "Triggered CI Data" on the next page
- "Used Scripts" on the next page
- "Discovered CITs" on page 282
- "Parameters" on page 282

Input CIT

Shell

Input Query



Triggered CI Data

Name	Value
connected_os_credentials_id	${SOURCE.connected_os_credentials_id:NA}
credentialsId	${SOURCE.credentials_id}
hostId	${SOURCE.root_container}
ip_address	${SOURCE.application_ip}
protocol	${SOURCE.root_class}

Used Scripts

- TTY_HR_CPU_Lib.py
- networking.py
- host_win_wmi.py
- host_discoverer.py
- host_win_shell.py
- hostresource_win_wmi.py
- networking_win_shell.py
- hostresource_win.py
- host_win.py
- hostresource.py
- solaris_networking.py
- ldom.py
- ldom_discover.py
- ldom_report.py
- ldom_by_shell.py

Discovered CITs

- Composition
- Containment
- Dependency
- ExecutionEnvironment
- Hypervisor
- Interface
- IpAddress
- Layer2Connection
- LDOM Resource
- Logical Volume
- Membership
- Node
- Realization

Parameters

Name	Description
match_domain_names_to_hostnames	When enabled, the discovery reports guest LDOMs, with their hostnames set to domain names, which may aid in the reconciliation of hosts. **Default**: false.

Oracle VM Server for SPARC Technology by Shell Job

This section includes the following information:

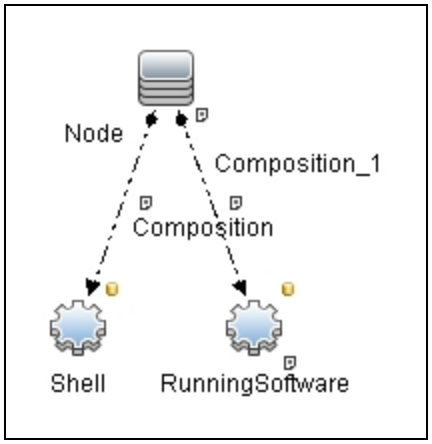
- "Adapter" below
- "Trigger Query" below

Adapter

This job uses the **Oracle VM Server for SPARC Technology by Shell** adapter.

Trigger Query

Name: ldom_control_domain_by_shell



Node Name	Condition
Node	None
Shell	CI Type Equal "SSH" or CI Type Equal "Telnet"
RunningSoftware	DiscoveredProductName Equal "Logical Domains Manager"

Discovery Flow

This section describes the discovery flow of the Oracle VM Server for SPARC Technology by Shell job.

General

- Discovery is performed by using the shell of the control domain
- The single command **ldm** of the control domain provides most of the required configuration information
- Guest domains:
  - Are completely isolated.
  - May have no network connectivity to control domain.
  - Can have an OS different from Solaris.

    > **Note:** For versions of LDOM below 2.0, and for guest OS different from Solaris, it is not possible to know whether it is a guest domain or a regular host.

    Accordingly, no specific discovery by guest domains is performed.
- Only domains that are in active or bound states are discovered, since for domains in other states the configuration may be incomplete or stale.

Oracle VM Server for SPARC Technology by Shell Job Flow

- **Get version of Logical Domains Manager**

  The **ldm** command is executed to get the version of **Logical Domains Manager**. See "Obtaining version information of Logical Domains manager" on the next page. To run **ldm**:
  - Make sure the **ldm** command is present, otherwise it is not a control domain and further discovery is impossible.
  - Get the proper path to the **ldm** command, which can be located under **/opt/SUNWldm/bin/ldm** or **/usr/sbin/ldm**.

- **Get configuration of all bound domains**

  The **ldm** command is executed to get the full configuration of all bound domains. See "Listing configuration of bound domains" on the next page.

- **Get general networking configuration**

  Standard networking discovery is performed, which involves the following commands:

  - netstat
  - ifconfig
  - dladm

  For more information see "UNIX-Based Processes" on page 1176.

- **Get names of interfaces that were created by virtual switches in domain**

  Each virtual switch that is created in the domain, creates additional virtual interfaces (usually named vsw<number>). By bringing these interfaces up, the parent domain can establish connectivity to its switch. To get the names of such interfaces an additional **find** command is run. See "Finding the interfaces created by virtual switches in domains" on page 289.

- **Get number of cores per physical CPU**

  Information about physical cores is taken from the command **/usr/sbin/prtpicl -c other | grep CORE**. After that, the normal approach for CPU discovery on Solaris is followed. For more information, see "How to Discover Host Resources and Applications".

Commands

This section gives examples of the commands used by this discovery.

Obtaining version information of Logical Domains manager

Command

```
/usr/sbin/ldm -V
```

Output

```
Logical Domains Manager (v 2.1)
       Hypervisor control protocol v 1.6
       Using Hypervisor MD v 1.3

System PROM:
```

```
       Hostconfig      v. 1.0.0.       @(#)Hostconfig 1.0.0.b 2010/09/15 03:03
[serpa:release]
       Hypervisor      v. 1.9.0.       @(#)Hypervisor 1.9.0.b 2010/09/15 01:48
       OpenBoot        v. 4.32.0.      @(#)OpenBoot 4.32.0.b 2010/09/29 19:13
```

Listing configuration of bound domains

Command

```
/usr/sbin/ldm list-bindings -p
```

Output

Output is truncated for brevity

```
VERSION 1.5
DOMAIN|name=primary|state=active|flags=normal,control,vio-
service|cons=SP|ncpu=8|mem=4294967296|util=2.4|uptime=10178475
UUID|uuid=11111111-1e91-c63f-99c7-e7484ec50000
MAC|mac-addr=00:21:28:11:73:a0
HOSTID|hostid=0x85117333
CONTROL|failure-policy=ignore
DEPENDENCY|master=
CORE
|cid=0|cpuset=0,1,2,3,4,5,6,7
VCPU
|vid=0|pid=0|util=0.7%|strand=100|cid=0
|vid=1|pid=1|util=0.6%|strand=100|cid=0
|vid=2|pid=2|util=0.9%|strand=100|cid=0
|vid=3|pid=3|util=0.8%|strand=100|cid=0
|vid=4|pid=4|util=2.1%|strand=100|cid=0
|vid=5|pid=5|util=0.5%|strand=100|cid=0
|vid=6|pid=6|util=0.5%|strand=100|cid=0
|vid=7|pid=7|util=3.3%|strand=100|cid=0
MAU
|id=0|cpuset=0,1,2,3,4,5,6,7
MEMORY
|ra=0x8000000|pa=0x8000000|size=4294967296
VARIABLES
|auto-boot?=false
|boot-device=disk0 disk1
|keyboard-layout=US-English
IO
|dev=pci@0|alias=pci
|dev=niu@80|alias=niu
|dev=pci@0/pci@0/pci@8/pci@0/pci@9|alias=MB/RISER0/PCIE0
|dev=pci@0/pci@0/pci@8/pci@0/pci@1|alias=MB/RISER1/PCIE1
|dev=pci@0/pci@0/pci@9|alias=MB/RISER2/PCIE2
```

```
|dev=pci@0/pci@0/pci@8/pci@0/pci@a|alias=MB/RISER0/PCIE3
|dev=pci@0/pci@0/pci@8/pci@0/pci@2|alias=MB/RISER1/PCIE4
|dev=pci@0/pci@0/pci@8/pci@0/pci@8|alias=MB/RISER2/PCIE5
|dev=pci@0/pci@0/pci@1/pci@0/pci@2|alias=MB/NET0
|dev=pci@0/pci@0/pci@1/pci@0/pci@3|alias=MB/NET2
|dev=pci@0/pci@0/pci@2|alias=MB/SASHBA
VCC|name=vcc|port-range=5001-5010
|client=guest1@vcc|port=5001
VSW|name=vsw1|mac-addr=00:21:28:11:73:a2|net-dev=e1000g2|dev=switch@1|default-vlan-
id=1|pvid=1|vid=|mode=|mtu=1500|linkprop=|id=1
|peer=vnet0@guest1|mac-addr=00:14:4f:f9:6f:4d|pvid=1|vid=|mtu=1500
VDS|name=vds0
|vol=guest1os|opts=|dev=/dev/zvol/dsk/ldoms/guest1os|mpgroup=
|vol=guest1ap|opts=|dev=/dev/zvol/dsk/ldoms/guest1ap|mpgroup=
|vol=L1_2234|opts=|dev=/dev/dsk/c6t600604800002901011775330323233 34d0s2|mpgroup=
|vol=L1_2228|opts=|dev=/dev/dsk/c6t600604800002901011775330323232 38d0s2|mpgroup=
|vol=L1_221C|opts=|dev=/dev/dsk/c6t600604800002901011775330323231 43d0s2|mpgroup=
|client=vdisk0@guest1|vol=guest1os
|client=vdisk1@guest1|vol=guest1ap
|client=vdisk2@guest1|vol=L1_2234
|client=vdisk3@guest1|vol=L1_2228
|client=vdisk4@guest1|vol=L1_221C
VCONS|type=SP
DOMAIN|name=guest1|state=active|flags=normal|cons=5001|ncpu=32|
mem=19327352832|util=0.0|uptime=8584562
UUID|uuid=22222222-8dfb-6742-9705-d2f4d4310000
MAC|mac-addr=00:14:4f:f9:35:8f
HOSTID|hostid=0x84f93555
CONTROL|failure-policy=ignore
DEPENDENCY|master=
CORE
|cid=1|cpuset=8,9,10,11,12,13,14,15
|cid=2|cpuset=16,17,18,19,20,21,22,23
|cid=3|cpuset=24,25,26,27,28,29,30,31
|cid=4|cpuset=32,33,34,35,36,37,38,39
VCPU
|vid=0|pid=8|util=0.3%|strand=100|cid=1
|vid=1|pid=9|util=0.1%|strand=100|cid=1
|vid=2|pid=10|util=0.0%|strand=100|cid=1
|vid=3|pid=11|util=0.0%|strand=100|cid=1
|vid=4|pid=12|util=0.3%|strand=100|cid=1
|vid=5|pid=13|util=0.0%|strand=100|cid=1
|vid=6|pid=14|util=0.0%|strand=100|cid=1
|vid=7|pid=15|util=0.0%|strand=100|cid=1
|vid=8|pid=16|util=0.0%|strand=100|cid=2
|vid=9|pid=17|util=0.0%|strand=100|cid=2
|vid=10|pid=18|util=0.0%|strand=100|cid=2
|vid=11|pid=19|util=0.0%|strand=100|cid=2
```

```
|vid=12|pid=20|util=0.0%|strand=100|cid=2
|vid=13|pid=21|util=0.0%|strand=100|cid=2
|vid=14|pid=22|util=0.3%|strand=100|cid=2
|vid=15|pid=23|util=0.1%|strand=100|cid=2
|vid=16|pid=24|util=0.0%|strand=100|cid=3
|vid=17|pid=25|util=0.0%|strand=100|cid=3
|vid=18|pid=26|util=0.1%|strand=100|cid=3
|vid=19|pid=27|util=0.1%|strand=100|cid=3
|vid=20|pid=28|util=0.0%|strand=100|cid=3
|vid=21|pid=29|util=0.0%|strand=100|cid=3
|vid=22|pid=30|util=0.0%|strand=100|cid=3
|vid=23|pid=31|util=0.0%|strand=100|cid=3
|vid=24|pid=32|util=3.6%|strand=100|cid=4
|vid=25|pid=33|util=0.0%|strand=100|cid=4
|vid=26|pid=34|util=0.0%|strand=100|cid=4
|vid=27|pid=35|util=0.0%|strand=100|cid=4
|vid=28|pid=36|util=0.2%|strand=100|cid=4
|vid=29|pid=37|util=0.0%|strand=100|cid=4
|vid=30|pid=38|util=0.0%|strand=100|cid=4
|vid=31|pid=39|util=0.0%|strand=100|cid=4
MAU
|id=1|cpuset=8,9,10,11,12,13,14,15
|id=2|cpuset=16,17,18,19,20,21,22,23
|id=3|cpuset=24,25,26,27,28,29,30,31
|id=4|cpuset=32,33,34,35,36,37,38,39
MEMORY
|ra=0x8000000|pa=0x108000000|size=19327352832
VARIABLES
|boot-device=/virtual-devices@100/channel-devices@200/disk@0:a disk net
|keyboard-layout=US-English
VNET|name=vnet0|dev=network@0|service=vsw1@primary|mac-
addr=00:14:4f:f9:6f:4d|mode=|pvid=1|vid=|mtu=1500|linkprop=|id=0
|peer=vsw1@primary|mac-addr=00:21:28:11:73:a2|mode=|pvid=1|vid=|mtu=1500
VDISK|name=vdisk0|vol=guest1os@vds0|timeout=|dev=disk@0|
server=primary|mpgroup=|id=0
VDISK|name=vdisk1|vol=guest1ap@vds0|timeout=|dev=disk@1|
server=primary|mpgroup=|id=1
VDISK|name=vdisk2|vol=L1_2234@vds0|timeout=|dev=disk@2|
server=primary|mpgroup=|id=2
VDISK|name=vdisk3|vol=L1_2228@vds0|timeout=|dev=disk@3|
server=primary|mpgroup=|id=3
VDISK|name=vdisk4|vol=L1_221C@vds0|timeout=|dev=disk@4|
server=primary|mpgroup=|id=4
VCONS|group=guest1|service=vcc@primary|port=5001
```

Finding the interfaces created by virtual switches in domains

Command

```
find /devices/virtual-devices@100 -type c -name virtual-network-switch*
```

Output

```
/devices/virtual-devices@100/channel-devices@200/virtual-network-switch@0:vsw0
/devices/virtual-devices@100/channel-devices@200/virtual-network-switch@1:vsw1
```

Finding the number of cores per CPU

Command

```
/usr/sbin/prtpicl -c other | grep CORE
```

Output

```
CORE0 (other, b2333315a2)
CORE1 (other, b2333315cc)
CORE2 (other, b2333315f6)
CORE3 (other, b233331620)
CORE0 (other, b2333315a2)
CORE1 (other, b2333315cc)
CORE2 (other, b2333315f6)
CORE3 (other, b233331620)
```

The output shows two physical CPUs with 4 cores each.

Troubleshooting and Limitations – Oracle VM Server for SPARC Technology Discovery

- Due to the technical limitation and architecture of LDOMs, not all guest domains can be reported by the discovery job. Guest domains that have no network connectivity to the Virtual Switch located in this control domain cannot be reported, since there is not enough identification information for such a domain.
- Several virtual network devices created by LDOMs have MAC addresses assigned. These MACs can be autogenerated or manually assigned. In some cases, different LDOM servers generate the MACs. Since there is no other identification information about guest domains available besides the MAC addresses of their virtual interfaces, if MACs on different LDOMs match, the corresponding Nodes of the domains may also merge in CMDB.

Chapter 18: Oracle VM for x86 Discovery

This chapter includes:

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Supported Versions 291

Topology 292

How To Discover Oracle VM for x86 Topology 293

Oracle VM for x86 by Manager Main CLI Job 293

Oracle VM Manager Discovery By MainCli Adapter 295

Overview

Oracle VM is a platform that provides a fully equipped environment with all the latest benefits of virtualization technology. Oracle VM enables deployment of operating systems and application software within a supported virtualization environment. Oracle VM insulates users and administrators from the underlying virtualization technology and allows daily operations to be conducted using goal-oriented GUI interfaces.

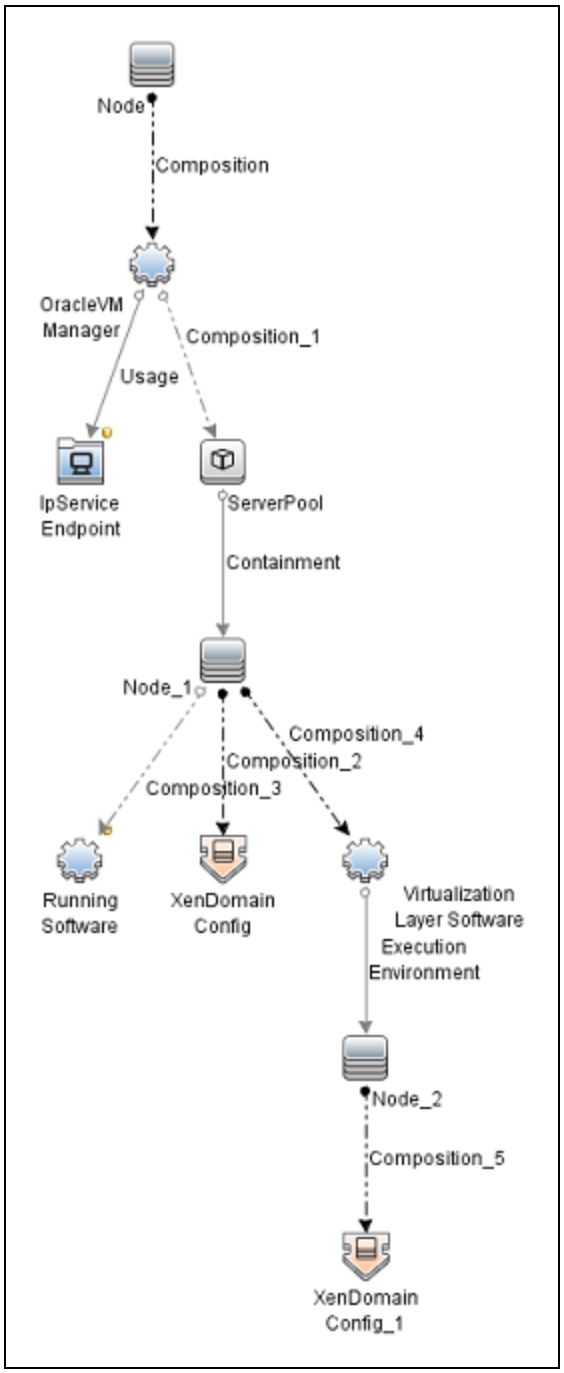
Oracle VM is an enterprise class server virtualization solution comprised of Oracle VM Server for x86, Oracle VM Server for SPARC, and Oracle VM Manager. For x86 servers, Oracle VM includes Oracle VM Manager and Oracle VM Server for x86.

Supported Versions

Oracle VM for x86 Discovery supports Oracle VM Server for x86, version 3.2.1 and later versions.

Topology

The topology for Oracle VM for x86 discovery is shown below.



How To Discover Oracle VM for x86 Topology

This section describes how to discover the Oracle VM for x86 Topology.

Prerequisites

- Ensure that there is shell connectivity to the Oracle VM Manager
- Set up SSH protocol credentials. If a port is specified in the credentials, then credentials are applied only to destinations where the port is listening. Otherwise, credentials are skipped.

Run the Discovery

> **Note:** Oracle VM for x86 Topology Discovery can be performed in shallow or deep mode. To perform a shallow discovery, carry out steps 1-3 below. To perform a deep discovery, carry out all the steps below.

1. Run the **Range IPs by ICMP** job (discovers reachable IPs).
2. Run the **Host Connection by Shell** job (discovers the target host and shell connectivity to the host).
3. Run the **Host Applications by Shell** job (discovers Oracle VM agents, the Oracle VM Manager, and the Oracle VM CLI listening port).

   > **Note:** If you want to perform only a shallow discovery, stop here and do not continue to the next step.

4. Run the **Oracle VM for x86 by Manager Main CLI** job (discovers virtualization topology managed by the Oracle VM Manager).

Oracle VM for x86 by Manager Main CLI Job

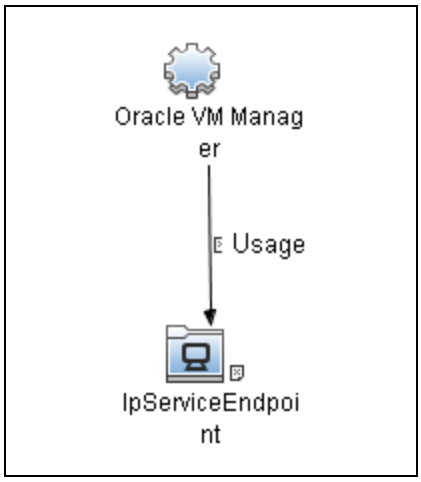
This section includes details about the job.

Adapter

ID: oracle_vm_manager_by_maincli

Trigger TQL

- Trigger CI: **OracleVmManager**, with the optional endpoint **ovm_manager_cli_ssh** connected.
- Trigger query:



- CI attribute conditions:

CI	Attribute Value
IpServiceEndpoint	ServiceNames contains ovm_manager_cli_ssh.

Discovery Flow

This job iterates over available SSH credentials and attempts to connect against the manager destination with the port specified in one of the following places:

- Main CLI endpoint port
- SSH credentials port
- Default port: 10000 (specified in script)

If a connection is established, Discovery is performed using OVM CLI in the following order:

1. This job sets the CLI command output to XML (command: **set output=xml**).
2. This job lists all the available servers (command: **list Server**).

3. This job lists all the virtual machines (command: **list VM**).
4. For each server, this job obtains its details (command: **show Server**).
5. For each virtual machine, this job obtains its details (command: **show Vm**).
6. This job gets the version of the CLI/Oracle VM Manager (command: **showversion**).

Oracle VM Manager Discovery By MainCli Adapter

This section includes details about the adapter.

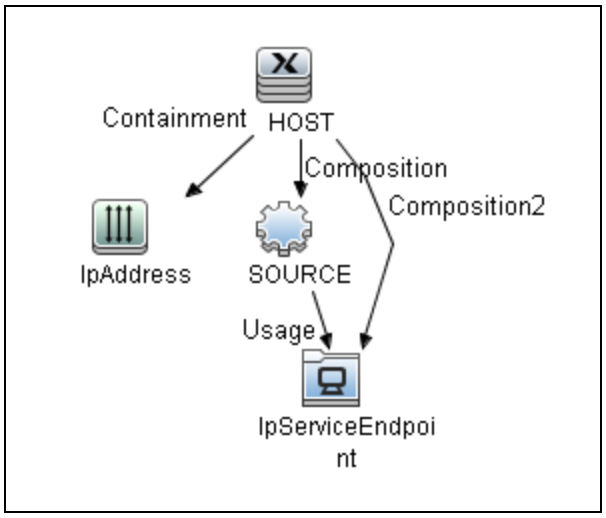
ID

`oracle_vm_manager_by_maincli`

Input CIT

`OracleVMManager`

Input TQL



Triggered CI Data

Name	Value
credentialsId	${SOURCE.credentials_id:NA}
ip_address	${SOURCE.application_ip:NA}
protocol_port	${IpServiceEndpoint.network_port_number:NA}

Used Scripts

- **iteratortools.py**
- **ovm_arg_validator.py**
- **ovm_reportage.py**
- **ovm_linkage.py**
- **ovm_software.py**
- **ovm_virtualization.py**
- **ovm_xen_domain.py**
- **ovm_flow.py**
- **ovm_node.py**
- **ovm_domain.py**
- **ovm_cli.py**
- **manager_by_ovm_cli.py.** The entry point script.

Discovered CITs

- Composition
- Containment
- Dependency

- ExecutionEnvironment
- Interface
- IpAddress
- IpServiceEndpoint
- Node
- Realization
- RunningSoftware
- ServerPool
- Usage
- Virtualization Layer Software
- XenDomainConfig

Parameters

- **commandExecutionDurationInMs.** The time (ms) allocated for execution of all CLI commands. The specified time value depends on the load factor of the manager host. The default value is 2000 ms (2 seconds).
- **reportStoppedVMs.** Performs discovery of stopped VMs. The default value is **false**.

Chapter 19: Solaris Zones Discovery

This chapter includes:

- Overview 299
- Supported Versions 299
- Topology 300
- How to Discover Solaris Zones 301
- Solaris Zones by TTY Job 302
  - Trigger Query 302
  - Adapter 302
  - Parameters 303
  - Created/Changed Entities 303
  - Used Scripts 304
  - Discovered CITs 304
  - Discovery Mechanism 306
- Troubleshooting and Limitations – Solaris Zones Discovery 317

Overview

The Solaris Zones partitioning technology is used to virtualize operating system services and provide an isolated and secure environment for running applications. A zone is a virtualized operating system environment created within a single instance of the Solaris Operating System. When you create a zone, you produce an application execution environment in which processes are isolated from the rest of the system. This isolation prevents processes that are running in one zone from monitoring or affecting processes that are running in other zones. Even a process running with superuser credentials cannot view or affect activity in other zones.

A zone also provides an abstract layer that separates applications from the physical attributes of the machine on which they are deployed. Examples of these attributes include physical device paths.

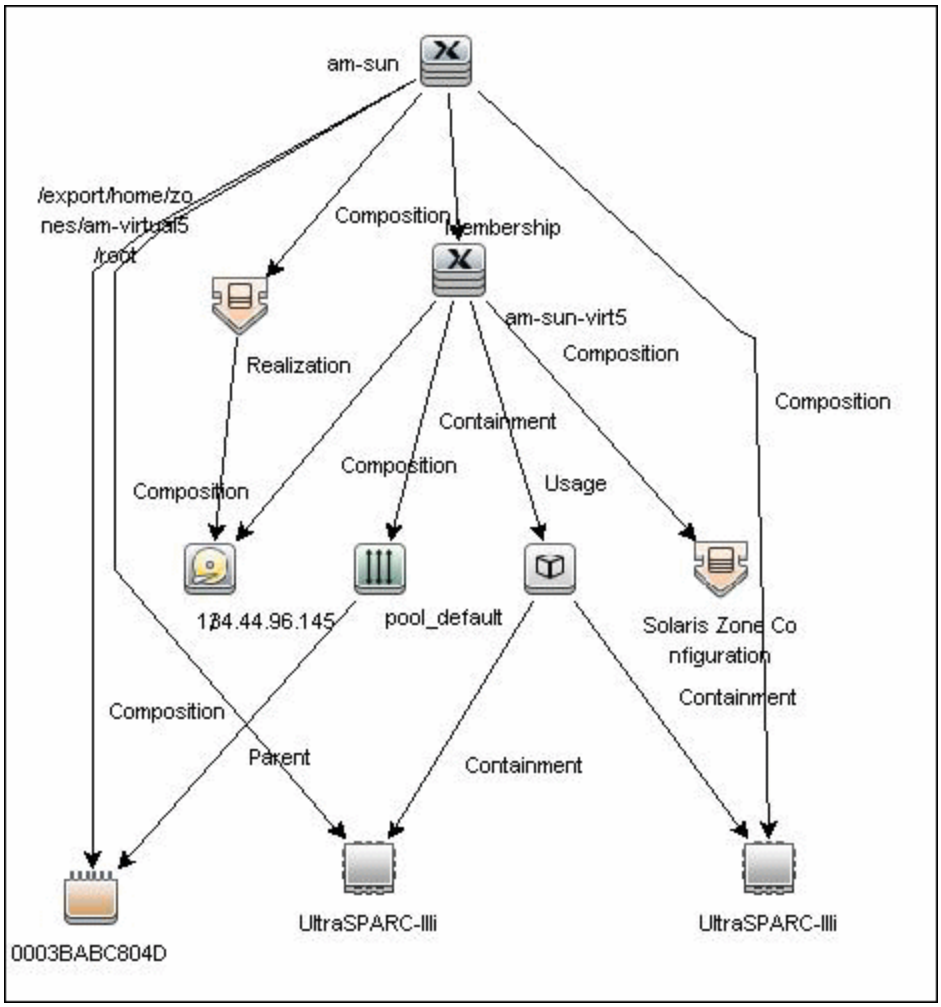
Supported Versions

Solaris Zones discovery supports Solaris 9, 10, and 11.

Topology

The following image displays the topology of the Solaris Zones discovery with sample output:

> **Note:** For a list of discovered CITs, see "Solaris Zones by TTY Job" on page 302.



How to Discover Solaris Zones

This task includes the following steps:

1. Prerequisites - Set up protocol credentials

   This discovery uses the SSH and Telnet protocols.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Prerequisites - Set up permissions

   Zones are discovered from the Global Zone of the machine, so you should have appropriate permissions to:

   - access the Global Zone and perform discovery
   - log into the Non-global Zones through the **zlogin** command

   > **Note:** The zlogin command can be executed:
   >
   > i. With root user (the default value)
   >
   > ii. With a connection to the global zone user. You can configure this option with the discovery pattern parameter **zloginWithConnectedUser**.

3. Run the discovery

   a. Run the **Range IPs by ICMP** job to discover which of the machines in the IP range are up.

   b. Run the **Host Connection by Shell** job to discover Shell connectivity and basic information about the hosts.

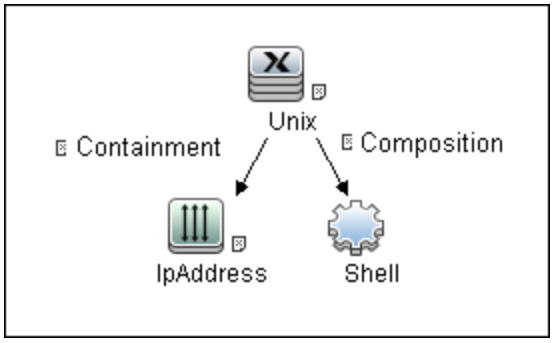
   c. Run the **Solaris Zones by TTY** job to discover zone configuration.

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

Solaris Zones by TTY Job

This section includes details about the job.

Trigger Query

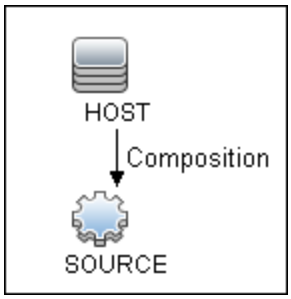


Adapter

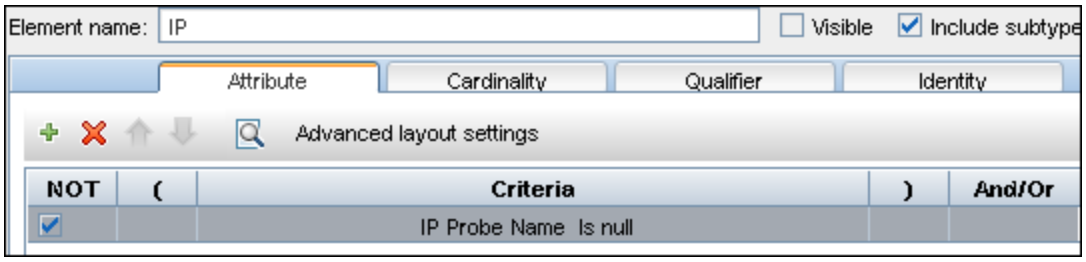
The Solaris Zones by TTY Job uses the **SolarisZone_Disc_By_TTY** adapter.

- **Input Query**

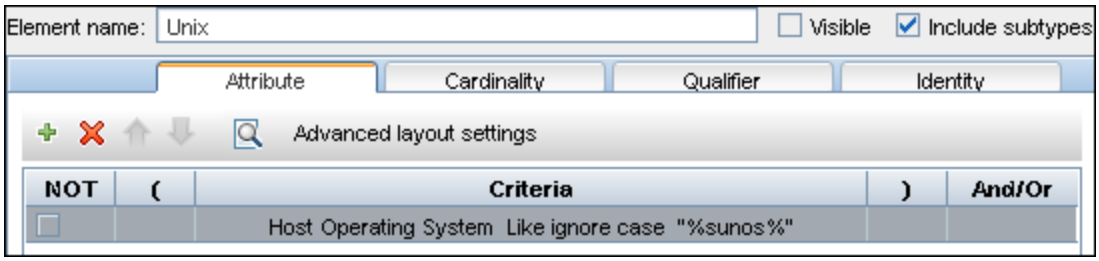
  The Input query contains one Shell CI only:



- **IP Process**



- **UNIX Process**



Parameters

Parameter	Description
reportBasicTopology	Determines whether to report the basic topology (true) or full topology(false). **Default:** false
reportNonGlobalZoneWarning	Determines whether to report the warning if the destination is not a global zone. **Default:** true
zloginWithConnectedUser	If **true**, zlogin is executed with a connection to the global user account. If **false**, zlogin uses the root account. **Default:** false.

Created/Changed Entities

- **Additional CI Types**:
  - Solaris Zones Config
  - Solaris Resource Pool

- **Additional valid links**:
  - Solaris Resource Pool > **Containment** > CPU
  - Unix > **Usage** > Solaris Resource Pool
  - Unix > **Composition** > Solaris Resource Pool
- **Modified views:**
  - Solaris Zones view
- **Modified scripts**:
  - SolarisZone_Disc_By_TTY.py
- **Additional enrichments**:
  - Solaris Zones Networking

Used Scripts

- vendors.py
- networking.py
- solaris_networking.py
- SolarisZone_Disc_By_TTY.py

Discovered CITs

- Composition
- Containment
- Cpu
- ExecutionEnvironment
- Fibre Channel HBA
- FileSystem
- FileSystemExport
- Hypervisor
- IPMP Group

- Interface
- IpAddress
- IpSubnet
- Membership
- Node
- Parent
- Realization
- Solaris Resource Pool
- Solaris Zone Config
- Usage

> **Note:** To view the topology, see "Topology" on page 300.

Discovery Mechanism

This section includes the following commands:

- "Verify the Connected OS is Zone-compliant" below
- "Obtain List of Zones, Verify the Connected Host is Global Zone" on the next page
- "Obtain Configuration for Each of the Non-global Zones" on page 308
- "Obtain MAC Addresses for Interfaces of Global Zone" on page 309
- "Obtain IP Information for Global Zone" on page 310
- "Obtain IP Information of Exclusive Zones" on page 312
- "Obtain MAC Addresses for Dedicated Interfaces of Exclusive Zones" on page 312
- "Obtain CPU Information in Global Zone" on page 313
- "Obtain Resource Pools" on page 314
- "Obtain Fibre Channel Adapters" on page 316

Verify the Connected OS is Zone-compliant

Command	uname -r
Example of output	`5.10`
Values taken	5.10
Comments	This command retrieves the Solaris OS version. If it is 5.10 it is assumed that the version supports zones and discovery continues. If it is not equal to 5.10 (for example, 5.9) it is assumed the host is not zone-compliant and discovery ends with the message **`Server does not support zones`**.

Obtain List of Zones, Verify the Connected Host is Global Zone

Command	/usr/sbin/zoneadm list -cp

Example of output 1	`0:global:running:/::native:shared`
	`27:zone1:running:/var/opt/zones/zone1 :11559a59-3c6f-6a6e-a723-cc8159351247: native:excl`
	`-:zone2:configured:/var/opt/zones/ zone2::native:shared`

Example of output 2 (no root permissions)	`0:global:running:/`
	`1:am-virtual6:running:/export/home/ zones/am-virtual6`
	`5:am-virtual5:running:/export/home/ zones/am-virtual5`
	`7:am-virtual3:running:/virtual/3`
	`9:am-virtual1:running:/am-virtual/1`

Values taken	Name of the zone: zone1 Status of the zone: running Zone path: /var/opt/zones/zone1
Comments	This command gives the list of zones and their configuration including names, status, and path. The following is verified: • That **global** is present in the output. If it is missing, the zone that discovery connected to is not global. • There is at least one more non-global zone apart from the global zone. If this is not true, discovery ends with the message **`Server does not have zones defined`**.

Obtain Configuration for Each of the Non-global Zones

Command	/usr/sbin/zonecfg -z <zonename> info
Example of output 1	zonename: zone1 zonepath: /var/opt/zones/zone1 brand: native autoboot: true bootargs: -m verbose pool: limitpriv: default,sys_time scheduling-class: ip-type: exclusive fs: dir: /mnt/globalzone special: /var/opt/zone1-data raw not specified type: lofs options: [] net: address not specified physical: bge2 defrouter not specified device match: /dev/bge2 dedicated-cpu: ncpus: 1 importance: 1 capped-cpu: [ncpus: 1.00] capped-memory: physical: 16G [swap: 8G] [locked: 12G]
Example of output 2	zonename: zone2 zonepath: /var/opt/zones/zone2 brand: native autoboot: true bootargs: -m verbose pool: limitpriv: default scheduling-class: FSS ip-type: shared fs:

	dir: /mnt special: /var/opt/zone2-data raw not specified type: lofs options: [] net: address: 134.44.0.100 physical: bge0 defrouter not specified device match: /dev/pts* rctl: name: zone.cpu-shares value: (priv=privileged,limit=5,action=none)
Values taken	The following information is obtained from the output: • brand (if it is not specified it is assumes to be native) • autoboot • resource pool name • limit privileges • scheduling class • ip type • all mounted file systems • networking information (IP and/or network interface) • dedicated CPUs and their importance • memory caps • cpu caps • cpu shares
Comments	This command is run for each non-global zone found. Most of these properties are stored in the **Solaris Zone Config** CI. File systems are reported as a File System Export from global zone to non-global. The resource pool name is used to create a link to a corresponding resource pool CI.

Obtain MAC Addresses for Interfaces of Global Zone

Command	/usr/bin/netstat -np
Example of	Net to Media Table: IPv4

output	Device IP Address Mask Flags Phys Addr ------ ------------------- --------------- -------- --------------- bge0 134.44.0.101 255.255.255.255 o 00:15:f2:05:9e:ff bge0 134.44.1.150 255.255.255.255 o 00:15:f2:9b:2d:96 bge0 134.44.0.100 255.255.255.255 SPLA 00:14:4f:82:74:a4 bge0 134.44.98.135 255.255.255.255 o 00:1c:c0:2b:57:35 bge0 224.0.0.0 240.0.0.0 SM 01:00:5e:00:00:00
Values taken	MAC addresses of corresponding interfaces.
Comments	This command retrieves the list of all interfaces except for the dedicated interface used in exclusive zones. Interfaces in the global zone are shared with shared zones, so this command runs only once. MAC addresses and information in the zonecfg output enables the creation of shared non-global zone Host CIs.

Obtain IP Information for Global Zone

Command	/usr/sbin/ifconfig -a
Example of output	lo0: flags=2001000849<UP,LOOPBACK, RUNNING,MULTICAST,IPv4,VIRTUAL> mtu 8232 index 1 inet 127.0.0.1 netmask ff000000 lo0:1: flags=2001000849<UP,LOOPBACK,RUNNING, MULTICAST,IPv4,VIRTUAL> mtu 8232 index 1 zone zone2 inet 127.0.0.1 netmask ff000000 e1000g1: flags=1000843<UP,BROADCAST,RUNNING, MULTICAST,IPv4> mtu 1500 index 2 inet 134.44.0.50 netmask ffffff00 broadcast 134.44.0.255 e1000g1:1: flags=1000843<UP,BROADCAST,RUNNING, MULTICAST,IPv4> mtu 1500 index 2 zone zone2 inet 134.44.0.100 netmask ffffff00 broadcast 134.44.0.255
Values taken	The MAC addresses of corresponding interfaces.
Comments	This command retrieves the IP configuration for the global zone that is shared with

	corresponding shared non-global zones. This information is used to report IP addresses and link them to corresponding network interfaces.

Obtain IP Information of Exclusive Zones

Command	/usr/sbin/zlogin -l <username> <zonename> /usr/sbin/ifconfig -a
Example of output	lo0: flags=2001000849<UP,LOOPBACK,RUNNING, MULTICAST,IPv4,VIRTUAL> mtu 8232 index 1 inet 127.0.0.1 netmask ff000000 bge2: flags=201004843<UP,BROADCAST,RUNNING, MULTICAST,DHCP,IPv4,CoS> mtu 1500 index 2 inet 134.44.0.200 netmask fffffc00 broadcast 134.44.0.255 ether 0:14:4f:82:74:a6
Values taken	All IPs that are present except loopback.
Comments	This command retrieves the IP information for exclusive non-global zones. The -l <user> switch is added to simplify setting up the sudo pattern for zlogin, but it can be removed from the job parameters. **Note**: Discovery runs zlogin for zones in a running state only.

Obtain MAC Addresses for Dedicated Interfaces of Exclusive Zones

Command	/usr/sbin/zlogin -l <username> <zonename> /usr/bin/netstat -np
Example of output	Net to Media Table: IPv4 Device IP Address Mask Flags Phys Addr ------ -------------------- --------------- -------- ----------- ---- bge2 134.44.0.200 255.255.255.255 SPLA 00:14:4f:82:74:a6 bge2 224.0.0.0 240.0.0.0 SM 01:00:5e:00:00:00
Values taken	MAC addresses.
Comments	MAC addresses of the interfaces are obtained together with interface names. **Note:** Discovery runs zlogin for zones in a running state only.

Obtain CPU Information in Global Zone

Command	/usr/sbin/psrinfo -v
Example of output	Status of virtual processor 0 as of: 05/03/2010 16:00:15 on-line since 04/26/2010 19:45:40. The sparcv9 processor operates at 1200 MHz, and has a sparcv9 floating point processor. Status of virtual processor 1 as of: 05/03/2010 16:00:15 on-line since 04/26/2010 19:45:42. The sparcv9 processor operates at 1200 MHz, and has a sparcv9 floating point processor.
Values taken	Number of virtual CPUs with IDs Virtual processor names (sparcv9) Processors speeds (1200)
Comments	For each instance of the virtual processor, discovery creates a CPU with a name (sparcv9) and speed (1200). They are linked to the global zone. They are also linked to the corresponding resource pool.

Obtain Resource Pools

Command	/usr/sbin/pooladm
Example of output	system default string system.comment int system.version 1 boolean system.bind-default true string system.poold.objectives wt-load pool SUNWtmp_zone1 int pool.sys_id 1 boolean pool.active true boolean pool.default false int pool.importance 1 string pool.comment boolean pool.temporary true pset SUNWtmp_zone1 pool pool_default int pool.sys_id 0 boolean pool.active true boolean pool.default true int pool.importance 1 string pool.scheduler FSS string pool.comment pset pset_default
Example of output *(cont'd)*	pset SUNWtmp_zone1 int pset.sys_id 1 boolean pset.default false uint pset.min 1 uint pset.max 1 string pset.units population

	uint pset.load 0 uint pset.size 1 string pset.comment boolean pset.temporary true cpu int cpu.sys_id 0 string cpu.comment string cpu.status on-line
Values taken	• Pools: ◦ Name ◦ Is default ◦ Is active ◦ Importance ◦ Scheduler • Pset: ◦ Name ◦ Min CPUs ◦ Max CPUs ◦ Objectives Relations from **Pool** to **Pset** and from **Pset** to assigned CPUs by IDs
Comments	This information enables reporting pools and links them to corresponding CPUs of the global zone by IDs. Currently discovery reports pool and its pset as one entity. If the resource pools facility is not used or not active discovery cannot read the configuration, but still reports the default (dummy) pool without attributes; all CPUs are linked there. If the non-global zone includes the name of the pool in the configuration discovery links the zone to this pool. If the non-global zone has a dedicated-cpu property set, discovery calculates the name of the temporary dynamic pool for linkage. The name takes the following format: SUNWtmp_<zonename>.

Obtain Fibre Channel Adapters

Command	/usr/sbin/fcinfo hba-port
Example of output	HBA Port WWN: 2100001c3491b18a OS Device Name: /dev/cfg/c1 Manufacturer: QLogic Corp. Model: 555-1156-02 Firmware Version: 05.01.00 FCode/BIOS Version: BIOS: 2.2; fcode: 2.1; EFI: 2.0; Serial Number: 0708R00-4259732555 Driver Name: qlc Driver Version: 20090610-3.21 Type: N-port State: online Supported Speeds: 1Gb 2Gb 4Gb Current Speed: 2Gb Node WWN: 2000001c3491b18a HBA Port WWN: 2101001c34b1b18a OS Device Name: /dev/cfg/c2 Manufacturer: QLogic Corp. Model: 555-1156-02 Firmware Version: 05.01.00 FCode/BIOS Version: BIOS: 2.2; fcode: 2.1; EFI: 2.0; Serial Number: 0708R00-4259732555 Driver Name: qlc Driver Version: 20090610-3.21 Type: N-port State: online Supported Speeds: 1Gb 2Gb 4Gb Current Speed: 2Gb Node WWN: 2001001c34b1b18a
Values taken	• Port WWN • Os Device Name • Manufacturer • Model • Type • Serial • Driver version
Comments	This information enables discovery to report the Fibre Channel HBA. The OS Device

	Name is held by the **name** attribute. The Port WWN is held by the **HBA WWN** attribute.

Troubleshooting and Limitations – Solaris Zones Discovery

Problem: The following warning message appears during discovery: `Not enough permissions to execute command, zone is skipped.`

Reason: This may indicate that the script cannot retrieve network information for exclusive zones using **zlogin** due to a lack of permissions for the user performing discovery.

Solution: Give required permissions to the user.

Chapter 20: VMware

This chapter includes:

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- VMware Infrastructure Discovery 320
  - Supported Versions 322
  - SSL Support for the VIM Protocol 322
  - Topology 322
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  - How to Run the Manual VMware VIM Connection Job 333
  - How to Discover VMware ESX Server Topology over CIM 333
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VMware Prerequisites

Before running any VMware jobs, you must complete the following prerequisites:

1. **Credentials and Permissions**

   vCenter Server and ESX server require credentials (username and password) for login. In addition, you must have permissions for all entities being discovered to allow retrieval from the server. You should verify that you (and each authorized user) appear in the **Permissions** tab of each entity (host, cluster, virtual machine etc) in the VMware vSphere Client with, at least, a Read-Only role.

2. **Installation of JAR Files**

   You must ensure the appropriate JAR file are installed on the Data Flow Probe machines. You may do this using Management Zones.

How to Install the JAR Files Using Management Zones

This task consists of the following steps:

a. Download the **vSphere Web Client SDK** from:

   http://developercenter.vmware.com/web/sdk/65/web-client

   The required version is 5.1 or later.

b. Extract the files to a local folder. For example: **C:\vsphere-client-sdk**.

   You install the jar files through an Inventory Discovery Activity. You may ***either*** create a new Inventory Discovery Activity, or edit an existing one.

c. Create a new Inventory Discovery Activity:

   i. Go to **Data Flow Management > Universal Discovery > Zone Based Discovery > Management Zones**.

   ii. Select the appropriate Management Zone.

   iii. Click the button and select **New Discovery Activity > Inventory**.

   The **New Inventory Discovery Activity** dialog box appears.

   iv. Create the activity and activate it by following the online prompts through the activity wizard.

   On the **Virtualization** page, you must:

   A. Select **Include virtualization topology**.

   B. Under **Discovery Options**, select **VMware SDK libraries**.

   C. Click **Import file** The Import file dialog box appears.

   D. Select the **vim25.jar** file from the **vsphere-client-sdk** folder.

To edit an existing Inventory Discovery Activity:

i. Go to **Data Flow Management > Universal Discovery > Zone Based Discovery > Management Zones**.

ii. Select the appropriate Management Zone.

iii. Select the existing Inventory Discovery Activity.

iv. Click the button.

The **Edit Inventory Discovery Activity** dialog box appears.

v. On the **Virtualization** page, complete the steps as described in step iv above.

How to Manually Install the JAR Files

a. Download the **vSphere Web Client SDK** from:

http://developercenter.vmware.com/web/sdk/65/web-client

The required version is 5.1 or later.

b. Extract the files to a local folder. For example: **C:\vsphere-client-sdk**.

c. Get the **vim25.jar** file from the **vsphere-client-sdk** folder.

d. Put the **vim25.jar** file under:

***<DataFlowProbe_Home>*/runtime/probeManager/discoveryResources/vmware**.

> **Note:** You must do this for each Data Flow Probe where VMware discovery is to run.

e. Restart the Data Flow Probe.

VMware Infrastructure Discovery

This section includes:

Supported Versions 322
Supported Versions for VIM Protocol 322
Supported Versions for CIM Protocol 322
SSL Support for the VIM Protocol 322
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How to Run the Manual VMware VIM Connection Job 333
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VMware ESX Connection by CIM Job 336
VMware ESX Connection by VIM Job 339
VMware ESX Topology by CIM Job 343
VMware ESX Topology by VIM Job 346
VMware vCenter Connection by VIM Job 350
VMware vCenter Topology by VIM Job 353

Supported Versions

Supported Versions for VIM Protocol

Discovery of VMware infrastructure over the VIM protocol is supported by the following servers:

- VirtualCenter 2.5, 2.0
- vCenter Server 4, 4.1, 5.0, 5.1, 5.5, 6.0, and 6.5
- ESX & ESXi Server 3.0, 3.5, 4.0, 4.1, 5.0, 5.1, 5.5, 6.0, and 6.5

Supported Versions for CIM Protocol

Discovery of VMware infrastructure over the CIM protocol is supported by ESX & ESXi servers 4.1, 5.0, 5.1, 5.5, 6.0, and 6.5.

SSL Support for the VIM Protocol

Web services use http transport which can also be transferred over SSL. The VIM protocol uses SSL by default, but it is possible to configure it without SSL usage.

Each server supporting the VIM protocol (vCenter server or ESX server) has its own SSL certificate. When connecting over SSL you should verify this certificate and accept it:

- Import all certificates from the server into a truststore and verify upon each connection while rejecting those that are not present in the set of trusted certificates (this is the secure method).
- Accept all certificates without verification (this is a less secure method).

Currently, DFM supports only one strategy (**accept all certificates always**).

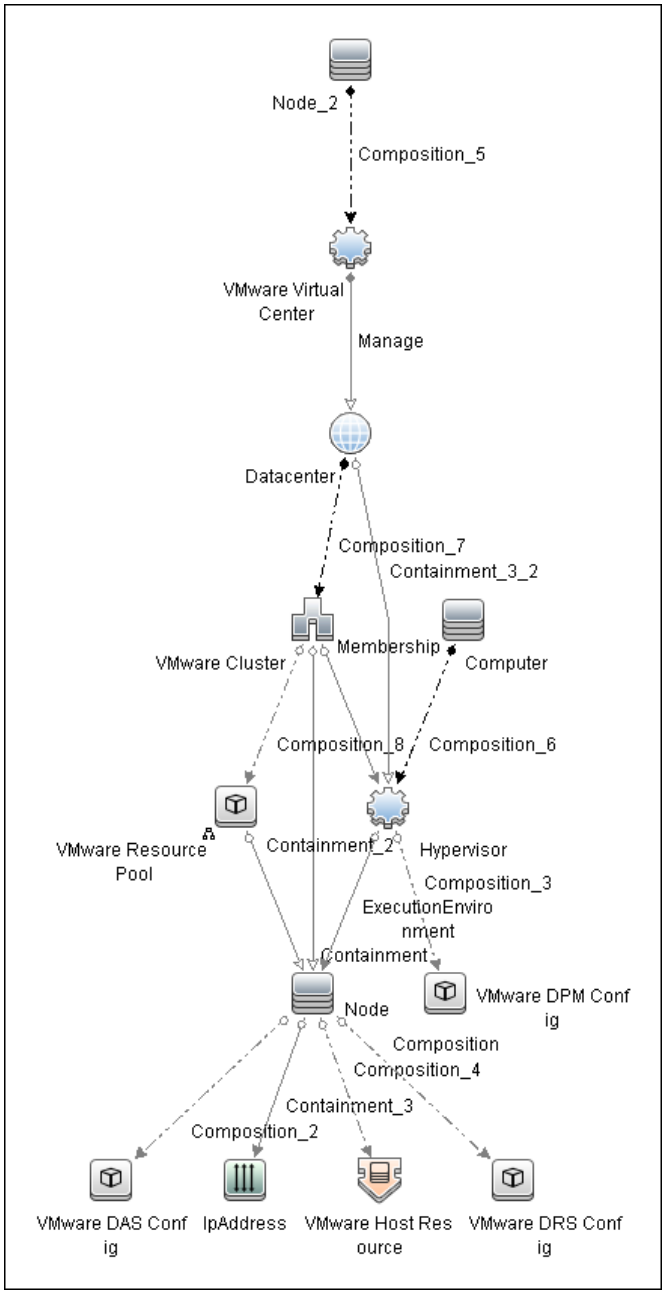
Topology

This section includes:

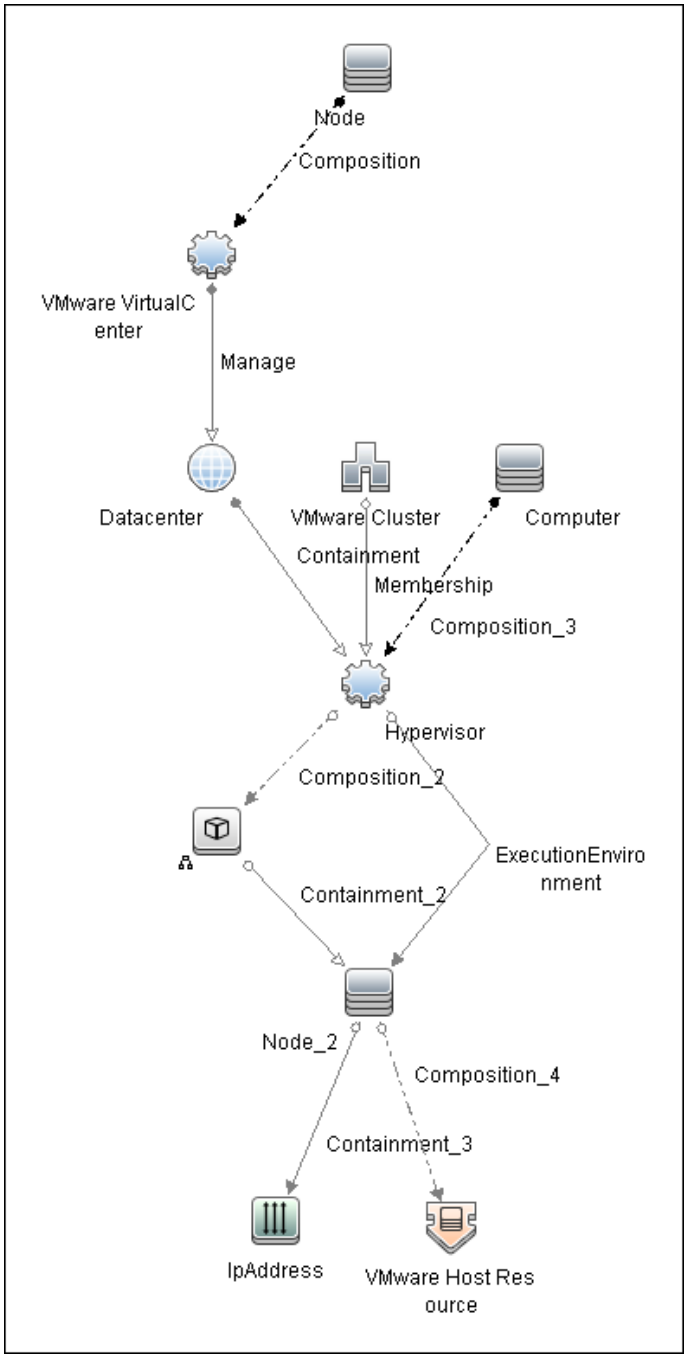
- "Virtual Topology View for Clusters" on page 324
- "Virtual Topology View for Non-Clusters" on page 325

- "Virtual Topology View for Networking" on page 326
- "Licensing Topology Map" on page 327
- "Virtual Topology View for Storage" on page 328
- "Topology for Distributed Networking" on page 329
- "VMware ESX Server Inventory and Virtual Topology View" on page 329
- "VMware ESX Server Inventory and Virtual Topology Instances Example" on page 330

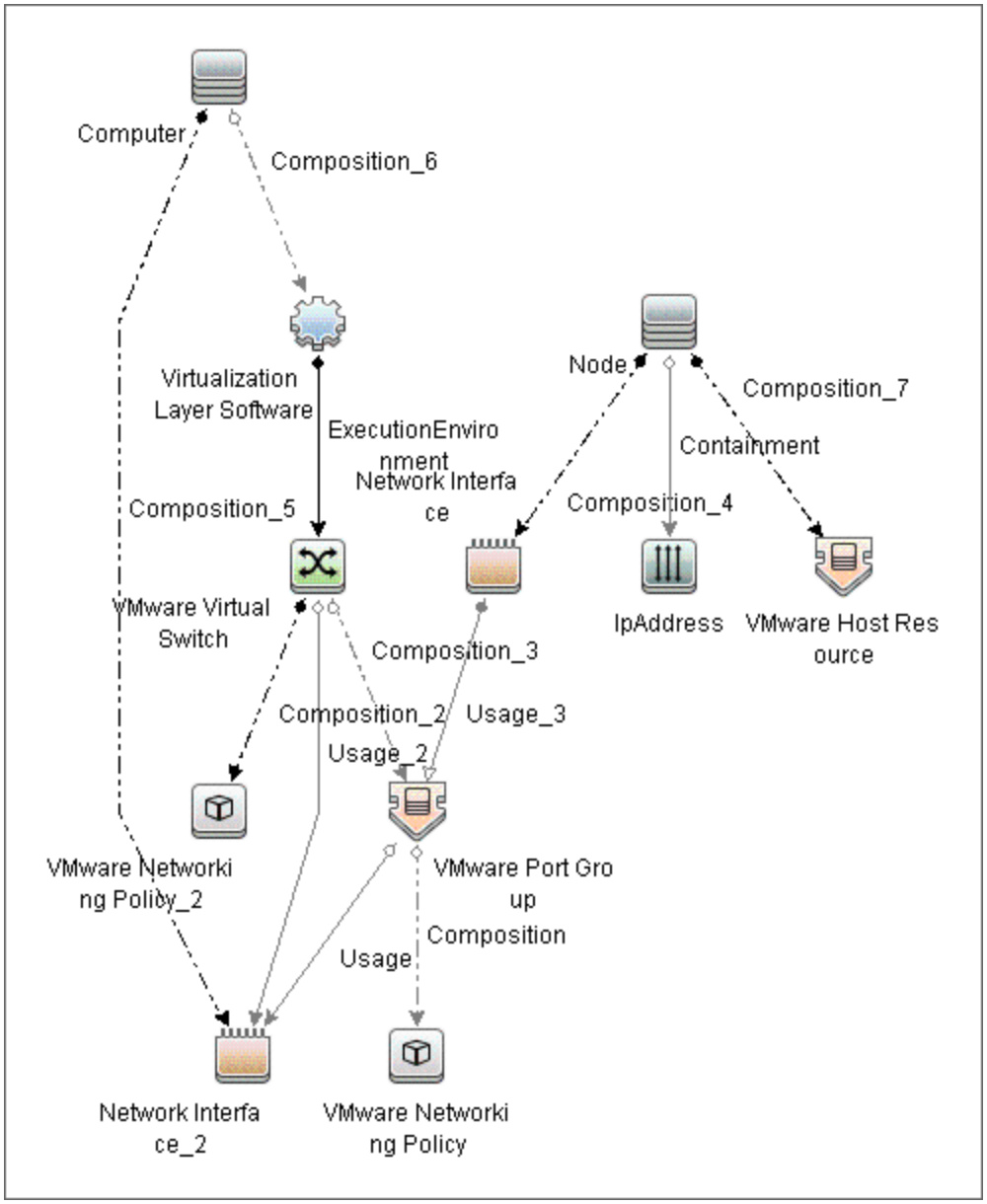
Virtual Topology View for Clusters



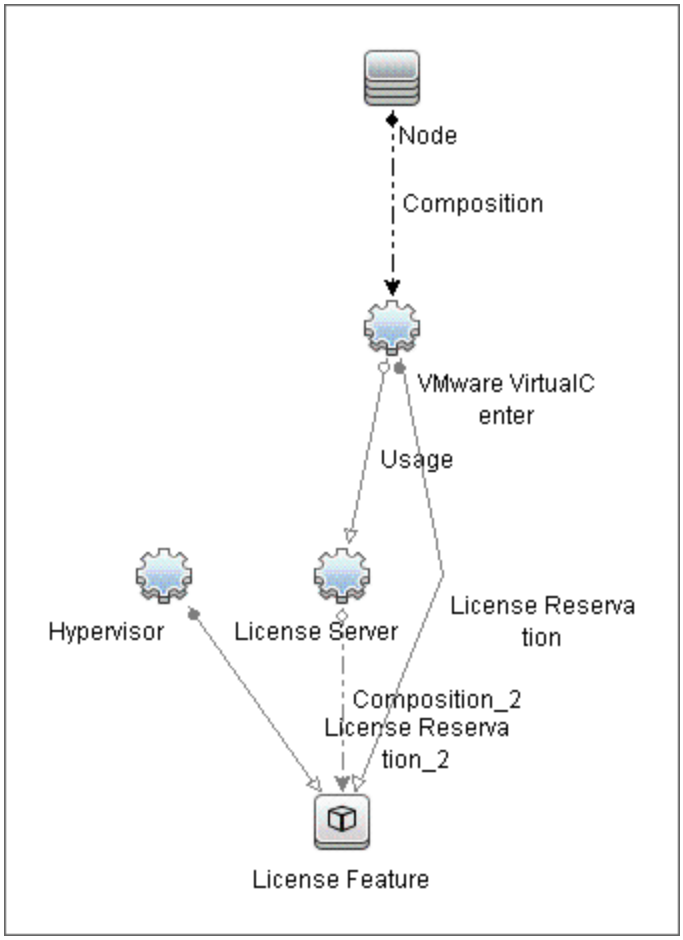
Virtual Topology View for Non-Clusters



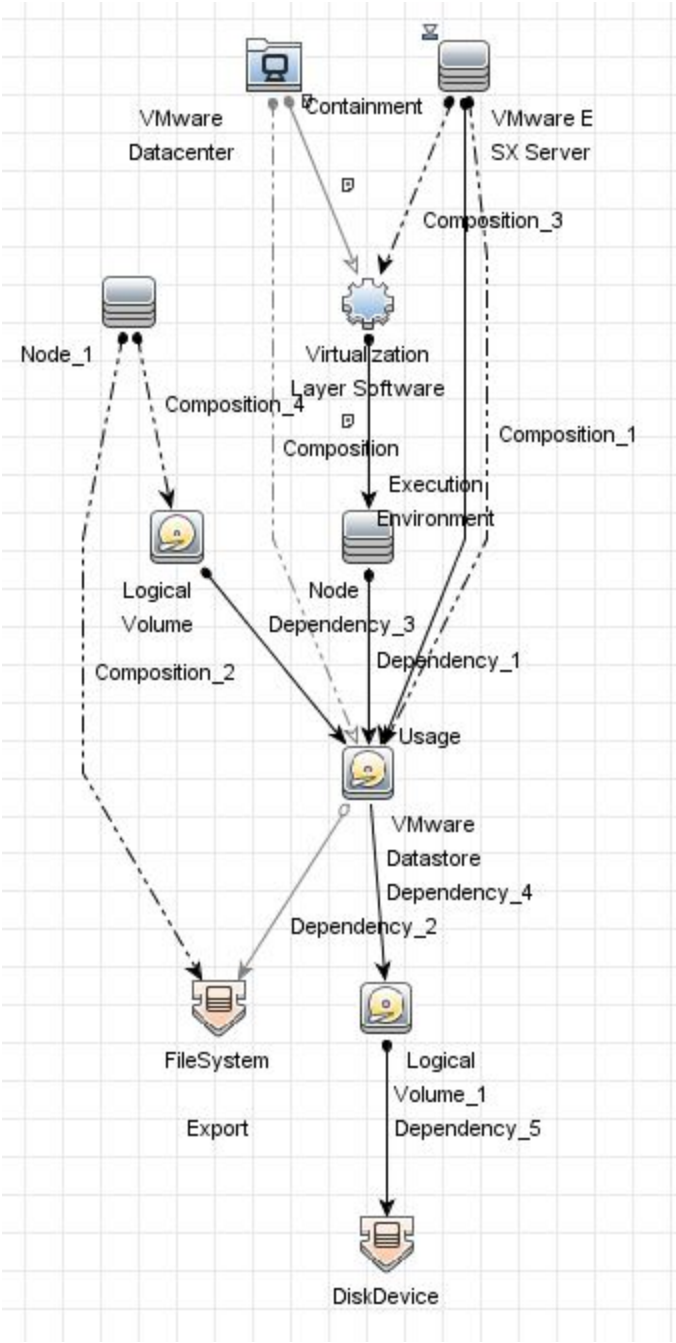
Virtual Topology View for Networking



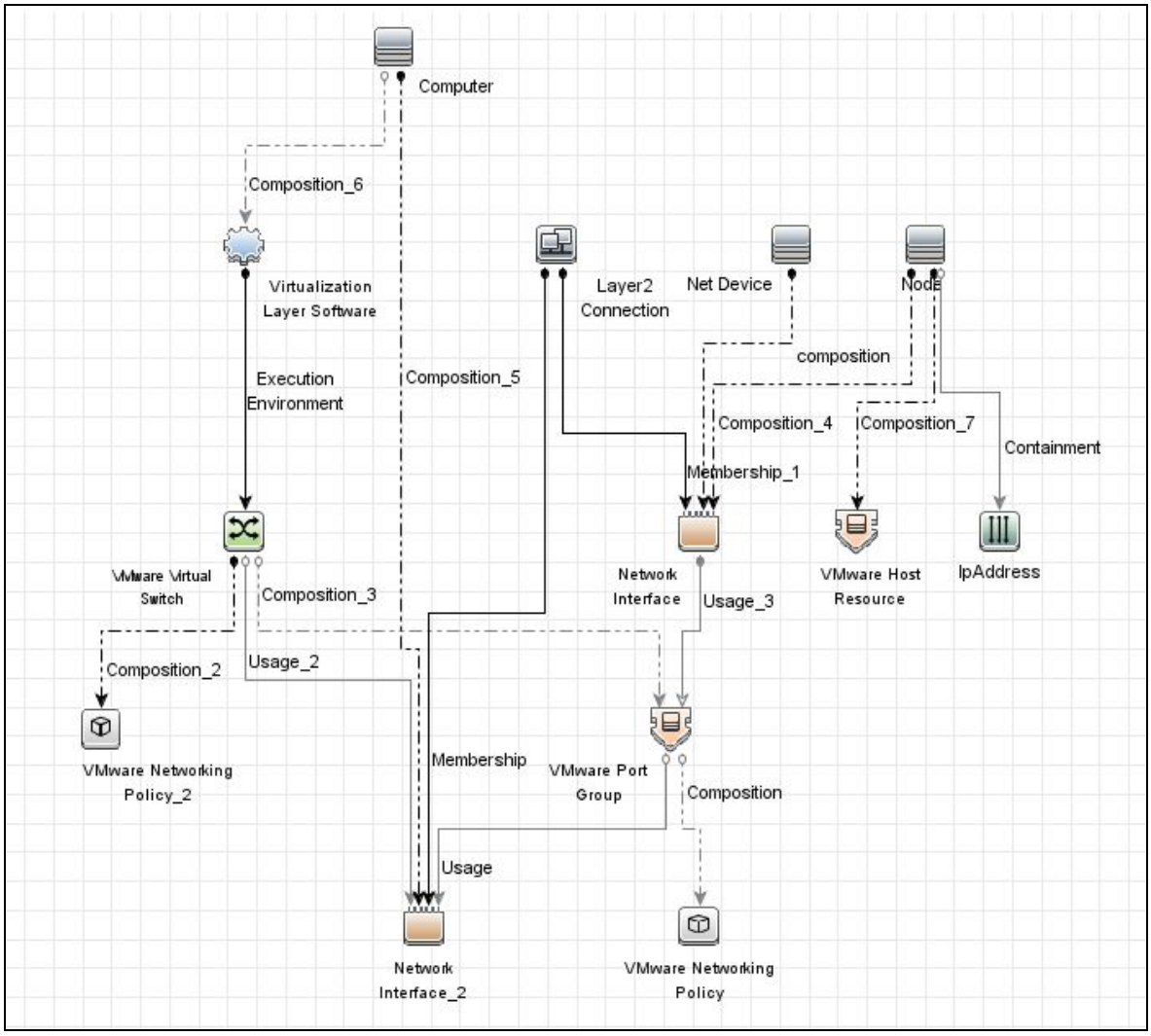
Licensing Topology Map



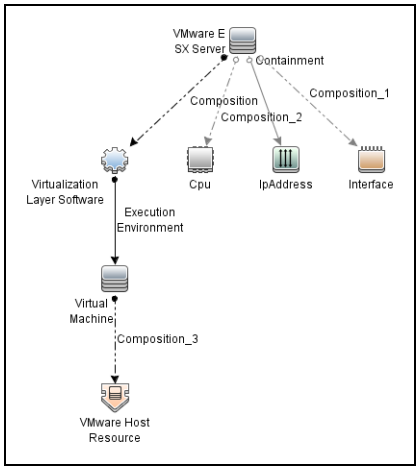
Virtual Topology View for Storage



Topology for Distributed Networking

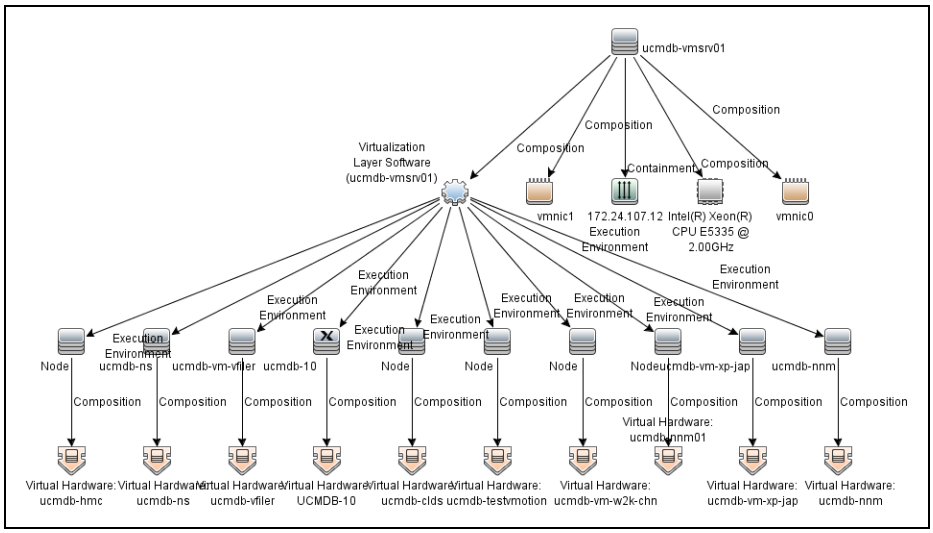


VMware ESX Server Inventory and Virtual Topology View



This view is reported using the CIM protocol.

VMware ESX Server Inventory and Virtual Topology Instances Example



VMware ESX Server Inventory and Virtual Topology Instances are reported using the CIM protocol.

How to Discover VMware VIM Topology

This task describes how to discover the VMware VIM Topology suite of applications. You can discover virtual machines (VM), ESX servers, networking and clustering resources that are running on VMware.

> **Note:** For details on running jobs, see "Discovery Control Panel" in the *HPE Universal CMDB Data Flow Management Guide*.

This task includes the following steps:

- "Prerequisite - Set up protocol credentials" below
- "Prerequisites – Set up VMware Infrastructure permissions" below
- "Run Host discovery" on the next page
- "Run Processes discovery" on the next page
- "Run VMware Infrastructure discovery" on the next page

1. **Prerequisite - Set up protocol credentials**
   - The WMI, Shell (Telnet, SSH, NTCMD), and SNMP protocols are required to discover hosts and host processes.

     These protocols require the user name, password, and domain name (the domain name is optional for NTCMD).
   - The VIM protocol is required for all VMware jobs.
     - This protocol requires a user name and password.
     - **Port Number** is optional.
     - **Use SSL.true**: select if the VMware servers are configured to use SSL by default. **false**: select if the VMware servers are configured to use non-secured http.

     For credential information, see "Supported Protocols" in the *HPE Universal CMDB Discovery and Integrations Content Guide*.
2. **Prerequisites – Set up VMware Infrastructure permissions**

   The VMware Infrastructure Management (VIM) protocol requires the following permissions:
   - **System.Read** permissions for users performing discovery. Users should have permissions for all entities being discovered, and must have been assigned at least a Read-Only role.

- **Global.Licenses** permissions to obtain the total and available number of licenses for each License Feature. If the user does not have these permissions, these attributes remain empty.

3. ### Run Host discovery

   To connect to each potential VMware server (vCenter, VirtualCenter, or ESX), discover its Host CI by running one of the **Host Connection by Shell/WMI** jobs.

4. ### Run Processes discovery

   To connect to each potential VMware server (vCenter, VirtualCenter, or ESX), you must discover Process CIs that match certain criteria, and run Application Signatures discovery by running one of the **Host Applications by Shell/WMI** jobs.

5. ### Run VMware Infrastructure discovery

   The **Virtualization** module includes two jobs for vCenter or VirtualCenter Server discovery and two for ESX Server discovery:

   - If the VMware Infrastructure environment is managed by vCenter or VirtualCenter Servers, run the **VMware vCenter Connection by VIM** job, followed by the **VMware vCenter Topology by VIM** job.
   - If the VMware Infrastructure environment includes unmanaged ESX servers (standalone) or the entire environment is unmanaged, run the **VMware ESX Connection by VIM** job, followed by the **VMware ESX Topology by VIM** job.

   > **Note:** The **Manual VMware VIM Connection** job is intended for use in those instances when the above jobs cannot discover the VMware environment. You must, however, manually run this job. See "How to Run the Manual VMware VIM Connection Job" on the next page.

   For details about each job, see:

   - "VMware vCenter Connection by VIM Job" on page 350
   - "VMware vCenter Topology by VIM Job" on page 353
   - "VMware ESX Connection by VIM Job" on page 339
   - "VMware ESX Topology by VIM Job" on page 346

How to Run the Manual VMware VIM Connection Job

You can use this job when the regular connection job (VMware ESX Connection by VIM or VMware vCenter Connection by VIM) cannot run because there is no shell access for the ESX server or the vCenter server.

This task contains the following steps:

1. **Prerequisites**

   Go to Modeling Studio and create a new query. For details on creating a new query, see the *How to Define a TQL Query* section in the *HPE Universal CMDB Modeling Guide*.

   > **Note:**
   > - Select the IpAddress CIs that belong to the vCenter servers (or individual VMware ESX/ESXi hosts) against which the VMware discovery is supposed to be run.
   > - When setting the query properties, in the Query Definition Properties dialog box that appears, select **Discovery** in the **Type** field, and then click **OK**.
   > - Save the query to the **Root** directory > the **Discovery** folder, and then click **OK**.

2. Go to **Data Flow Management > Universal Discovery > Discovery Modules/Jobs > Discovery Modules > Cloud and Virtualization > Virtualization > VMware**.
3. Select **Manual VMware VIM Connection**.
4. In the **Properties** tab > **Trigger Queries** pane, click the button. In the **Choose Discovery Query** dialog box that appears, select the query name that you created in step 1, and then click **OK**.
5. Click **OK** to save the changes.
6. Right-click the **Manual VMware VIM Connection** job, and then select **Activate** to activate the job.

How to Discover VMware ESX Server Topology over CIM

This task describes how to discover the VMware ESX server inventory and virtual topology over CIM.

Prerequisites

- Ensure that CIM agents are enabled on the target ESX servers.
- Define CIM credentials.

This task contains the following steps:

1. To discover the target IPs, run the **Range IPs by ICMP** job.
2. To discover the connectivity to target ESX servers and their basic topology, run the **VMware ESX Connection by CIM** job.
3. To discover the server inventory and virtualization topology, run the **VMware ESX Topology by CIM** job.

> **Note:**
>
> - Discovery uses the CIM client, which is based on SBLIM library (http://sblim.wiki.sourceforge.net).
> - Discovery accesses the following three namespaces to collect all required information:
>   - root/interop: To verify that the target server implements the Basic Server Profile and to find a reference to the UnitaryComputerSystem instance.
>   - root/cimv2: To collect server inventory information.
>   - vmware/esxv2: To collect virtualization topology information.

Manual VMware VIM Connection Job

This job supports connection to ESX and vCenter servers.

Adapter

This job uses the **VMware_VIM_Connection_Manual** adapter.

Parameters

Parameter	Description
remoteJVMArgs	The JVM parameters that should be passed to the remote process.
remoteJVMClasspath	The class path used by the external Java process.
runInSeparateProcess	When **true**, this enables the execution of the job in the external java virtual machine. **Default:** true. **Note:** Do not change this parameter from the default.

Discovery Flow

1. The discovery job triggers on the IP address.
2. The discovery obtains the list of credentials applicable to that IP address.
3. The discovery uses each credential and tries to connect to the destination by composing a URL using the above-mentioned IP address, taking the port/protocol from the credential entry.
4. If the connection is successful, it determines whether the connected server is an ESX server or a vCenter server.
5. The job reports the discovered servers.

VMware ESX Connection by CIM Job

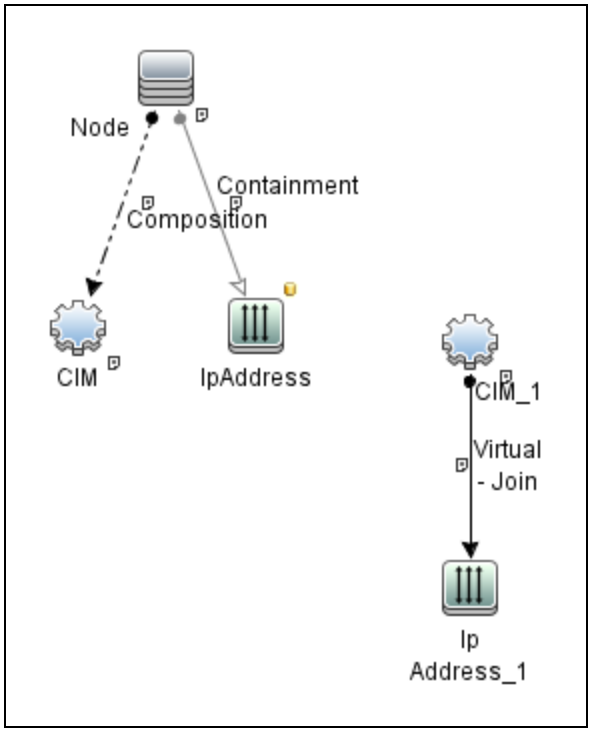
This job discovers the connectivity to target ESX servers and their basic topologies using the CIM protocol.

This section includes:

- "Trigger Query" below
- "Adapter" on the next page
- "Discovered CITs" on the next page

Trigger Query

- Trigger CI: IpAddress
- Trigger Query:



Node Name	Condition
Node	None
CIM	None
IpAddress	`NOT IP Probe Name Is null AND NOT IP Is Broadcast Equal "True"`

Adapter

This job uses the **VMware_ESX_Connection_by_CIM** adapter.

- Triggered CI Data

Name	Value
ip_address	${SOURCE.name}

- Adapter parameters: none
- Scripts:
  - cim.py
  - cim_discover.py
  - host_discoverer.py
  - vmware_cim_discover.py
  - vmware_cim_report.py
  - vmware_esx_connection_by_cim.py

Discovered CITs

- CIM
- Composition
- Containment
- IpAddress
- Interface
- Virtualization Layer Software

- VMware ESX Server

VMware ESX Connection by VIM Job

This job discovers the connections to VMware ESX servers using the VIM protocol.

This section includes:

- "Discovery Mechanism" below
- "Trigger Query" on the next page
- "Adapter" on the next page
- "Discovered CITs" on page 341
- "Troubleshooting and Limitations" on page 341

Discovery Mechanism

Data Flow Management performs the following procedure:

- DFM checks the credentials for the VIM protocol.
- If the current credential includes a defined port, DFM uses this port.

  Otherwise, the port is not specified in the generated connection URL.

  The prefix is determined from the current credential's **use SSL** attribute.
- DFM generates a connection URL: **<prefix>://<ip_address>:<port>/sdk**.
- DFM creates a VMware Infrastructure Client and connects using the generated URL and the user name and password from the credentials.
- If the connection is successful, DFM obtains the product details for the ESX server (version, build, and description), which will be used to populate the attributes of the **Virtualization Layer Software** CI.

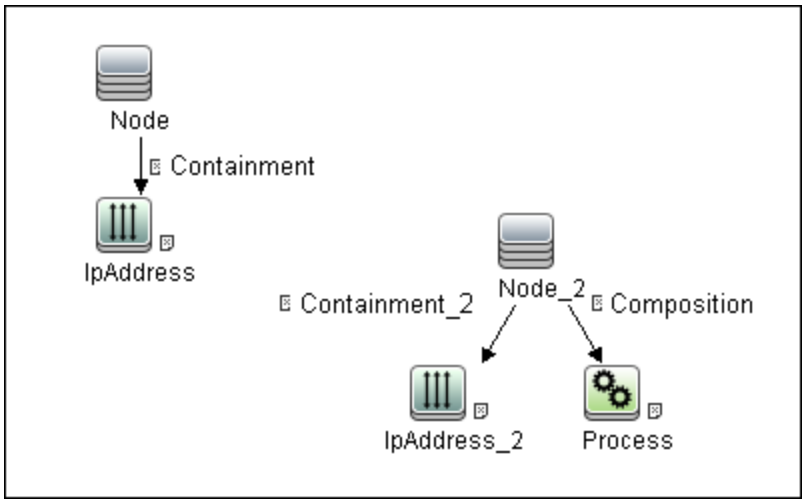
  In addition, DFM retrieves the UUID and name of the ESX server. ESX UUID is stored in the `host_key` attribute of the **VMware ESX Server** CI.

  The hostname of the ESX server is stored in the **name** (key) attribute of the **VMware ESX Server** CI.
- DFM clears all errors or warnings and returns all discovered results.

Otherwise, if the connection is unsuccessful, DFM tries the next VIM protocol credential, until all are tried.

Trigger Query

- Trigger CI: Node
- Trigger query:



Adapter

This job uses the **VMware_ESX_Connection_by_VIM** adapter.

- **Triggered CI Data**

Name	Description
ip_addresses	List of all IPs connected to Host.

- **Used Scripts**
  - memory.py
  - shared_resources_util.py
  - _vmware_vim_base.py

- _vmware_vim_20.py
- host_discoverer.py
- _vmware_vim_25.py
- _vmware_vim_40.py
- _vmware_vim_41.py
- vmware_vim.py
- vmware_esx_connection_by_vim.py

- **Adapter Parameters**

Parameter	Description
remoteJVMArgs	The JVM parameters that should be passed to the remote process.
remoteJVMClasspath	The class path used by the external Java process.
runInSeparateProcess	When **true**, this enables the execution of the job in the external java virtual machine. **Default:** true. **Note:** Do not change this parameter from the default.

Discovered CITs

- Composition
- VMware ESX Server
- Virtualization Layer Software

Troubleshooting and Limitations

- **Problem.** The following error message is displayed when an operation cannot be performed due to lack of permissions:

  ```
  User does not have required '<permission>' permission
  ```

Solution. Check that permissions are set as **System.Read**.

- **Problem.** The following error message is displayed when credentials are not correct:

  ```
  Invalid user name or password
  ```

- **Problem.** The job completes with a time-out warning message:

  ```
  <<Progress message, Severity: Error>>
  VMware VIM: Timeout trying to connect to remote agent, try increasing credential
  timeout value
  ```

  Limitation. You cannot set the connection timeout value for the job, due to VMware API limitations. The default 60 seconds timeout is always used.

VMware ESX Topology by CIM Job

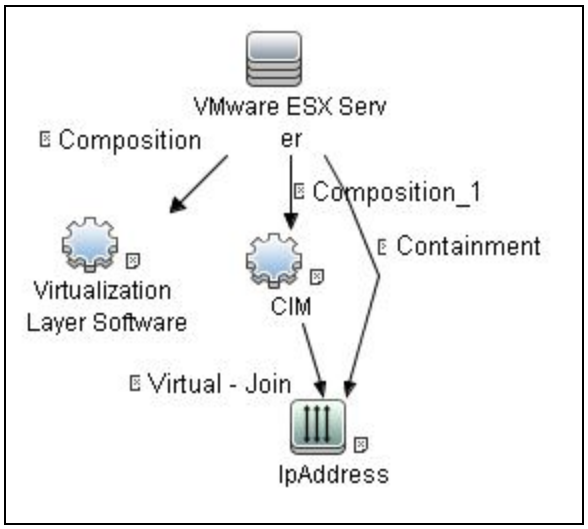
This job discovers the server inventory and virtualization topology using the CIM protocol.

This section includes:

- "Trigger Query" below
- "Adapter" on the next page
- "Discovered CITs" on the next page
- "Limitation" on page 345

Trigger Query

- Trigger CI: VMware ESX Server
- Trigger Query:



Node Name	Condition
CIM	NOT Reference to the credentials dictionary entry Is null AND CimCategory Contains "VMware"
VMware ESX Server	NOT BiosUuid Is null
IpAddress	NOT IP Probe Name Is null

Adapter

This job uses the **VMware_ESX_Topology_by_CIM** adapter.

- **Triggered CI Data**

Name	Value
credentialsId	${CIM.credentials_id}
esx_bios_uuid	${SOURCE.bios_uuid}
esx_cmdb_id	${SOURCE.root_id}
hypervisor_cmdb_id	${HYPERVISOR.root_id}
ip_address	${IP.name}

- **Adapter parameters:** none
- **Used Scripts:**
  - memory.py
  - host_discoverer.py
  - cim.py
  - cim_discover.py
  - vmware_cim_discover.py
  - vmware_cim_report.py
  - vmware_esx_topology_by_cim.py

Discovered CITs

- Composition
- Containment
- Cpu
- IpAddress
- Virtualization Layer Software
- VMware ESX Server

- Node
- VMware Host Resource
- ExecutionEnvironment

Limitation

Only BIOS UUID, Primary IP Address and hostname values may be available in virtualization namespace for virtual machines. If none of these values are present, VMs cannot be reported and are skipped.

VMware ESX Topology by VIM Job

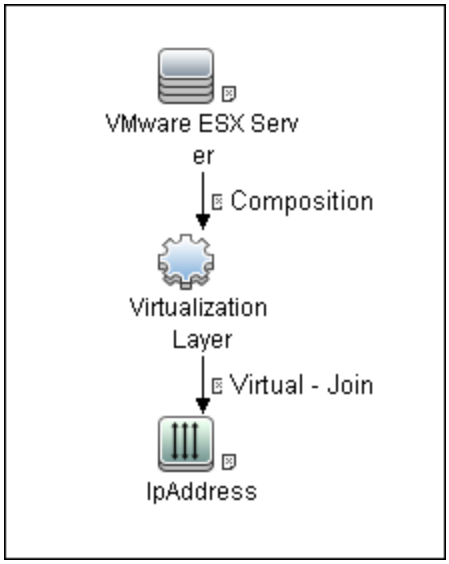
This job connects to ESX servers and discovers their topology using the VIM protocol.

This section includes:

- "Trigger Query" below
- "Adapter" below
- "Discovered CITs" on page 348
- "Troubleshooting " on page 349

Trigger Query

- Trigger CI: Virtualization Layer Software
- Trigger query:



Adapter

This job uses the **VMware_ESX_Topology_by_VIM** adapter.

- **Triggered CI Data**

credentialsId	The credentials ID of the VMware Infrastructure (VIM) protocol, saved in the ESX server attribute.
server_url	The URL for connection, taken from the ESX server **connection_url** attribute.
ip_address	The IP address of the ESX server.

- **Used Scripts**
  - vendors.py
  - memory.py
  - shared_resources_util.py
  - _vmware_vim_base.py
  - _vmware_vim_20.py
  - host_discoverer.py
  - _vmware_vim_25.py
  - _vmware_vim_40.py
  - _vmware_vim_41.py
  - vmware_vim.py
  - vmware_esx_topology_by_vim.py
- **Adapter Parameters**

Parameter	Description
discoverUnknownIPs	Determines whether to discover IP addresses that are out of the probe range. **Default:** true.
remoteJVMArgs	The JVM parameters that should be passed to the remote process.
remoteJVMClasspath	The class path used by the external Java process.
reportBasicTopology	Determines whether to report the basic topology (true) or full topology (false). **Default:** false.
reportLastBootTime	Determines whether to report the last boot time of virtual machines. **Default:** true.

reportLayer2connection	Determines whether to report Layer2 connections. **Default:** false. > **Note:** When **true**, the job will take more time to do the discovery.
reportPoweredOffVMs	Determines whether to report powered off virtual machines (true) or not (false). **Default:** false.
runInSeparateProcess	When **true**, this enables the execution of the job in the external java virtual machine. **Default:** true. > **Note:** Do not change this parameter from the default.

Discovered CITs

- Composition
- Containment
- Cpu
- Dependency
- ExecutionEnvironment
- FileSystemExport
- Interface
- IpAddress
- iSCSI Initiator
- iSCSI Target
- License Feature
- License Reservation
- License Server
- LUN

- Node
- Usage
- VMware Datastore
- VMware ESX Server
- VMware Host Resource
- VMware Networking Policy
- VMware Port Group
- VMware Resource Pool
- VMware Virtual Switch
- Virtualization Layer Software

Troubleshooting

- **Problem.** The following error message is displayed when an operation cannot be performed due to lack of permissions:

  ```
  User does not have required '<permission>' permission
  ```

  Check that permissions are set as **System.Read**.

- **Problem.** The following error message is displayed when credentials are not correct:

  ```
  Invalid user name or password
  ```

- **Problem.** The following warning message is displayed when DFM cannot retrieve licensing information due to insufficient permissions:

  ```
  User does not have required '<permission>' permission, licensing information
  won't be reported
  ```

VMware vCenter Connection by VIM Job

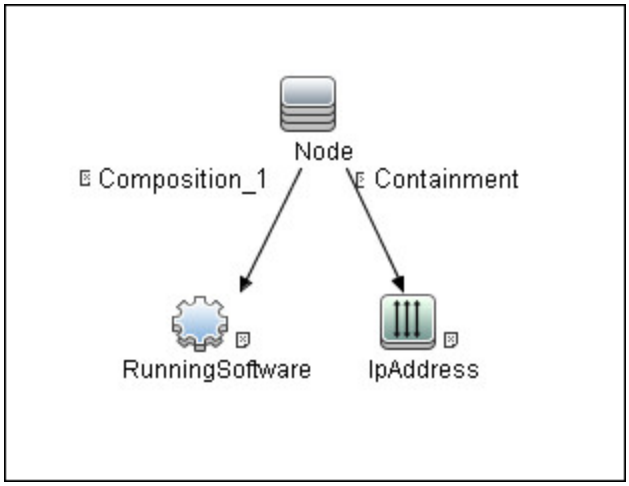
This job discovers vCenter or VirtualCenter Servers.

This section includes:

- "Trigger Query" below
- "Adapter" below
- "Discovered CITs" on page 352
- "Troubleshooting" on page 352

Trigger Query

- Trigger CI: Node
- Trigger query:



Adapter

This job uses the **VMware_VirtualCenter_Connection_by_VIM** adapter.

- **Triggered CI Data**

Name	Description
connection_url	The connection URL of the vCenter server.
credentialsId	The credentials ID of the WMI agent CI.
ip_addresses	List of all IPs connected to Host.
rs_id	The CMDB ID of the vCenter server, reported as RunningSoftware.
vc_id	The CMDB ID of the vCenter server.

- **Used Scripts**
  - memory.py
  - shared_resources_util.py
  - _vmware_vim_base.py
  - _vmware_vim_20.py
  - host_discoverer.py
  - _vmware_vim_25.py
  - _vmware_vim_40.py
  - _vmware_vim_41.py
  - vmware_vim.py
  - vmware_virtualcenter_connection_by_vim.py
- **Adapter Parameters**

Parameter	Description
remoteJVMArgs	The JVM parameters that should be passed to the remote process.
remoteJVMClasspath	The class path used by the external Java process.
runInSeparateProcess	When **true**, this enables the execution of the job in the external java virtual machine. **Default:** true. **Note:** Do not change this parameter from the default.

Discovered CITs

- Composition
- Containment
- IpAddress
- Node
- VMware VirtualCenter

Troubleshooting

- **Problem.** The following error message is displayed when an operation cannot be performed due to lack of permissions:

  ```
  User does not have required '<permission>' permission
  ```

  Solution. Check that the user has permissions for all entities being discovered: In the **VMware Infrastructure Client**, access the **Permissions** tab of each entity (host, cluster, VM, and so on). Verify that the user has been assigned at least a Read-Only role.

  > **Note:** You can view necessary permissions in the **Discovery Job Details** pane (**Universal Discovery > Discovery Modules/Jobs tab >** select **<job>** > **Details** tab).

- **Problem.** The following error message is displayed when credentials are not correct:

  ```
  Invalid user name or password
  ```

- **Problem.** The **VMware vCenter Connection by VIM** job fails to connect to remote process and the job cannot run in FIPS mode or in non-FIPS mode.

  Solution.

  - If you re-installed the probe, then no further manual modification is required.
  - If you upgraded the probe from an older version (for example, from 10.20 to 10.21), then you need to add the following values into the **basic_discovery_minimal_classpath** setting in the **DataFlowProbe.properties** file:

    ../lib/cryptojce.jar;../lib/cryptojcommon.jar;../lib/jcmFIPS.jar;

VMware vCenter Topology by VIM Job

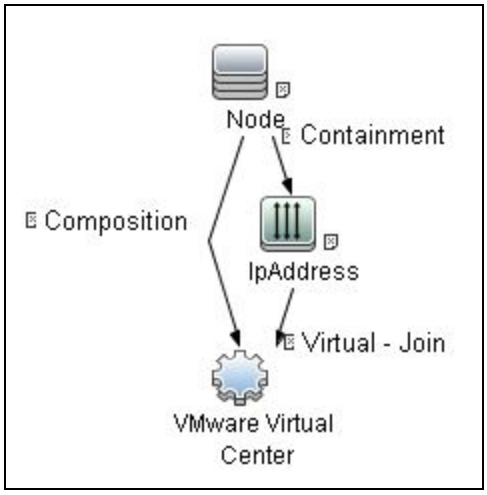
This job connects to vCenter or VirtualCenter Servers and discovers the full VMware Infrastructure topology.

This section includes:

- "Trigger Query" below
- "Adapter" below
- "Discovered CITs" on page 355
- "Troubleshooting" on page 357

Trigger Query

- Trigger CI. VMware VirtualCenter.
- Trigger TQL query:



Adapter

This job uses the **VMware_VirtualCenter_Topology_by_VIM** adapter.

- **Triggered CI Data**

Name	Description
credentialsId	The credentials ID of the VMware Infrastructure Management (VIM) protocol saved in the vCenter or VirtualCenter Server's attribute.
connection_url	The URL for connecting to VMware Infrastructure, taken from the vCenter or VirtualCenter Server's **connection_url** attribute.

- **Used Scripts**
  - vendors.py
  - host_win.py
  - networking_win_shell.py
  - host_win_shell.py
  - _vmware_vim_base.py
  - _vmware_vim_20.py
  - host_discoverer.py
  - _vmware_vim_25.py
  - _vmware_vim_40.py
  - _vmware_vim_41.py
  - vmware_vim.py
  - vmware_virtualcenter_topology_by_vim.py
- **Adapter Parameters**

Parameter	Description
discoverUnknownIPs	Determines whether to discover IP addresses that are out of the probe range. **Default:** true. **Note:** If this parameter is set to **false**, the job also ignores virtual machines that have the corresponding IP address outside the configured probe IP ranges because they have a Virtual-Join relationship.
remoteJVMArgs	The JVM parameters that should be passed to the remote process.

remoteJVMClasspath	The class path used by the external Java process.
reportBasicTopology	Determines whether to report the basic topology (true) or full topology (false). **Default:** false.
reportLayer2connection	Determines whether to report Layer2 connections. **Default:** false. **Note:** When **true**, the job will take more time to do the discovery.
reportDiscoveredOsName	When **true**, the job fills in the **DiscoveredOsName** attribute of the Node CIT. **Default:** false. **Note:** HPE highly recommends not to enable this parameter, as duplicated OS names of VM instances will be reported.
reportPoweredOffVMs	Determines whether to report powered off virtual machines (true) or not (false). **Default:** false.
runInSeparateProcess	When **true**, this enables the execution of the job in the external Java virtual machine. **Default:** true. **Note:** Do not change this parameter from the default.

Discovered CITs

- Composition
- Containment
- Cpu
- Dependency
- ExecutionEnvironment
- FileSystemExport

- Interface
- IpAddress
- iSCSI Initiator
- iSCSI Target
- Licence Feature
- License Reservation
- License Server
- LUN
- Manage
- Membership
- Node
- Usage
- VMware Cluster
- VMware DAS Config
- VMware DPM Config
- VMware DRS Config
- VMware Datacenter
- VMware Datastore
- VMware Distributed Virtual Switch
- VMware ESX Server
- VMware Host Resource
- VMware Networking Policy
- VMware Port Group
- VMware Resource Pool
- VMware Uplink
- VMware Virtual Switch
- VMware VirtualCenter

- Virtualization Layer Software

Troubleshooting

- **Problem:** The following error message is displayed when an operation cannot be performed due to lack of permissions:

  ```
  User does not have required '<permission>' permission
  ```

  Solution: Check that permissions are set as **System.Read**.

- **Problem:** The following error message is displayed when credentials are not correct:

  ```
  Invalid user name or password
  ```

- **Problem:** The following warning message is displayed in the Communication log during discovery:

  ```
  VM '<name>': powered off, VM is skipped
  ```

  Solution: This message indicates that the discovery found a powered-off VM. By default, powered-off VMs are not reported, mainly because the configuration of such powered-off VMs may be outdated. This outdated information can impact the identification of the VMs, so the topology reported might be incorrect.

  For example:

  - The MAC address of one of the interfaces might now be assigned to different VMs, yet still be listed for the powered-off VM.
  - The IP address might still be listed for the powered-off VM, but was reassigned to different machine by the DHCP server before discovery began.

  If you still want powered-off VMs to be reported, set the topology job's **reportPoweredOffVMs** parameter to **true**.

- **Problem:** The following warning message is displayed in the Communication log during discovery:

  ```
  Host '<name>': cannot find UUID, Host is skipped
  ```

  Solution: The UUID of the ESX server is a key attribute for the ESX server CI. It is not possible to report ESX server without a valid UUID. A UUID of the ESX server that consists of all zeros is also considered invalid. The message in the Communication log indicates that the specified ESX server was discovered but was skipped due to a missing or invalid UUID.

- **Problem:** The following warning message is displayed in the Communication log during discovery:

  ```
  VM '<name>': duplicate host key '<key>' found in another VM '<name>' which was preferred, VM is skipped
  ```

  Solution: After all VMs are discovered, VMs containing duplicated host keys are filtered out. **host_key** is a key attribute of the VM, so it is not possible to report two VMs with the same host keys. The message in the Communication log indicates that there were duplicates found and one of the duplicated VMs was skipped.

  If the **reportPoweredOffVMs** parameter is set to **true**, if the two VMs have different power statuses, the powered-on VM is preferred over the powered-off VM.

VMware VMotion Discovery and Event Tracking

This section includes:

Overview 359
Supported Versions 359
How to Discover VMware VMotion and Track Events 359
VMware vMotion Monitor by VIM Job 360

Overview

VMware VMotion technology moves an entire running VM instantaneously from one server to another. The VMware vCenter Server exposes a management interface that can be used by DFM to:

- Connect to vCenter Server using the VIM protocol, to discover its topology (Datacenters, Clusters, ESX Servers, Resource Pools, Virtual Machines, and so on).
- Connect to ESX Server and discover its full topology. This discovery is limited to the server itself.
- Listen for events that occur in the inventory structure. Currently two types of events are tracked and reported:
  - VMotion events, when the VM migrates from server to server.
  - VM powering-on event, when the VM is turned on.

VMware provides an SDK describing this interface, which includes documentation, API reference, libraries, and examples. VMware Infrastructure SDK can be downloaded from http://www.vmware.com/support/developer/vc-sdk/.

Supported Versions

This discovery supports:

- VirtualCenter 2.5, 2.0
- vCenter Server 4, 4.1, 5.0, 5.1, 5.5, 6.0, and 6.5
- ESX & ESXi Server 3.0, 3.5, 4.0, 4.1, 5.0, 5.1, 5.5, 6.0, and 6.5

How to Discover VMware VMotion and Track Events

This task includes the following steps:

1. Prerequisites - Set up protocol credentials

   To connect to any server using the VIM protocol, prepare the following:

   - A connection URL, for example, **https://vcserver/sdk**.
   - Credentials (user name and password). A user account must be created for you on the VMware

server.

For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Prerequisites - Set up permissions

   VMotion event-driven discovery requires special permissions for the protocol used:

   - **System.Read** permissions for the user performing the login, for all DFM actions. The user must be a member of the **Read-Only** user group.

3. Run the discovery

   For details on running jobs, see "Module/Jobe-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

   a. Run the **VMware vCenter Connection by VIM** and **VMware vCenter Topology by VIM** jobs.

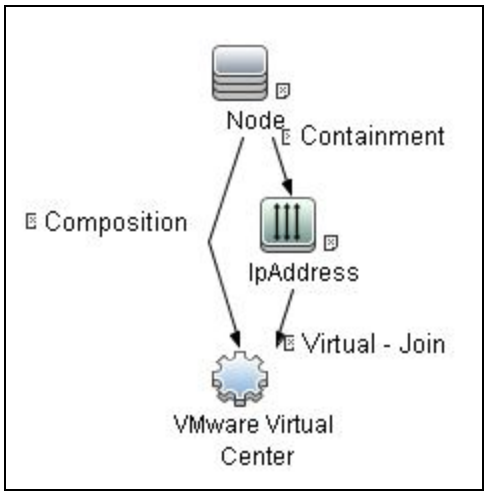
   b. Run the **VMware vMotion Monitor by VIM** job. The job includes the **VMware_VMotion_discovery_by_VIM** adapter that listens for VM migration events collected by the VirtualCenter server.

VMware vMotion Monitor by VIM Job

This section includes details about the job.

Trigger Query

- Trigger CI: VMware VirtualCenter
- Trigger query:



Adapter

This job uses the **VMware_VMotion_discovery_by_VIM** adapter.

- **Triggered CI Data**

Name	Value	Description
credentialsId	${SOURCE.credentials_id}	The credentials ID of the VIM protocol saved in the VirtualCenter attribute.
ip_address	${SOURCE.application_ip}	The IP address, taken from the vCenter Server's **application_ip**.
server_url	${SOURCE.connection_url}	The URL for connection, taken from the vCenter Server's **connection_url** attribute.

- **Used Scripts**
  - vendors.py
  - memory.py
  - shared_resources_util.py
  - _vmware_vim_base.py
  - _vmware_vim_20.py
  - host_discoverer.py
  - _vmware_vim_25.py

- _vmware_vim_40.py
- _vmware_vim_41.py
- vmware_vim.py
- vmware_vmotion_monitor.py

- **Adapter Parameters**

Property	Description
connectionRetryNumber	The maximum number of times that DFM attempts to restore the connection. **Default:** 0 (zero), meaning the number of attempts is unlimited.
discoverUnknownIPs	Determines whether to discover IP addresses that are out of the Data Flow Probe range. **Default:** true.
eventBasedDiscoveryEnabled	If this parameter is set to **true**, every time the job is activated, it stays connected to the destination machine listening for VMotion events, until the job is stopped. **Default:** true.
historyHours	The period within which DFM checks for untracked VMotion events. DFM calculates the period from when the job is activated going backwards in time. **Default: 24 hours**.
remoteJVMArgs	The JVM parameters that should be passed to the remote process.
remoteJVMClasspath	The class path used by the external Java process.
runInSeparateProcess	When **true**, this enables the execution of the job in the external java virtual machine. **Default:** true. **Note:** Do not change this property from the default.

Discovered CITs

- Composition
- Containment
- ExecutionEnvironment
- Interface
- IpAddress
- Node
- Usage
- VMware Host Resource
- VMware Port Group
- VMware Virtual Switch
- Virtualization Layer Software

VMware Discovery Troubleshooting and Limitations

This section includes:

VMware Discovery Troubleshooting 364
VMware Discovery Limitations 365

VMware Discovery Troubleshooting

- **Problem.** The following error message is displayed:

  ```
  Required class %s not found. Verify VMware SDK jar files are present in probe.
  See documentation for details.
  ```

  Cause. The SDK *.jar files are not copied to the Data Flow Probe.

  Solution. Copy the *.jar files as described in "VMware Prerequisites" on page 318.

- **Problem.** The following error message is displayed:

  ```
  User does not have required 'System.Read' permission
  ```

  Cause. There is a lack of permissions from the user account when DFM connects to the ESX server's vCenter Server.

  Solution.

  a. Verify that credentials are defined for the VMware Infrastructure Management (VIM) protocol in the proper priority, so that credentials with full permissions have a lower index number than credentials with less permissions. For details, see "Index" in the HPE Universal CMDB Data Flow Management Guide.

  b. If DFM previously discovered connections using credentials with less than full permissions, you must rerun the connection job.

  - For ESX connection and topology: run **VMware ESX Connection by VIM**) to update the `credentials ID attribute` of ESX server, and then run the topology job **VMware ESX Topology by VIM)**.
  - For vCenter topology: edit the integration point and choose credentials with more permissions.

- **Problem.** The **VMware vCenter Connection by VIM** or **Manual VMware VIM Connection** job fails with the following error message:

  ```
  java.security.cert.CertificateException: Certificates does not conform to
  algorithm constraints
  ```

  Cause. Java security policy has been changed in Java 7u40 or later. The key size restriction has been changed to 1024 bit or more but VMware vCenter 4.0 uses 512 bit key.

  Solution.

a. Go to the **<DataFlowProbe installation folder>\bin\jre\lib\security** directory.

b. Open the **java.security** file, and then find the following setting:

```
jdk.certpath.disabledAlgorithms=MD2, DSA, RSA keySize < 1024
```

c. Change the value **1024** to **512** or less than 512.

VMware Discovery Limitations

- DFM can discover the total number of licenses and available licenses for each feature, but only when the user has **Global.Licenses** permission. If the user does not have such permissions, these attributes of the `License Feature` CI are not populated.
- Different versions of ESX Servers (versions 3.0 and 3.5) report the `feature_is_edition` flag differently for the `esxFull` feature: for the older version it is reported as `false` and for the newer version it is reported as `true`. Because of this discrepancy, DFM does not report this attribute.
- Different versions of ESX Servers (versions 3.0 and 3.5) report the total or available license counts differently for ESX-specific features (`nas`, `iscsi`, `vsmp`, `san`) that are included in the `esxFull` edition license. For these features, DFM does not report these attributes.
- There is a difference between the VMware protocol versions: certain attributes appear only in newer versions and do not appear in previous versions. As a result, when using an old protocol certain attributes are not discovered, especially for clusters and licenses.
- DFM does not discover or report licensing information for vCenter\ESX server version 4.0 or above.
- DFM does not report information about the order of teamed interfaces. You can group server physical interfaces of an ESX server into NIC Teaming groups, while specifying the order of such interfaces in a group (first, second, and so on). Information about what interface are teamed is reported but the order of these interfaces is not.

Chapter 21: Xen and KVM Discovery

This chapter includes:

Overview 367
Supported Versions 367
Topology 367
Discovery Mechanism 368
How to Discover KVM and Xen 369
Xen and KVM by Shell Adapter 369
Xen and KVM by Shell Job 372

Overview

Xen is a Hypervisor providing services that allow multiple computer operating systems to execute concurrently on the same computer hardware. Xen is currently available for the IA-32, x86-64 and ARM computer architectures.

Kernel-based Virtual Machine (KVM) is a virtualization infrastructure for the Linux kernel. KVM supports native virtualization on processors with hardware virtualization extensions. KVM has also been ported to FreeBSD and Illumos in the form of loadable kernel modules.

KVM originally supported x86 and x86-64 processors and has been ported to S/390, PowerPC, and IA-64. An ARM port is in progress, KVM hypervisor porting to ARM Cortex-A15 is made available by Virtual Open Systems.

Libvirt is an open source API, daemon and management tool for managing platform virtualization. You can use it to manage Linux KVM, Xen, VMware ESX and other virtualization technologies. Graphical interfaces use it, such as Virtual Machine Manager, as do command line interfaces (virsh), and higher level tools like oVirt.

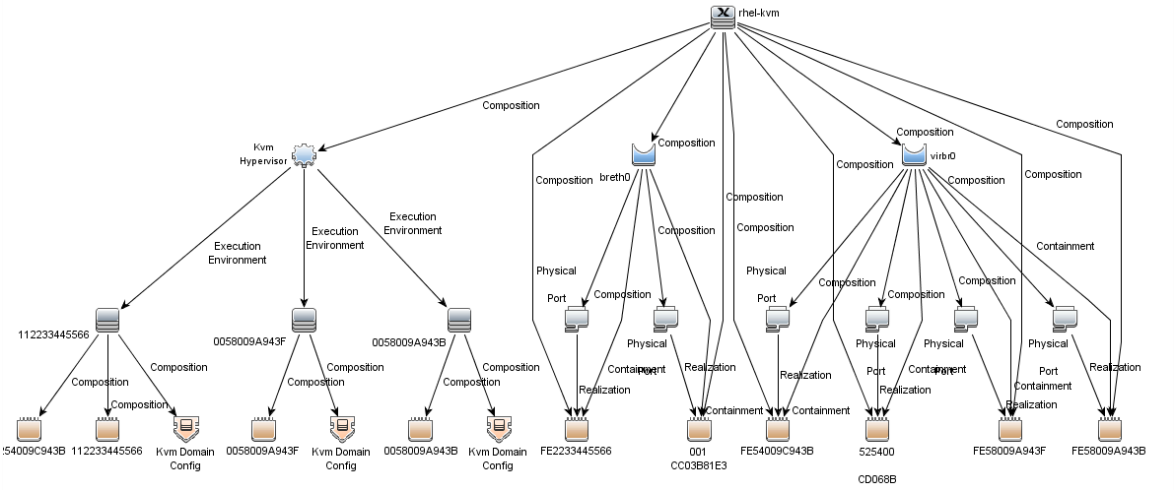
This package discovers Xen and KVM virtualization solutions using libvirt as an API via shell connection.

Supported Versions

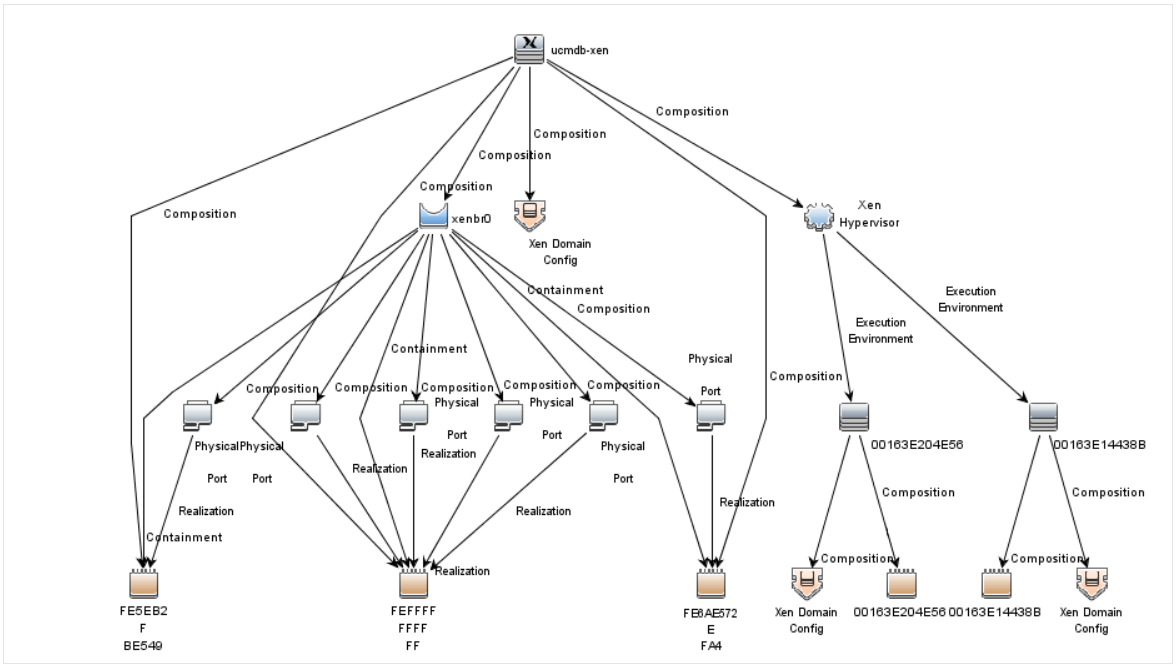
Libvirt provides a unified API to manage Xen and KVM. This discovery supports libvirt versions 0.x, 1.x, 2.x, and 3.x.

Topology

The following image displays the topology of KVM discovery:



The following image displays the topology of Xen discovery:



Discovery Mechanism

A regular connection by shell is performed to the destination machine running Xen or KVM with installed libvirt managing tools. Using the libvirt CLI, you can discover details about the destination machine.

How to Discover KVM and Xen

This discovery is performed in the following stages:

- Discover generic Linux hosts
- Discover virtualization for XEN and KVM

1. Prerequisite - Set up protocol credentials

   You must set up the SSH or Telnet protocol. For either protocol, you must prepare a user name and password.

2. Run the discovery

   a. Run the **Range IPs by ICMP** job to discover IP CIs.

   b. Run the **Host Connection by Shell** job to discover the target host and shell connectivity to it.

   c. Run the **Xen and KVM by Shell** job to discover topology for Xen and KVM.

Xen and KVM by Shell Adapter

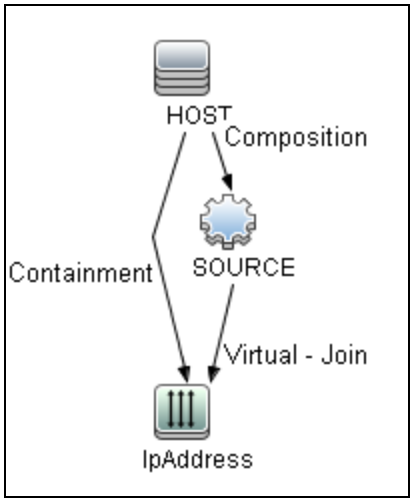
This discovery uses the Xen and KVM by Shell adapter.

Input CIT

Shell

Input TQL Query

The following graphic shows an input TQL query for this job.



Attribute	Condition
HOST	NOT CI Type Equal nt
IpAddress	NOT IP Probe Name Is null

Triggered CI Data

Name	Value
Protocol	${SOURCE.root_class}
connected_os_credentials_id	${SOURCE.connected_os_credentials_id:NA}
credentialsId	${SOURCE.credentials_id}
hostId	${SOURCE.root_container}
ip_address	${SOURCE.application_ip}

Used Script

xen_by_tty.py

Discovered CITs

- Bridge
- Composition
- Containment
- ExecutionEnvironment
- FileSystem
- FileSystemExport
- Interface
- Kvm domain config
- Layer2Connection
- Node
- PhysicalPort
- Realization
- Virtualization Layer Software
- XenDomainConfig

Parameters

Parameter	Type	Description
virsh_path	String	The full path to the virsh management utility.

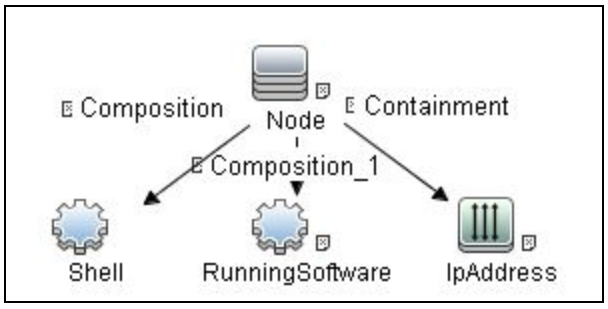
Xen and KVM by Shell Job

This section includes details about the job.

Adapter

This job uses the Xen and KVM by Shell adapter.

Trigger Query



Parameters

Parameter	Type	Description
virsh_path	String	The full path to the virsh management utility.

Discovery Flow

1. **Discover list of domains**

   virsh list sample output:

```
Id Name                 State
----------------------------------
0 Domain-0             running
```

```
15 ucmdb-vm-vista       idle
16 ucmdb-vm-xp          idle
```

2. **Discover list of domain configurations**

   The following command creates an xml file with the configuration:

   virsh dumpxml <domain_name>

   a. Distinguishing hypervisor:

      Xen : <domain type='xen' id='15'>

      KVM: <domain type='kvm' id='12'>

   b. VM memory configuration

      Xen and KVM : <memory>1572864</memory> <currentMemory>1572864</currentMemory>

   c. VM CPU configuration

      Xen and KVM: <vcpu>1</vcpu>

   d. VM Networking configuration

      Xen and KVM: <interface type='bridge'><mac address='00:16:3e:20:4e:56'/><source bridge='xenbr0'/><script path='vif-bridge'/><target dev='vif15.0'/></interface>

Part 3: Clustering and Load Balancing > Failover Clusters

Chapter 22: EMC AutoStart Discovery

This chapter includes:

- Overview 376
- Supported Versions 376
- Topology 376
- How to Discover EMC AutoStart 378
- EMC AutoStart by Shell Job 379
  - Adapter 379
  - Trigger Query 379
  - Parameters 380
- EMC_AutoStart_by_Shell Adapter 381
- Discovery Flow 384
- EMC AutoStart Discovery Commands 386

Overview

EMC AutoStart provides high availability for multiple operating systems to deal with service outages - planned or unplanned.

The EMC AutoStart discovery process allows you to discover a full topology.

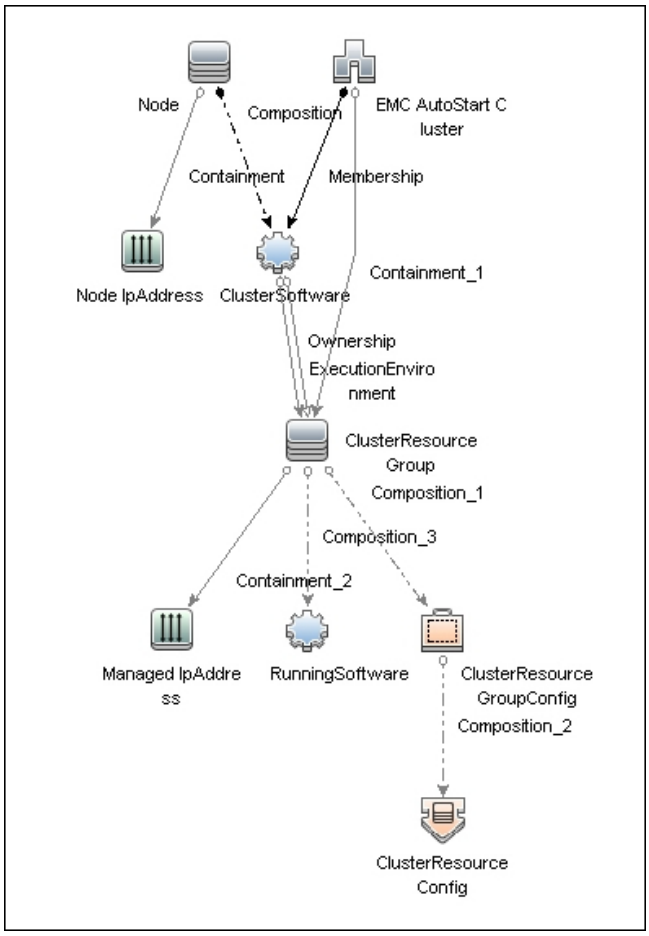
Supported Versions

EMC AutoStart discovery supports version 5.x of EMC AutoStart.

Topology

The following image displays EMC AutoStart topology.

> **Note:** For a list of discovered CITs, see "Discovered CITs" on page 382.


Node
Composition
EMC AutoStart C luster
Containment
Membership
Node IpAddress
ClusterSoftware
Containment_1
Ownership
ExecutionEnviro nment
ClusterResource Group
Composition_1
Composition_3
Containment_2
Managed IpAddre ss
RunningSoftware
ClusterResource GroupConfig
Composition_2
ClusterResource Config

How to Discover EMC AutoStart

This task includes the following steps:

1. Prerequisites - Set up protocol credentials

   This discovery uses the following protocols:

   - **SSH**
   - **Telnet**
   - **NTCMD**

     For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Prerequisites - Other

   a. Ensure there is Shell connectivity to one or more nodes of the AutoStart domain.

   b. If required, configure sudo on each target host to allow execution of all commands used. See "EMC AutoStart Discovery Commands" on page 386.

   c. In Windows, if connecting with **NTCMD**, run the **HPCmdSvc** service as a user recognized by AutoStart. Otherwise, configuration information is unavailable.

3. Run the Discovery

   a. Run the **Range IPs by ICMP** job in order to discover the target IPs.

   b. Run the **Host Connection by Shell** job in order to discover the target host and shell connectivity to it.

   c. Run the **Host Applications by Shell** job in order to discover applications of the target host, including EMC AutoStart Cluster software and agent processes.

   d. Run the **EMC AutoStart by Shell** job in order to discover the topology of the target EMC AutoStart cluster.

EMC AutoStart by Shell Job

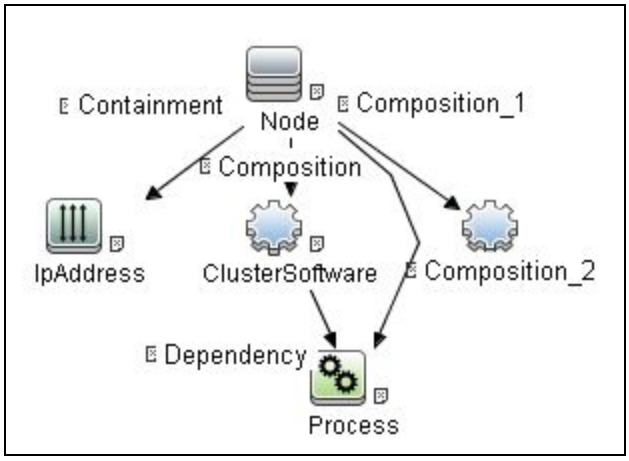
This section gives details about the EMC AutoStart by Shell job.

Adapter

This job uses the **EMC_AutoStart_by_Shell** adapter.

Trigger Query

emc_autostart_with_shell



Node Name	Condition
Shell	NOT Reference to the credentials dictionary entry Is null AND NOT Application IP Is null
IpAddress	NOT IP Probe Name Is null
Process	NOT Process Path Is null AND Name Like "ftAgent%"
ClusterSoftware	DiscoveredProductName Equal "EMC AutoStart Cluster SW" AND NOT Name Is null
Node	None

Parameters

This job uses parameter values from the adapter. By default, parameters are not overridden.

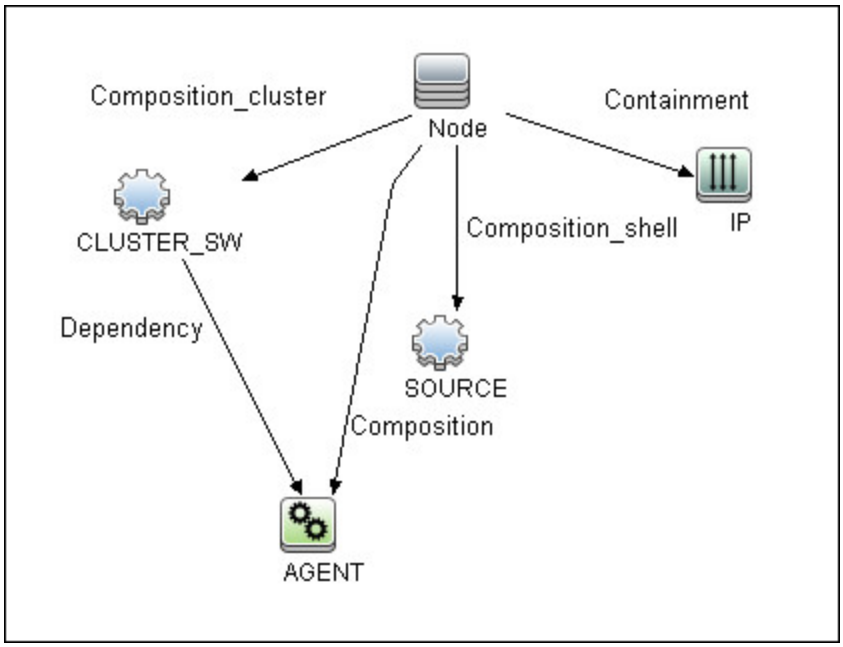
EMC_AutoStart_by_Shell Adapter

This section gives details about the **EMC_AutoStart_by_Shell** adapter.

Input CIT

Shell

Input TQL Query



Node Name	Condition
SOURCE	NOT Reference to the credentials dictionary entry Is null AND NOT Application IP Is null
IP	NOT IP Probe Name Is null
AGENT	NOT Process Path Is null AND Name Like "ftAgent%"
CLUSTER_SW	DiscoveredProductName Equal "EMC AutoStart Cluster SW" AND NOT Name Is null
Node	None

Triggered CI Data

Name	Value
Protocol	${SOURCE.root_class}
agentPath	${AGENT.process_path}
connected_os_credentials_id	${SOURCE.connected_os_credentials_id:NA}
credentialsId	${SOURCE.credentials_id}
domainName	${CLUSTER_SW.name}
ip_address	${SOURCE.application_ip}

Used Scripts

- emc_autostart.py
- emc_autostart_discover.py
- emc_autostart_report.py
- emc_autostart_by_shell.py

Discovered CITs

- ClusterResourceConfig
- ClusterResourceGroup
- ClusterResourceGroupConfig
- ClusterSoftware
- Composition
- Containment
- EMC AutoStart Cluster
- ExecutionEnvironment
- IpAddress
- Membership

- Node
- Ownership

Discovery Flow

This section describes the discovery flow of the **EMC Autostart by Shell** job.

1. Calculate paths

   The path of the **ftAgent** process discovered by **Application Signatures** is analyzed. These paths are calculated:

   - root of deployment
   - path to folder with executable files (bin)

2. Verify presence of ftcli command

   Execute command **ftcl** with **-version** argument to:

   - Verify the command is available by calculated path.
   - Get version information about installed EMC AutoStart software.

3. Verify domain name

   Domain name calculated from command line of EMC AutoStart software processes should be verified.

   - The job tries to read the configuration file **<root>/config/<domain-name>-sites**.
   - If the file is missing, the domain name is considered invalid and the job ends.

4. Discover cluster topology

   The command **ftcli** is used to read configuration of the cluster, including:

   - **nodes** (listNodes, getNode)
   - **managed IPs** (listManagedIPS, getIP)
   - **managed NICs** (listManagedNics, getNic)

- **resource Groups** (listResourceGroups, getResourceGroup)
- **data sources** (getDataSource)
- **processes** (getProc)

EMC AutoStart Discovery Commands

This section describes the commands used by EMC AutoStart Discovery.

Command ftcli.exe -version

```
"C:\Program Files\EMC\AutoStart\DDM_dom\bin\ftcli.exe" -version
```

Output

```
Version 5.4.1 Build 82

                                EMC AutoStart
                             Version 5.4.1 build 82
                        Built: Thu Nov 3 16:09:59 EDT 2011
```

Command ftcli.exe -cmd "listNodes"

```
"C:\Program Files\EMC\AutoStart\DDM_dom\bin\ftcli.exe" -cmd "listNodes"
```

Output

```
Node                      Type            State
------------------------  ------------    --------------
ddm-autostart             Primary         Agent Running
ddm-autostart2            Primary         Agent Running
```

Command ftcli -cmd "getNode node1"

```
/opt/EMCas/bin/ftcli -cmd "getNode node1"
```

Output

```
Description       : Entry for node node1
System Name       : node1
Operating System  : HP-UX 11.31
Kernel Arch       : ia64
Main Memory (MB)  : 4076
Swap space  (MB)  : 24506
Supported DS      :
IP Address(es)    : 10.20.30.136
                    10.20.30.137
Node Attributes   : name=Ticket               value=1
```

```
LAAM Version      : 5.4.1
LAAM Version Info : Version 5.4.1 build 82
Build Date        : Thu Nov 3 16:09:30 EDT 2011
State             : Agent Running
```

Chapter 23: IBM High Availability Cluster Multiprocessing (HACMP) Discovery

This chapter includes:

Overview 389
Supported Version 389
Topology 390
How to Discover IBM HACMP 391
Discovery Mechanism 394
HACMP Topology Discovery Job 399
HACMP Application Discovery Job 400

Overview

High Availability Cluster Multiprocessing (HACMP) is an IBM solution for high-availability clusters on the AIX UNIX and Linux for IBM System p platforms.

HACMP can run on up to 32 computers or nodes, each of which is either actively running an application (active) or waiting to take over should another node fail (passive). Data on file systems can be shared between systems in the cluster.

HACMP relies heavily on IBM's Reliable Scalable Cluster Technology (RSCT). RSCT includes daemons that are responsible for monitoring the state of the cluster (for example, a node, NIC or network crash) and for coordinating the response to these events. HACMP is an RSCT aware client. RSCT is distributed with AIX.

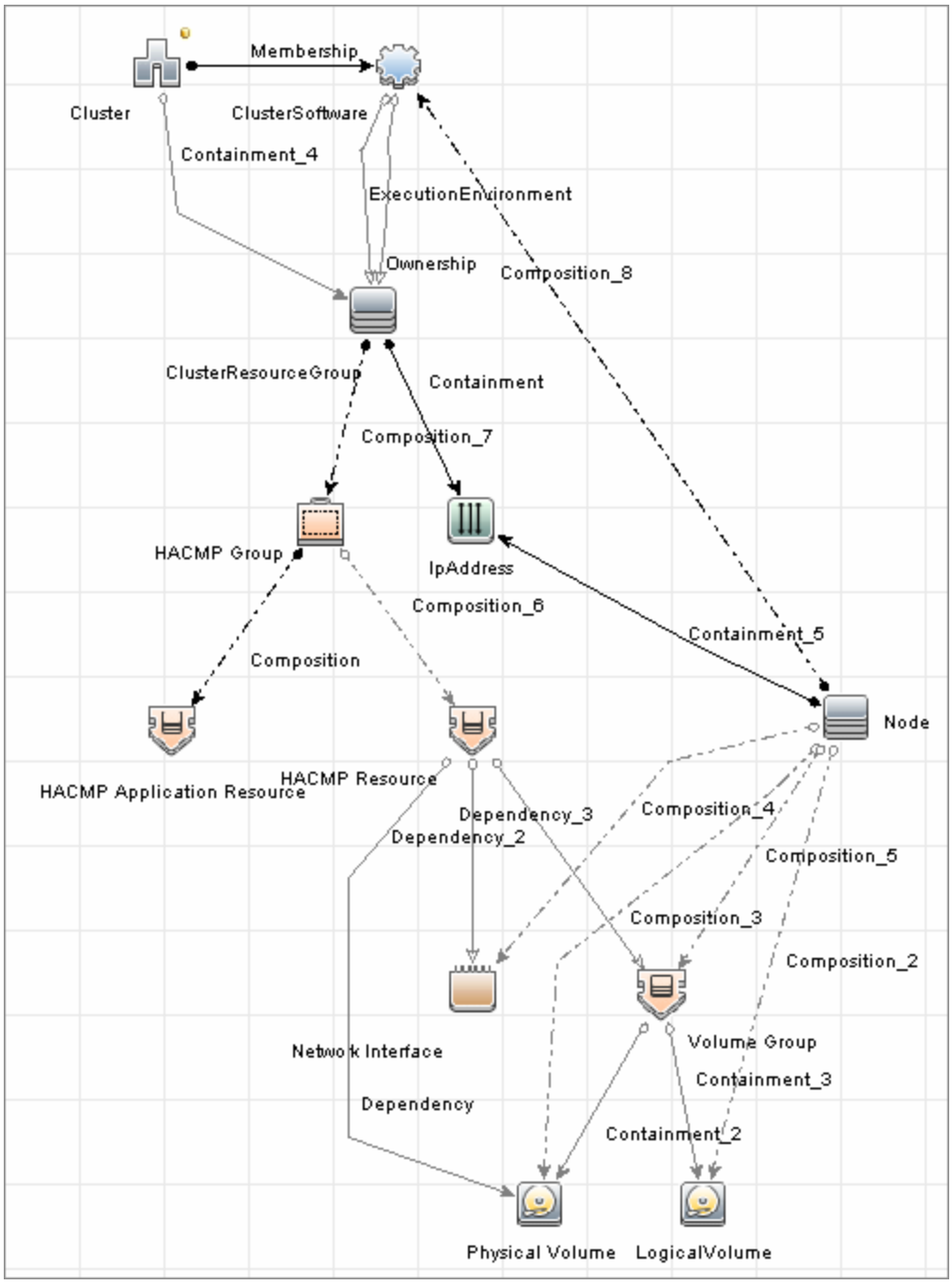
The **IBM_HACMP** package discovers HACMP on AIX via TTY (SSH or Telnet protocols). The package follows the discovery model to discover the HACMP Topology (configured networks, node interfaces-both public TCP/IP and serial heartbeat, and service IPs) and Application Resources (configured resource groups, application servers, and volume groups). The package maps the configured public interfaces to UCMDB IPs, serial interfaces to directories beneath the UCMDB hosts, as well as volume groups to logical disks beneath the UCMDB host, and Application Resources to the Topology.

Supported Version

This discovery supports HACMP 5.3 and 5.4 on AIX 5.3.

Topology

The following image displays the topology of the HACMP discovery.



How to Discover IBM HACMP

This task includes the following steps:

1. Prerequisite - Set up protocol credentials

   This discovery uses the following Shell protocols:

   - SSH Protocol
   - Telnet Protocol

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Prerequisites - Other

   - Verify that the Host Connection adapters have been successfully run on the nodes involved in the cluster.

     For details, see "Host Connection" on page 1168.

   - Load the Storage Topology add-on package prior to deployment of the HACMP package.

3. Run the Discovery

   a. Verify that the Probe has an IP range assigned to it that includes the IPs of the target machines running IBM HACMP Cluster.

   b. Verify that the Shell (SSH or Telnet) credentials are specified. For details, see "Prerequisite - Set up protocol credentials" above.

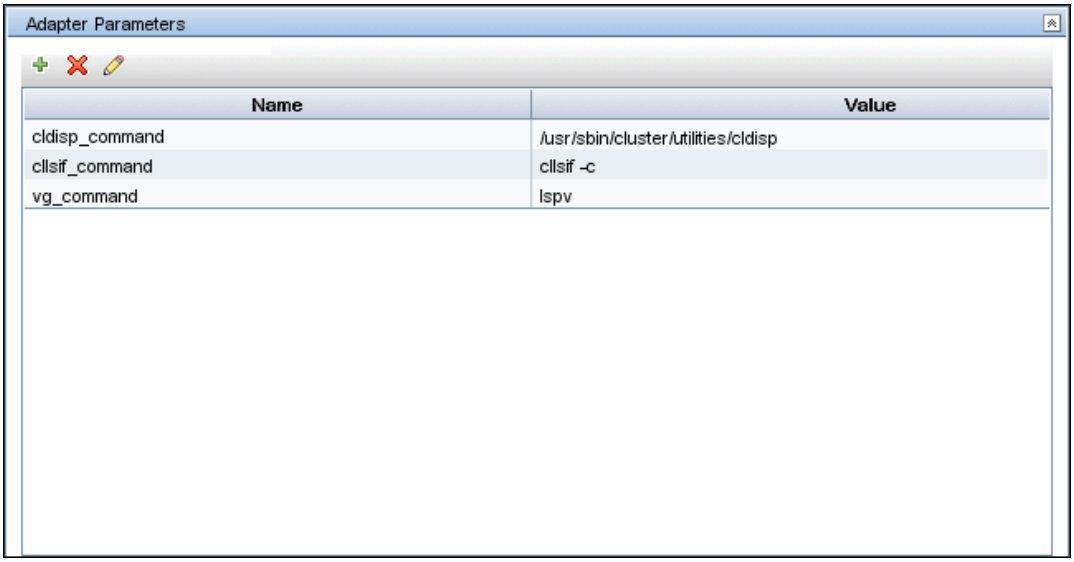
   c. Run the **Range IPs by ICMP** job to discover which of the machines in the IP range are up.

   d. Run the **Host Connection by Shell** job to discover Shell connectivity and basic information about the hosts.

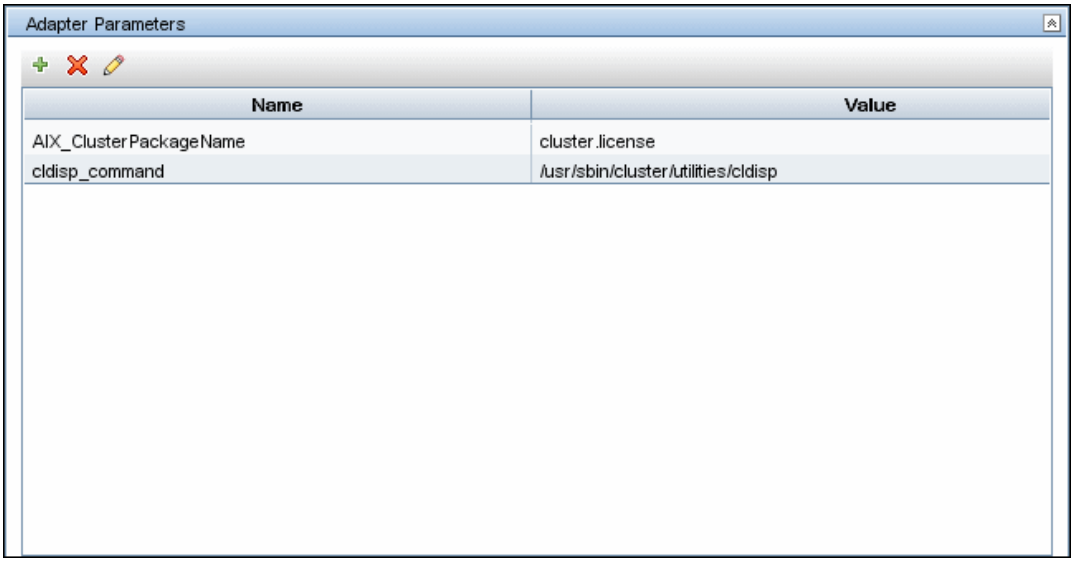
   e. Verify that the **Host Connection** jobs have previously discovered the hosts that are to be part of the HACMP cluster. For details, see "Prerequisite - Set up protocol credentials" above. If you have not yet run these jobs, you can activate them now.

   f. Check the adapter parameters for the **TTY_HACMP_Applications** and **TTY_HACMP_ Topology** adapters. To use **sudo** with the commands, adjust the parameters appropriately. They can also be adjusted on the job.

TTY_HACMP_Applications adapter



TTY_HACMP_Topology adapter



g. Activate the **HACMP Topology Discovery** job. After the job completes, verify the creation of **HACMP** CIs through the Discovery Results pane. For details on the CIs that are discovered, see the section describing discovery progress and results in the *HPE Universal CMDB Data Flow Management Guide*.

h. Activate the **HACMP Application Discovery** job. This job creates HACMP application and resource CIs.

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

Discovery Mechanism

This section describes the following commands:

- "Verify that the Connected OS Supports HACMP" below
- "Get the Version of HACMP" below
- "Get Cluster Information" on the next page
- "Get DNS Information from the Host File" on the next page
- "Get Volume Group Information" on page 396
- "Get HACMP Application Information" on page 396

Verify that the Connected OS Supports HACMP

Command	uname
Example of output	`aix`
Values taken	aix
Comments	This command retrieves the OS. This package runs only on AIX platforms so Discovery must verify the OS.

Get the Version of HACMP

Command	lslpp -l cluster.license
Example of output	`cluster.license 5.4.0.0 COMMITTED HACMP Electronic License`
Values taken	5.4.x.x
Comments	This command gives the HACMP version. Discovery verifies that the HACMP version is valid.

Get Cluster Information

Command	/usr/sbin/cluster/utilities/cldisp
Example of output	## == ## Cluster: db590_db591 ## Cluster services: active ## State of cluster: up ## Substate: stable ## ## ############# ## APPLICATIONS ## ############# ## ... ## ==
Values taken	Cluster: db590_db591
Comments	This command retrieves the HACMP Cluster name.

Get DNS Information from the Host File

Command	cat /etc/hosts
Example of output	## Sample output... ## == ## # Do not remove the following line, or various programs ## # that require network functionality will fail. ## 127.0.0.1 testserver localhost.localdomain localhost ## 12.20.30.3 server1 server1.compay.net ## 12.20.20.3 server1-backup server1-backup.company.net ## 192.168.1.103 server1-local server1-local.company.net ## 12.20.30.4 server2 server1.compay.net ## 12.20.20.4 server2-backup server2-backup.company.net

	## 192.168.1.104 server2-local server2-local.company.net ## ====================================
Values taken	IP Address and name
Comments	This command retrieves the host name and the IP.

Get Volume Group Information

Command	lspv
Example of output	## Sample output... # dwscmdb : lspv # hdisk1 00ca4bbe84bdab4f rootvg active # hdisk0 00ca4bbe84bdac14 rootvg active # hdisk2 00ca4bbeeeb6b3c2 QSWIQ9A0_vg concurrent # hdisk3 00ca4bbeeeb3c581 None # hdisk4 00ca4bbeeeb6b499 QSWIQ9A0_vg concurrent # hdisk5 00ca4bbeeeb3c403 None # hdisk6 00ca4bbeeeb6b60d QSWIQ9B0_vg concurrent # hdisk7 00ca4bbeeeb3c4c2 QSWIQ9B0_vg concurrent # hdisk8 00ca4bbeeeb6b84f QSWIQ9A0_vg concurrent # hdisk9 00ca4bbeeeb6b920 QSWIQ9A0_vg concurrent # hdisk10 00ca4bbeeeb3c641 None # hdisk11 00ca4bbeeeb3c7c0 None # hdisk12 00ca4bbeeeb6b6e5 QSWIQ9B0_vg concurrent # hdisk13 00ca4bbeeeb3c700 QSWIQ9B0_vg concurrent
Values taken	Volume group name
Comments	This command retrieves the volume groups.

Get HACMP Application Information

Command	cldisp

Example of output	## Sample output... ## == ## Cluster: db590_db591 ## Cluster services: active ## State of cluster: up ## Substate: stable ## ## ############# ## APPLICATIONS ## ############# ## Cluster sy008_sy015 provides the following applications: assy008 ## Application: assy008 {online} ## This application is part of resource group 'ressy008'. ## Resource group policies: ## Startup: on home node only ## Fallover: to next priority node in the list ## Fallback: never ## Nodes configured to provide assy008: a_wwasy008 {up} b_ddasy015 {up} ## Node currently providing assy008: a_wwasy008 {up} ## The node that will provide assy008 if a_wwasy008 fails is: b_ddasy015 ## assy008 is started by /usr/local/bin/start_assy008 ## assy008 is stopped by /usr/local/bin/stop_assy008 ## Resources associated with assy008: ## Service Labels ## wwasy008(141.122.74.142) {online} ## Interfaces configured to provide wwasy008: ## wwasy008-boot {down} ## with IP address: 141.122.74.149

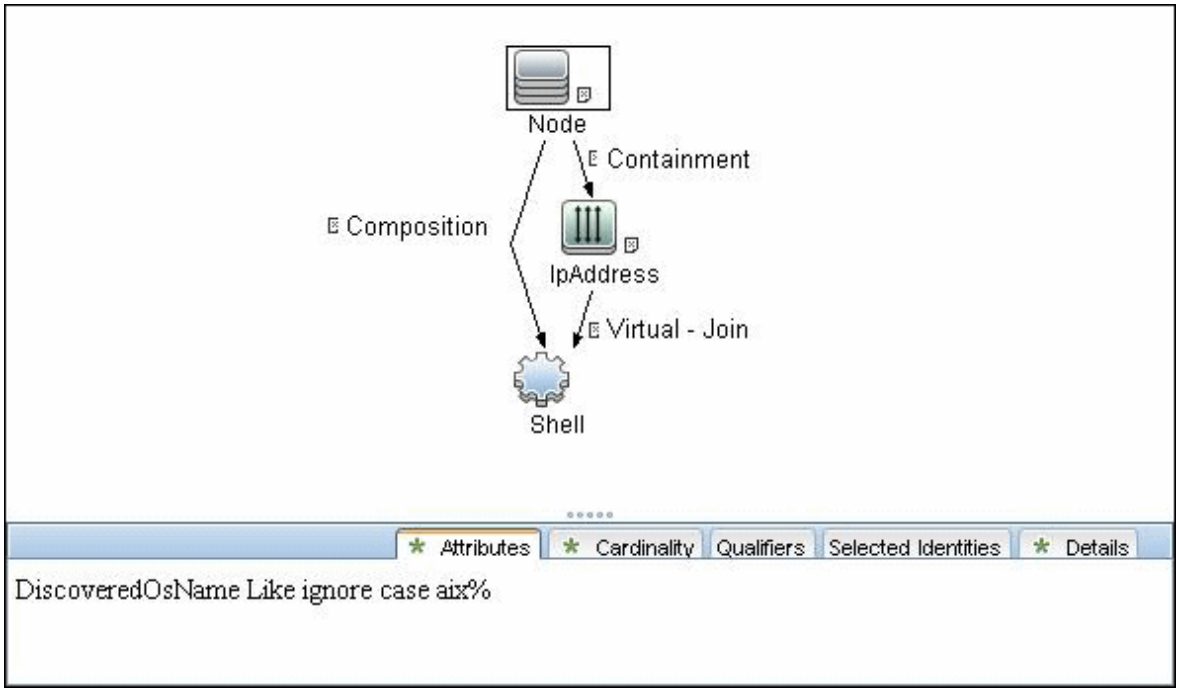
	## on interface: en1 ## on node: a_wwasy008 {up} ## on network: net_ether_01 {up} ## wwasy008-stdby {up} ## with IP address: 192.168.2.40 ## on interface: en2 ## on node: a_wwasy008 {up} ## on network: net_ether_01 {up} ## ddasy015 {up} ## with IP address: 141.122.74.154 ## on interface: en1 ## on node: b_ddasy015 {up} ## on network: net_ether_01 {up} ## ddasy015-stdby {up} ## with IP address: 192.168.2.10 ## on interface: en2 ## on node: b_ddasy015 {up} ## on network: net_ether_01 {up} ## Shared Volume Groups: ## vg100 ## vg199 ## No application monitors are configured for assy008. ## ## ############## ## TOPOLOGY ## ############## ## ... ## =================
Values taken	Application information
Comments	This command retrieves the HACMP Application information.

HACMP Topology Discovery Job

This section includes details about the job.

Trigger Query (shell_not_ntcmd_HACMP)

This trigger requires a TTY Shell that is not an NTCMD Shell.



Adapter

Used Scripts

- storage_topology.py
- TTY_HACMP_Topology.py

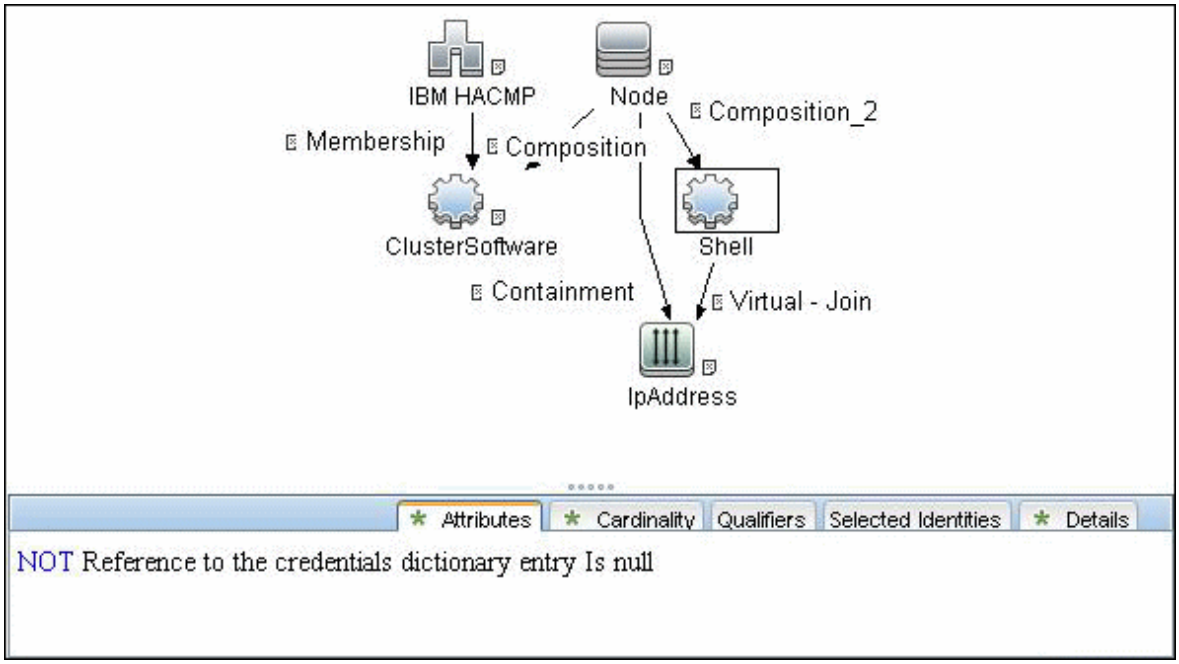
Discovered CITs

- ClusterSoftware
- Composition
- Containment
- HACMP Cluster
- Interface
- IpAddress
- LogicalVolume
- Membership
- Node
- Physical Volume
- Volume Group

HACMP Application Discovery Job

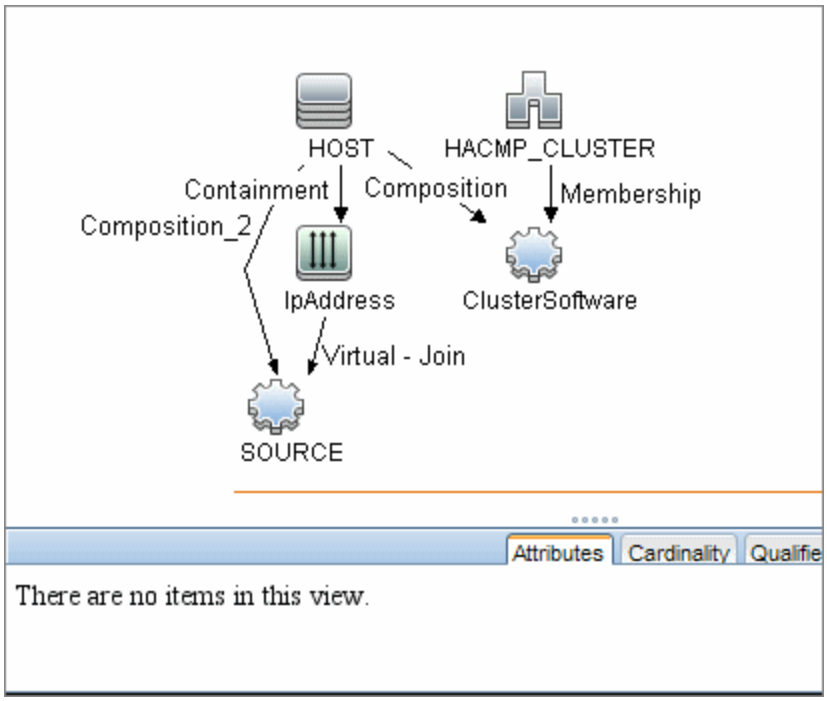
This section includes details about the job.

Trigger Query (shell_in_HACMP_cluster)



Adapter

- **Input Query**



Used Script

- TTY_HACMP_Applications.py

Discovered CITs

- ClusterResourceGroup
- ClusterSoftware
- Composition
- Containment
- Dependency
- ExecutionEnvironment
- HACMP Cluster
- HACMP Resource
- HACMP Resource Group
- Interface

- IpAddress
- Membership
- Node
- Ownership
- Physical Volume
- RunningSoftware
- Usage
- Volume Group

Chapter 24: Microsoft Cluster Discovery

This chapter includes:

Microsoft Cluster Server View Topology 405

Supported Versions 406

How to Discover Microsoft Cluster Servers 407

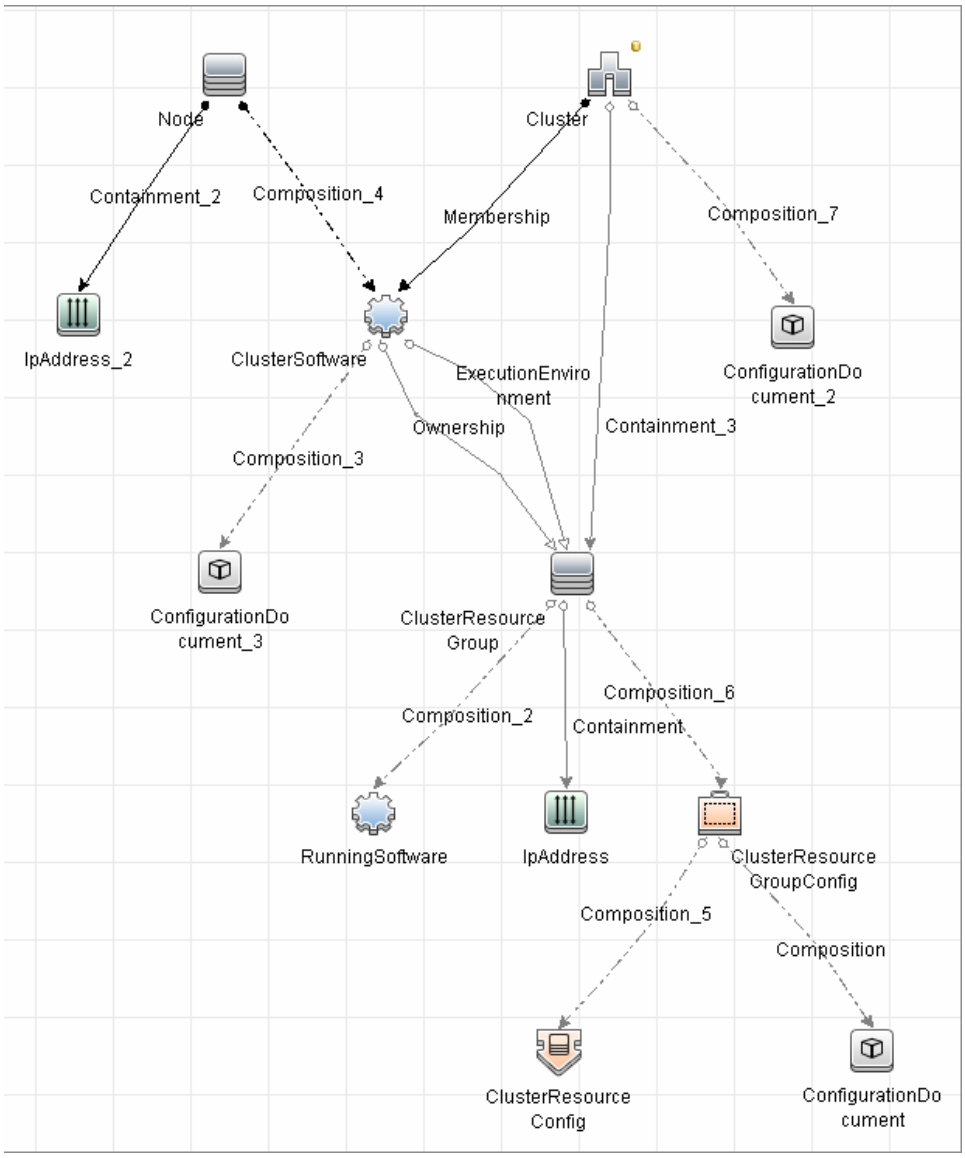
MS Cluster by NTCMD or UDA Job 407

Microsoft Cluster Server View Topology

The Microsoft Cluster Server View shows the MS Cluster and the cluster software (the agents running on the actual host) as its members.

The cluster is composed of several `Clustered Servers` that are the virtual hosts or servers providing the platform for the virtual service used by the cluster clients (through the virtual IPs). The cluster contains Microsoft Cluster Groups. Each of the groups contains Microsoft Cluster Resources. For each Cluster Resource Group, it is assumed that different, dedicated, virtual IPs are being assigned; these IPs are configured for the use of the cluster clients.

> **Note:** For a list of discovered CITs, see "Discovered CITs" on page 409.



Supported Versions

- Windows Server 2003
- Windows Server 2008
- Windows Server 2008 R2
- Windows Server 2012
- Windows Server 2012 R2
- Windows Server 2016

How to Discover Microsoft Cluster Servers

The MS Cluster discovery process enables you to discover the topology of a Microsoft Cluster Server on the network.

This task includes the following steps:

1. Prerequisite - Set up protocol credentials

   This discovery uses the WMI and NTCMD or PowerShell protocols.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Run the discovery

   Activate the relevant jobs in the following order:

   a. **Host Connection by Shell** or **Host Connection by PowerShell**

   b. **Host Applications by Shell/SNMP/WMI/PowerShell** and **Host Resources by Shell/SNMP/WMI/PowerShell**.

   c. **MS Cluster by NTCMD or UDA**

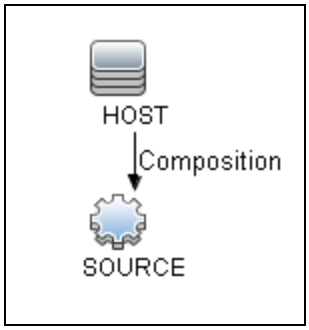
   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

MS Cluster by NTCMD or UDA Job

Input CI Type

Agent

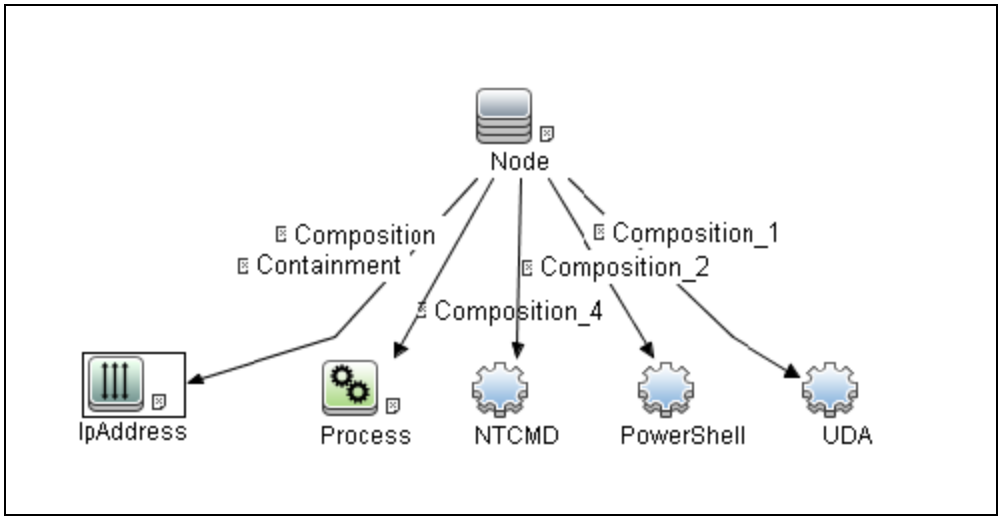
Input TQL Query



Triggered CI Data

Name	Value
credentialsId	${SOURCE.credentials_id}
ip_address	${SOURCE.application_ip}

Trigger Query



CI Attribute Conditions

CI	Condition
IpAddress	NOT IP Probe Name Is null
Process	Name Equal ignore case clussvc.exe
NTCMD	NOT Reference to the credentials dictionary entry Is null
PowerShell	NOT Reference to the credentials dictionary entry Is null

Used Scripts

- entity.py
- ms_cluster.py
- ms_cluster_discoverer.py
- MS_Cluster_Topology.py

Discovered CITs

For details on the CIs that are discovered, see the statistics table in the **Details** tab.

- ClusterResourceGroup
- ClusterSoftware
- Composition
- ConfigurationDocument
- Containment
- Dependency
- ExecutionEnvironment
- IpAddress
- MS Cluster
- MSCS Resource Group
- MSCS resource

- Membership
- Node
- Ownership
- Virtual

> **Note:** To view the topology, see "Microsoft Cluster Server View Topology" on page 405.

Chapter 25: Red Hat Cluster Suite Discovery

This chapter includes:

Overview 412
Supported Versions 412
Topology 412
How to Discover Red Hat Cluster Suite Topology 413
Red Hat Cluster by Shell Job 413
Red Hat Cluster by Shell Adapter 415
Limitations 417

Overview

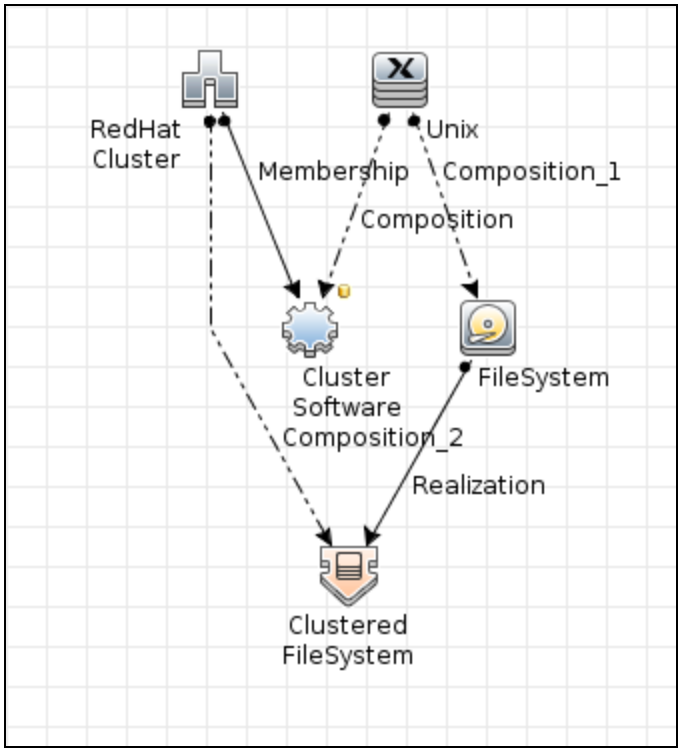
Red Hat Cluster Suite (RHCS) is a set of software components that enables setting up a high availability and load balancing cluster. Global File System 2 (GFS2) provides a clustered file system for use the with Red Hat Cluster Suite. GFS2 allows multiple nodes to share storage at a block level as if the storage is connected locally to each cluster node.

Supported Versions

Red Hat Cluster Suite Discovery is supported on Red Hat version 6.3.

Topology

The following diagram depicts the topology for Red Hat Cluster Suite Discovery.



How to Discover Red Hat Cluster Suite Topology

This section describes how to discover the topology managed by Red Hat Cluster Suite.

Prerequisites

- Ensure that there is shell connectivity to cluster nodes.
- Set up SSH protocol credentials.

Run the Discovery

> **Note:** Red Hat Cluster Suite Discovery can be performed in shallow or deep mode. To perform a shallow discovery, carry out steps 1-3 below. To perform a deep discovery, carry out all of the steps below.

To perform Red Hat Cluster Suite Discovery, execute the following jobs in the listed order:

1. **Range IPs by ICMP** (discovers the target IPs)
2. **Host Connection by Shell** (discovers the target host and shell connectivity to it)
3. **Host Applications by Shell** (discovers Red Hat cluster software)

   > **Note:** If you want to perform only a shallow discovery, stop here and do not continue to the next step.

4. **Red Hat Cluster by Shell** (discovers Red Hat cluster resources)

Red Hat Cluster by Shell Job

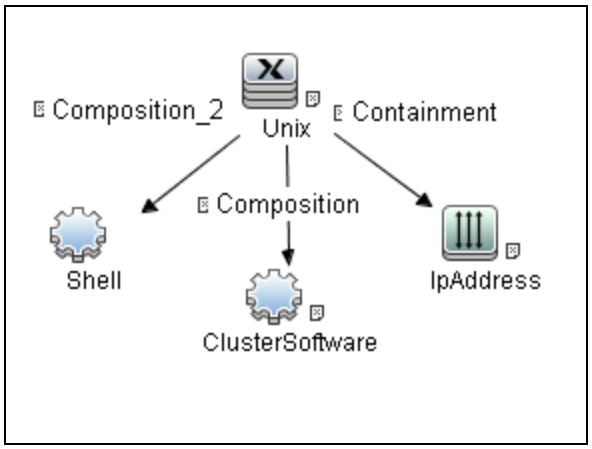
This section includes details about the job.

Adapter

ID: red_hat_cluster_by_shell

Trigger TQL

This job is triggered when **ClusterSoftware** has **ProductName=redhat_cluster** on the node with shell access, and the node's IP address is in the Probe's range. The shell should have valid credentials.



Node Name	Condition
IpAddress	NOT IP Probe Name Is null
Shell	NOT Reference to the credentials dictionary entry Is null
Unix	None
ClusterSoftware	ProductName Equal redhat_cluster

Discovery Flow

The discovery flow for the **Red Hat Cluster by Shell** job is as follows:

1. The job obtains cluster information (**clustat -x**) and create the necessary cluster topology.
2. The job resolves hosts by using **nslookup** or the **hosts** file.
3. The job run the **blkid** command to determine if GFS/GFS2 is in use.
4. The job runs the **gfs_edit** and **blkid** commands to obtain the GFS configuration.
5. The job runs the **cat/etc/mtab** command to obtain mount points.

Red Hat Cluster by Shell Adapter

This section includes details about the adapter.

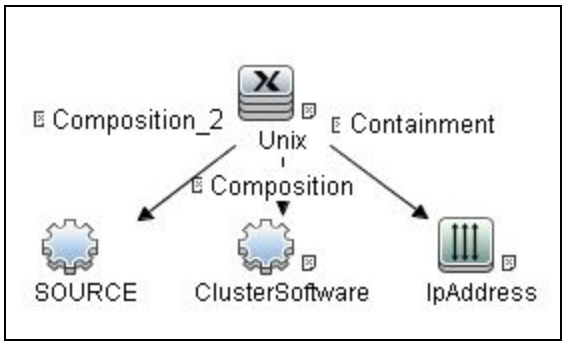
ID

red_hat_cluster_by_shell

Input CIT

Shell

Input TQL



The job is triggered when **ClusterSoftware** has **ProductName = redhat_cluster** and has a node with shell access, and the node's IP address is in the probe's range. The shell should have valid credentials.

Node Name	Condition
Unix	None
SOURCE	NOT Reference to the credentials dictionary entry Is null
ClusterSoftware	ProductName Equal redhat_cluster
IpAddress	NOT IP Probe Name Is null

Triggered CI Data

Name	Value
Protocol	${SOURCE.root_class}
credentialsId	${SOURCE.credentials_id}
ip_address	${SOURCE.application_ip}

- **Protocol.** The shell's root_class.
- **CredentialsId.** The shell's credentials_id.
- **IP Address.** The shell's application_ip.

Used Script

- red_hat_cluster_by_shell.py

Discovered CITs

- ClusteredFileSystem
- ClusterSoftware
- Composition
- FileSystem
- Membership
- Node
- Realization
- RedHatCluster

Parameters

None

Limitations

Red Hat Cluster Suite Discovery has the following limitations:

- Currently, only GFS and basic cluster information discovery is supported.
- Clustered services discovery is not supported.
- LVM discovery is not supported.

Chapter 26: HPE ServiceGuard Cluster Discovery

This chapter includes:

Overview 419
Supported Versions 419
Topology 419
How to Discover HPE ServiceGuard Cluster Topology 420
Service Guard Cluster Topology by TTY Job 421
Service Guard Cluster Topology Adapter 423
HPE ServiceGuard Cluster Commands 424

Overview

HPE ServiceGuard is the cluster solution for HP-UX. HPE Global Workload Management adjusts workloads to optimize performance, and integrates with Instant Capacity on Demand. HPE Global Workload Management ServiceGuard allows the clustering of FileSystem with the installed services. The **Service Guard Cluster Topology by TTY** job discovers CIs like packages, file system elements, and running services, with the corresponding logical links.

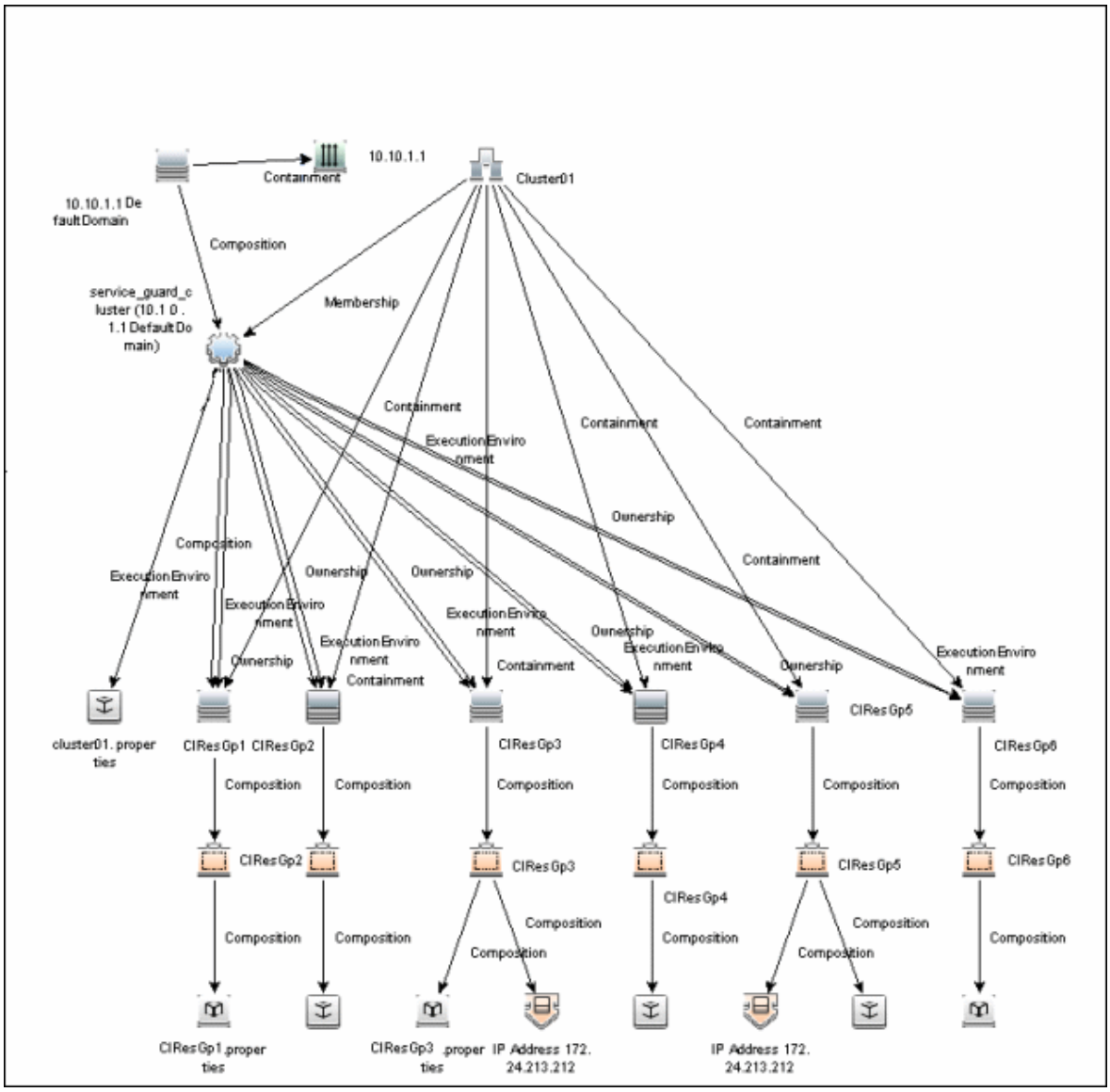
Supported Versions

This discovery solution supports HPE ServiceGuard Cluster on top of HP-UX 10.xx and 11.xx.

Topology

The following image displays the topology of the HPE ServiceGuard Cluster Discovery.

> **Note:** For a list of discovered CITs, see "Service Guard Cluster Topology Adapter" on page 423.



How to Discover HPE ServiceGuard Cluster Topology

This task explains how to discover HPE ServiceGuard Cluster Topology.

1. **Prerequisite - Permissions**

   Before starting the discovery, ensure the user has the permissions required to run the following commands:

- `/usr/sbin/cmviewcl -v`
- `cat <package config or log>`
- `uname`
- `ps -ef`
- `lsnrctl status`
- `pfiles`
- `lsof`

2. **Prerequisite - Set up protocol credentials**

   To discover HPE ServiceGuard cluster topology, you must set up the appropriate Shell protocol: SSH, Telnet, or both, depending on the particular system being accessed. Prepare the following information for the Shell protocol: **user name**, **password**, and **domain name**.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

3. **Run the discovery**

   Run the following jobs:

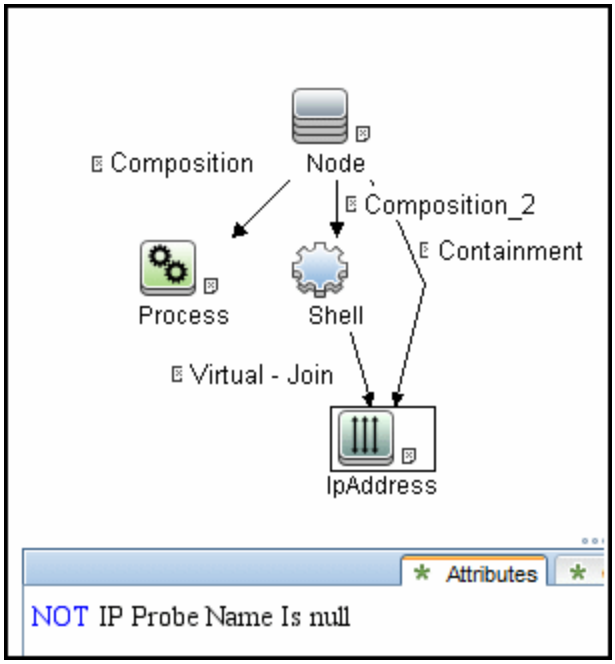
   - **Range IPs by ICMP** to discover the HPE ServiceGuard cluster IP addresses
   - **Host Connection by Shell** to discover the HPE ServiceGuard system with the SSH agent and networking topology connected
   - **Host Applications by Shell** to discover if HPE ServiceGuard is set up and running on the destination
   - **Service Guard Cluster Topology by TTY**

For details on running jobs, see "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

Service Guard Cluster Topology by TTY Job

This section includes details about the job.

Trigger Query



CIT	Attribute
IpAddress	NOT IP Probe Name Is null
Shell	None
Node	None
Process	Name Equal ignore case cmcld OR Name Equal ignore case cmclconfd

Adapter

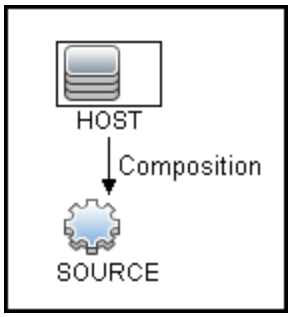
This job uses the **Service Guard Cluster Topology** adapter.

For details, see "Service Guard Cluster Topology Adapter" on the next page.

Service Guard Cluster Topology Adapter

This section includes details about the adapter.

Input Query



Input CIT

Shell

Triggered CI Data

Name	Value
Protocol	${SOURCE.root_class}
cmclconfig_path	${PARAMETERS.cmclconfig_path}
connected_os_credentials_id	${SOURCE.connected_os_credentials_id:NA}
credentialsId	${SOURCE.credentials_id}
ip_address	${SOURCE.application_ip}

Used Scripts

- file_mon_utils.py
- file_ver_lib.py
- entity.py

- networking.py
- oracle_shell_utils.py
- service_guard.py
- service_guard_discoverers.py
- Service_Guard_Cluster_Topology.py

Discovered CITs

- ClusterSoftware
- Composition
- ConfigurationDocument
- Containment
- Dependency
- ExecutionEnvironment
- IpAddress
- Membership
- Node
- Ownership
- SG Package
- SG Resource
- Service Guard Cluster

HPE ServiceGuard Cluster Commands

This section includes the ServiceGuard clustering commands.

/usr/local/bin/sudo /usr/sbin/cmviewcl -v

Output:

```
CLUSTER         STATUS
SomeClusterName   up
```

```
NODE     STATUS     STATE
Node1    up     running

Quorum_Server_Status:
NAME       STATUS   STATE
172.24.0.5 up       running

 Network_Parameters:
INTERFACE   STATUS   PATH                NAME
PRIMARY     up     0/2/2/1           lan3
PRIMARY     up     0/1/1/1             lan1
PRIMARY     up     0/2/2/0             lan2
PRIMARY     up    0/1/1/0             lan0
STANDBY     up     0/3/0/0/0/0/4/0/0/ lan7
STANDBY     up     0/3/0/0/0/0/2/0/0/ lan5
STANDBY     up    0/3/0/0/0/0/4/0/0/ lan6
STANDBY     up                       0/3/0/0/0/0/2/0/0/ lan4

PACKAGE   STATUS   STATE   AUTO_RUN   NODE
PackageName1 up    running     enabled   Node1

 Policy_Parameters:
POLICY_NAME CONFIGURED_VALUE
Failover   configured_node
Failback   manual

 Node_Switching_Parameters:
NODE_TYPE  STATUS  SWITCHING  NAME
Primary    up    enabled Node1 (current)

PACKAGE   STATUS   STATE   AUTO_RUN   NODE
 PackageName2  up running enabled Node1

 Policy_Parameters:
POLICY_NAME CONFIGURED_VALUE
Failover   configured_node
Failback   manual

 Script_Parameters:
ITEM   STATUS   MAX_RESTARTS RESTARTS NAME
Subnet   up     192.168.62.0
Subnet   up     172.24.0.0
```

```
 Node_Switching_Parameters:
NODE_TYPE  STATUS  SWITCHING NAME
Primary      up    enabled Node1 (current)

PACKAGE STATUS STATE AUTO_RUN NODE
PackageName3 up running enabled Node1

 Policy_Parameters:

POLICY_NAME CONFIGURED_VALUE
Failover configured_node
Failback manual

 Node_Switching_Parameters:
NODE_TYPE STATUS SWITCHING NAME
Primary    up    enabled Node1 (current)
```

Mapping

Output of this command is used to fill in the attributes of the CIs:

CMD Output Attribute	CI Name	CI Attribute
SomeClusterName	Service Guard Cluster	Name
PackageName1,..., PackageName3	SG Package	Name
IP Address	SG Resource	Name
Subnet value	Network	Name
Node1	Node	Name

find /etc/cmcluster/ -name '*.cfg'

Output:

```
/etc/cmcluster/scripts/exampleapplicatie.cfg
/etc/cmcluster/package1/package1.cfg
/etc/cmcluster/package2/package2.cfg
/etc/cmcluster/package3/package3.cfg
```

Mapping:

This command is used to find package configuration files in the SG Cluster configuration directory.

find /etc/cmcluster/ -name '*.config'

Output:

```
/etc/cmcluster/scripts/exampleapplicatie.config
/etc/cmcluster/package1/package1.config
/etc/cmcluster/package2/package2.config
/etc/cmcluster/package3/package3.config
```

Mapping:

This command is used to find package configuration files in the SG Cluster configuration directory.

cat "/etc/cmcluster/package1/package.cfg" | grep -iE "PACKAGE_NAME|SCRIPT_LOG_FILE|RUN_SCRIPT|FS_DIRECTORY"

Output:

```
# "PACKAGE_NAME" is the name that is used to identify the package.
# Legal values for PACKAGE_NAME:
PACKAGE_NAME package1
# "RUN_SCRIPT" is the script that starts a package.
# Legal values for RUN_SCRIPT:
RUN_SCRIPT /etc/cmcluster/package1/package1.cntl
# "RUN_SCRIPT_TIMEOUT" is the number of seconds allowed for the package to start.
```

Mapping:

PACKAGE_NAME and RUN_SCRIPT variable values are used in further commands for discovery of IP and Mount Points, which are managed by this package.

cat "/etc/cmcluster/package1/package1.cntl.log" | grep -E "Mounting"

Output:

```
Jul 11 09:27:10 - Node "Node1":
 Mounting /dev/vg1/lvol1 at /oracle/somename1
 Jul 11 09:27:22 - Node "Node1":
 Mounting /dev/vg1/lvol2 at /oracle/somename2
 Jul 11 09:27:53 - Node "Node1":
 Mounting /dev/vg1/lvol3 at /oracle/somename3
```

Mapping:

Discovered data for mount points will be used to link the RunningSoftware to the proper Clustered Service (actually a package). This linking approach relies on the running process path.

cat "/etc/cmcluster/package1/package1.cntl.log" | grep -E "Adding IP"

Output:

```
Jun 12 09:27:11 - Node "Node1":
 Adding IP address 192.168.62.146 to subnet 192.168.62.0
 Jun 12 09:27:11 - Node "Node1":
 Adding IP address 172.24.10.142 to subnet 172.24.0.0
```

Mapping:

Discovered IP Address and Network will be reported as corresponding CIs. This is done because not all IP Resources might be present in the cmviewcl output.

ps -ef | grep "tnslsnr"

Output:

```
orauser 21926 1 0 Jun 9 ?
 6:09 /oracle/somename1/applic/oracle/db/
 10.2.0/instns1/bin/tnslsnr listener_name1 -inherit
```

Mapping:

From the fetched Oracle Listener process information ORACLE_HOME value, listener name and pid will be parsed out. ORACLE_HOME and listener name will be used in further discovery to get listener status and parse out Oracle DB SIDs.

/oracle/somename1/applic/oracle/db/10.2.0/instns1/bin/lsnrctl status listener_name1

Output:

```
LSNRCTL for HPUX: Version 10.2.0.5.0 -
Production on 20-JUL-2011 06:44:11
Copyright (c) 1991, 2010, Oracle. All rights reserved.

Connecting to (DESCRIPTION=(ADDRESS=(PROTOCOL=IPC)(KEY=oic6)))
STATUS of the LISTENER
------------------------
Alias listener_name1
Version TNSLSNR for HPUX: Version 10.2.0.5.0 -
 Production Start Date 09-JUN-2011 21:56:34
Uptime 40 days 8 hr. 47 min. 36 sec
Trace Level off
Security ON: Local OS Authentication
SNMP OFF
Listener Parameter File
/oracle/somename1/applic/oracle/db/10.2.0/
instns1/network/admin/listener.ora
Listener Log File
/oracle/somename1/applic/oracle/db/10.2.0/
instns1/network/log/listener_name1.log
Listening Endpoints Summary...
DESCRIPTION=
ADDRESS=(PROTOCOL=ipc)(KEY=sid1)))
DESCRIPTION=
ADDRESS=(PROTOCOL=tcp)(HOST=192.168.80.24)(PORT=1521)))
DESCRIPTION=
ADDRESS=(PROTOCOL=ipc)(KEY=EXTPROCsidas)))

Services Summary...
Service "PLSExtProcsid1" has 1 instance(s).
Instance "PLSExtProcdis1", status UNKNOWN,
has 1 handler(s) for this service...
Service "sid1.somedomain" has 1 instance(s).
Instance "sid1", status UNKNOWN,
```

```
has 1 handler(s) for this service...
The command completed successfully
```

Mapping:

Instance value will be parsed out and treated as SID; any instance name starting from PLSExtProc will be filtered out since this is RPC call service.

```
nice lsof -i 4 -a -P -n -p <Actual Pid>
```

or

```
nice pfiles 21926 2>&1 | awk "/S_IFSOCK|SOCK_STREAM|SOCK_
DGRAM|port/ { print }"
```

Mapping:

Discovered IP and port information is used to set Application IP and Port on reported Running Software.

```
cat
"/oracle/somename2/applic/oracle/oas/10.1.2/somename5/opmn
/conf/opmn.xml"
```

Output:

```
......skip......
<ias-instance id="somename.somedomain">
<environment>
<variable id="TMP" value="/tmp"/>
<variable id="LD_LIBRARY_PATH" value="/usr/lib"/>
<variable id="LD_PRELOAD" value="libloghost.so.1"/>
......skip......
```

Mapping:

The Oracle iAS CI name is taken from value of ias-instance in the following order: parameter name, parameter id, Default Server.

Chapter 27: Solaris Cluster Discovery

This chapter includes:

- Overview 432
- Supported Versions 432
- Topology 432
- How to Discover Sun Cluster 434
- Sun Cluster by Shell Job 434
- Sun Cluster by Shell Adapter 436
- Solaris Cluster Discovery Commands 438
  - Get Name of Cluster 438
  - Get Nodes of Cluster 440
  - Resolve Node Names to IPs 440
  - Get Status of Nodes 441
  - Get Resource Groups and Resources 441
  - Get Details for Resource Groups and Resources 442
  - Get Cluster Interconnection Information 452
  - Get Quorum Configuration 455

Overview

The Sun Cluster product is an integrated hardware and software solution used to create highly available and scalable services. The Sun Cluster environment extends the Solaris Operating System into a cluster operating system. A cluster is a collection of one or more nodes that belong exclusively to that collection.

Supported Versions

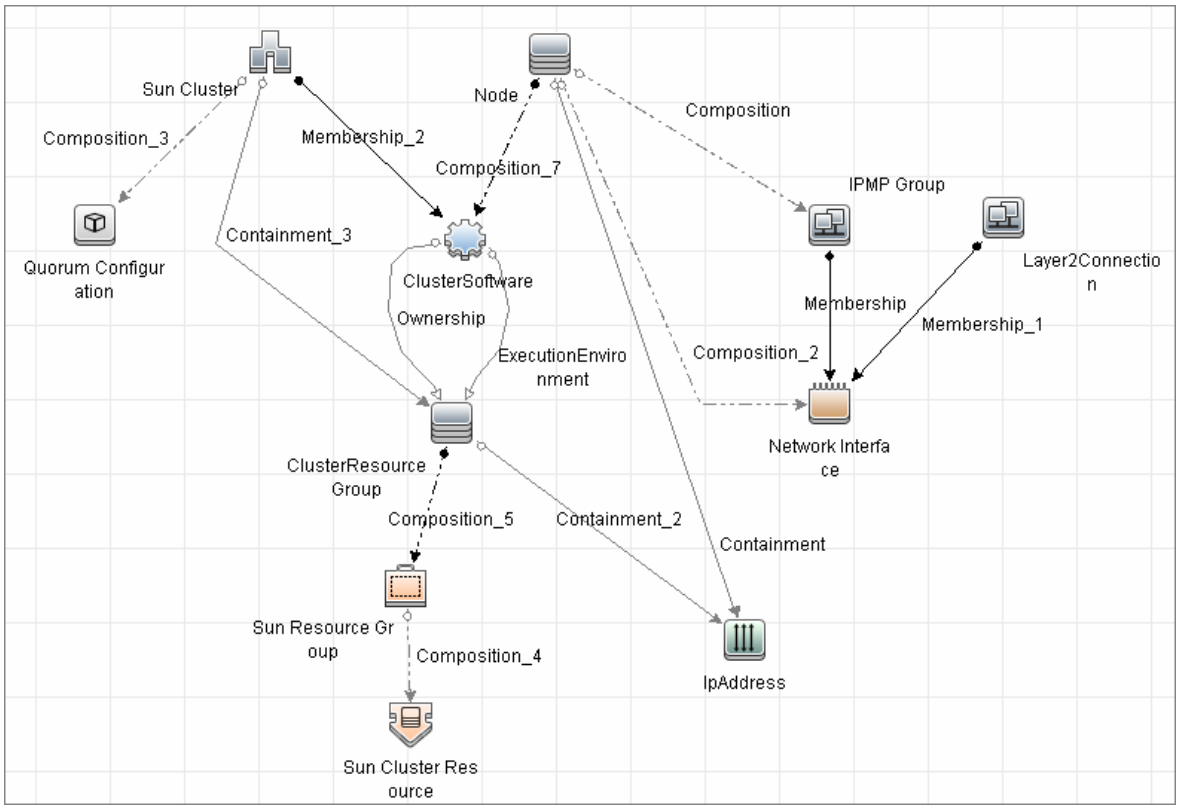
The Sun Cluster package supports Sun Cluster 3.2. Support for older versions of Sun Cluster has not been verified.

The Sun Cluster software integrates with the Solaris operating system, thus only this operating system is supported.

Topology

The following image displays the topology of the Solaris Cluster discovery.

> **Note:** For a list of discovered CITs, see "Sun Cluster by Shell Job" on page 434.


Sun Cluster
Node
Composition
Composition_3
Membership_2
Composition_7
IPMP Group
Containment_3
Quorum Configur
ation
ClusterSoftware
Layer2Connectio
n
Membership
Ownership
Membership_1
ExecutionEnviro
nment
Composition_2
Network Interfa
ce
ClusterResource
Group
Composition_5
Containment_2
Containment
Sun Resource Gr
oup
Composition_4
IpAddress
Sun Cluster Res
ource

How to Discover Sun Cluster

This task includes the following steps:

1. Prerequisites - Set up protocol credentials and permissions
   - This discovery uses the Telnet and SSH protocols.

     For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.
   - Set up permissions for users performing Solaris Cluster discovery to run clustering commands (**scrgadm**, **scstat**, **scconf**, and so on). For a full list of commands see "Solaris Cluster Discovery Commands" on page 438.
2. Run the discovery

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

   Run the following jobs in the following order:

   a. Run the **Range IPs by ICMP** job to discover which of the machines in the IP range are up.

   b. Run the **Host Connection by Shell** job to discover Shell connectivity and basic information about the hosts.

   c. Run the **Host Applications by Shell** job to discover processes on the target machines.

   d. Run the **Sun Cluster by Shell** job to discover the Sun Cluster topology. For job details, see "Sun Cluster by Shell Job" below.

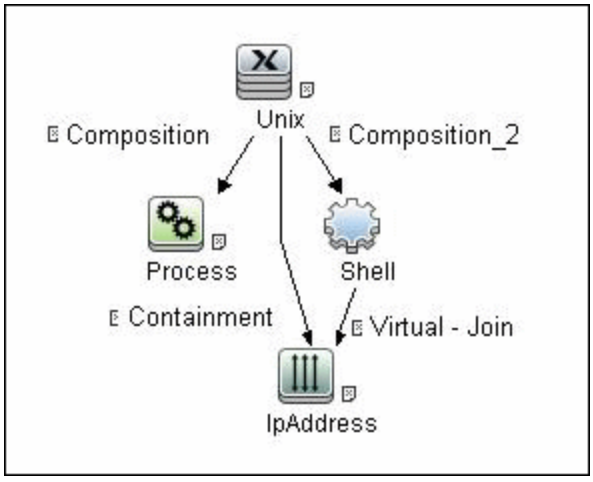
Sun Cluster by Shell Job

This section includes details about the job.

Adapter

ID:`Sun_Cluster_by_Shell`

Trigger TQL



CI Attribute Conditions

Attribute	Condition
Process	`Name Equal ignore case "cluster"`
Shell	`NOT Reference to the credentials dictionary entry is null`
IpAddress	`Not IP Probe Name is null`

Parameters

None

Prerequisites

See the prerequisites in "How to Discover Sun Cluster" on the previous page.

Discovery Flow

The discovery flow for the Sun Cluster by Shell job is as follows:

1. Get the cluster configuration (using the command **/usr/cluster/bin/scconf -pv**), including:
   - Cluster name
   - Names of cluster nodes

- Transport adapters
- Quorum devices

2. Get the cluster version (using the command **/usr/cluster/bin/scinstall –p**).
3. Get the quorum status (using the command **/usr/cluster/bin/scstat -q**).
4. Analyze the cluster nodes that were found and resolve their hostnames to IPs.
5. Get the statuses of the cluster nodes (using the command **/usr/cluster/bin/scstat -n**).
6. Get the standard network information, specifically **netstat** information (using the command **/usr/bin/netstat -np**). This information is used to resolve MAC addresses of transport adapters on the cluster node that the job connected to.
7. Resolve IP addresses of transport adapters to their MACs via the ARP table for cluster nodes that are not the node the job is currently connected to (using the command **/usr/sbin/arp <IP>**).
8. Get cluster resources (using the command **/usr/cluster/bin/scrgadm –pvv**), including:
   - Resource Groups
   - Resources. Host names in resources of types **LogicalHostname** or **SharedAddress** are resolved to IPs.
9. Get statuses of resource groups (using the command **/usr/cluster/bin/scstat -g**).
10. Get transport paths (using the command **/usr/cluster/bin/scstat –W**).
11. Create the result vector with the topology discovered and send it to the UCMDB.

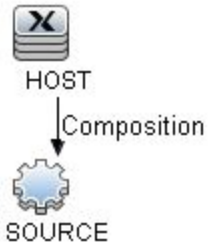
Sun Cluster by Shell Adapter

This section includes details about the adapter.

Input CIT

Shell

Input Query



Triggered CI Data

Name	Value
Protocol	${SOURCE.root_class}
connected_os_credentials_id	${SOURCE.connected_os_credentials_id:NA}
credentialsId	${SOURCE.credentials_id}
ip_address	${SOURCE.application_ip}

Used Scripts

- networking.py
- solaris_networking.py
- sun_cluster_by_shell.py

Discovered CITs

- ClusterSoftware
- Composition
- ConfigurationDocument
- Containment
- ExecutionEnvironment
- Interface

- IpAddress
- Layer2Connection
- Membership
- Node
- Sun Cluster
- Sun Cluster Resource
- Sun Resource Group

> **Note:** To view the topology, see "Topology" on page 432.

Solaris Cluster Discovery Commands

This section includes the Sun clustering commands:

- "Get Name of Cluster" below
- "Get Nodes of Cluster" on page 440
- "Resolve Node Names to IPs" on page 440
- "Get Status of Nodes" on page 441
- "Get Resource Groups and Resources" on page 441
- "Get Details for Resource Groups and Resources" on page 442
- "Get Cluster Interconnection Information" on page 452
- "Get Quorum Configuration" on page 455

Get Name of Cluster

Command	/usr/cluster/bin/scconf -p

Example of output	`Cluster name: cluster1`
	`Cluster ID: 0x4A7BDCD3`
	`Cluster install mode: disabled`
	`Cluster private net: 172.2.0.0`
	`Cluster private netmask: 255.255.255.192`

	Cluster maximum nodes: 6 Cluster maximum private networks: 4 Cluster new node authentication: unix Cluster authorized-node list: <. - Exclude all nodes> Cluster transport heart beat timeout: 10000 Cluster transport heart beat quantum: 1000 Round Robin Load Balancing UDP session timeout: 480 Cluster nodes: node1 node2 Cluster node name: node1 ...
Values taken	Name of the cluster: cluster1
Comments	Name of the cluster enabling the creation of the Sun Cluster CI.

Get Nodes of Cluster

Command	/usr/cluster/bin/scconf -p
Example of output	Cluster name: cluster1 Cluster ID: 0x4A7BDCD3 Cluster install mode: disabled Cluster private net: 172.2.7.0 Cluster private netmask: 255.255.255.192 Cluster maximum nodes: 6 Cluster maximum private networks: 4 Cluster new node authentication: unix Cluster authorized-node list: <. - Exclude all nodes> Cluster transport heart beat timeout: 10000 Cluster transport heart beat quantum: 1000 Round Robin Load Balancing UDP session timeout: 480 Cluster nodes: node1 node2 ...
Values taken	Node names

Resolve Node Names to IPs

Command	/usr/sbin/nslookup node1
Example of output	Server: 134.44.0.10 Address: 134.44.0.10#53 Name: node1.example.com Address: 134.44.0.75
Values taken	IP of the node
Comments	The IP enables the creation of an incomplete Host for each node in the cluster

Get Status of Nodes

Command	/usr/cluster/bin/scstat -n

Example of output	`-- Cluster Nodes --`
	`Node name Status`
	`--------- ------`
	`Cluster node: node1 Online`
	`Cluster node: node2 Online`

Values taken	Node statuses
Comments	Although statuses are not reported, Discovery needs this status. For example, Discovery should not issue an arp command to resolve the MAC address if the node is off-line.

Get Resource Groups and Resources

Command	/usr/cluster/bin/scstat -g

Example of output	`-- Resource Groups and Resources --`
	`Group Name Resources`
	`---------- ---------`
	`Resources: oracle1 oracle1-zfs oracle1-lh oracle1-ora oracle1-cron oracle1-lsnr_ano_10`
	
	`-- Resource Groups --`
	`...`

Values taken	List of groups. List of resources in a group. Status of a group on each of the nodes (run links are created based on this).

Get Details for Resource Groups and Resources

Command	/usr/cluster/bin/scrgadm -pvv
Example of output	Res Group name: oracle1 (oracle1) Res Group RG_description: <NULL> (oracle1) Res Group mode: Failover (oracle1) Res Group management state: Managed (oracle1) Res Group RG_project_name: user.oracle (oracle1) Res Group RG_SLM_type: manual (oracle1) Res Group RG_affinities: <NULL> (oracle1) Res Group Auto_start_on_new_cluster: True (oracle1) Res Group Failback: False (oracle1) Res Group Nodelist: node1 node2 (oracle1) Res Group Maximum_primaries: 1 (oracle1) Res Group Desired_primaries: 1 (oracle1) Res Group RG_dependencies: <NULL> (oracle1) Res Group network dependencies: True (oracle1) Res Group Global_resources_used: <All> (oracle1) Res Group Pingpong_interval: 3600 (oracle1) Res Group Pathprefix: <NULL> (oracle1) Res Group system: False (oracle1) Res Group Suspend_automatic_recovery: False (oracle1) Res name: oracle1-zfs (oracle1:oracle1-zfs) Res R_description: (oracle1:oracle1-zfs) Res resource type: SUNW.HAStoragePlus:8 (oracle1:oracle1-zfs) Res type version: 8 (oracle1:oracle1-zfs) Res resource group name: oracle1 (oracle1:oracle1-zfs) Res resource project name: user.oracle (oracle1:oracle1-zfs{kvsdb1}) Res enabled: True
Example of	(oracle1:oracle1-zfs{kvsdb2}) Res enabled: True

Command	/usr/cluster/bin/scrgadm -pvv
output (continued)	(oracle1:oracle1-zfs{kvsdb1}) Res monitor enabled: True (oracle1:oracle1-zfs{kvsdb2}) Res monitor enabled: True (oracle1:oracle1-zfs) Res strong dependencies: <NULL> (oracle1:oracle1-zfs) Res weak dependencies: <NULL> (oracle1:oracle1-zfs) Res restart dependencies: <NULL> (oracle1:oracle1-zfs) Res offline restart dependencies: <NULL> (oracle1:oracle1-zfs) Res property name: Retry_interval (oracle1:oracle1-zfs:Retry_interval) Res property class: standard (oracle1:oracle1-zfs:Retry_interval) Res property description: Time in which monitor attempts to restart a failed resource Retry_count times. (oracle1:oracle1-zfs:Retry_interval) Res property type: int (oracle1:oracle1-zfs:Retry_interval) Res property value: 300 (oracle1:oracle1-zfs) Res property name: Retry_count (oracle1:oracle1-zfs:Retry_count) Res property class: standard (oracle1:oracle1-zfs:Retry_count) Res property description: Indicates the number of times a monitor restarts the resource if it fails. (oracle1:oracle1-zfs:Retry_count) Res property type: int (oracle1:oracle1-zfs:Retry_count) Res property value: 2 (oracle1:oracle1-zfs) Res property name: Failover_mode (oracle1:oracle1-zfs:Failover_mode) Res property class: standard (oracle1:oracle1-zfs:Failover_mode) Res property description: Modifies recovery actions taken when the resource fails. (oracle1:oracle1-zfs:Failover_mode) Res property type: enum (oracle1:oracle1-zfs:Failover_mode) Res property value: SOFT (oracle1:oracle1-zfs) Res property name: POSTNET_STOP_TIMEOUT (oracle1:oracle1-zfs:POSTNET_STOP_TIMEOUT) Res property class: standard (oracle1:oracle1-zfs:POSTNET_STOP_TIMEOUT) Res property description: Maximum execution time allowed for Postnet_stop method.

Command	/usr/cluster/bin/scrgadm -pvv
	(oracle1:oracle1-zfs:POSTNET_STOP_TIMEOUT) Res property type: int (oracle1:oracle1-zfs:POSTNET_STOP_TIMEOUT) Res property value: 1800 (oracle1:oracle1-zfs) Res property name: PRENET_START_TIMEOUT (oracle1:oracle1-zfs:PRENET_START_TIMEOUT) Res property class: standard (oracle1:oracle1-zfs:PRENET_START_TIMEOUT) Res property description: Maximum execution time allowed for Prenet_Start method. (oracle1:oracle1-zfs:PRENET_START_TIMEOUT) Res property type: int (oracle1:oracle1-zfs:PRENET_START_TIMEOUT) Res property value: 1800 (oracle1:oracle1-zfs) Res property name: MONITOR_CHECK_TIMEOUT (oracle1:oracle1-zfs:MONITOR_CHECK_TIMEOUT) Res property class: standard (oracle1:oracle1-zfs:MONITOR_CHECK_TIMEOUT) Res property description: Maximum execution time allowed for Monitor_Check method. (oracle1:oracle1-zfs:MONITOR_CHECK_TIMEOUT) Res property type: int (oracle1:oracle1-zfs:MONITOR_CHECK_TIMEOUT) Res property value: 90 (oracle1:oracle1-zfs) Res property name: MONITOR_STOP_TIMEOUT (oracle1:oracle1-zfs:MONITOR_STOP_TIMEOUT) Res property class: standard (oracle1:oracle1-zfs:MONITOR_STOP_TIMEOUT) Res property description: Maximum execution time allowed for Monitor_Stop method. (oracle1:oracle1-zfs:MONITOR_STOP_TIMEOUT) Res property type: int (oracle1:oracle1-zfs:MONITOR_STOP_TIMEOUT) Res property value: 90 (oracle1:oracle1-zfs) Res property name: MONITOR_START_TIMEOUT (oracle1:oracle1-zfs:MONITOR_START_TIMEOUT) Res property class: standard (oracle1:oracle1-zfs:MONITOR_START_TIMEOUT) Res property

Command	/usr/cluster/bin/scrgadm -pvv
	description: Maximum execution time allowed for Monitor_Start method. (oracle1:oracle1-zfs:MONITOR_START_TIMEOUT) Res property type: int (oracle1:oracle1-zfs:MONITOR_START_TIMEOUT) Res property value: 90 (oracle1:oracle1-zfs) Res property name: INIT_TIMEOUT (oracle1:oracle1-zfs:INIT_TIMEOUT) Res property class: standard (oracle1:oracle1-zfs:INIT_TIMEOUT) Res property description: Maximum execution time allowed for Init method. (oracle1:oracle1-zfs:INIT_TIMEOUT) Res property type: int (oracle1:oracle1-zfs:INIT_TIMEOUT) Res property value: 1800 (oracle1:oracle1-zfs) Res property name: UPDATE_TIMEOUT (oracle1:oracle1-zfs:UPDATE_TIMEOUT) Res property class: standard (oracle1:oracle1-zfs:UPDATE_TIMEOUT) Res property description: Maximum execution time allowed for Update method. (oracle1:oracle1-zfs:UPDATE_TIMEOUT) Res property type: int (oracle1:oracle1-zfs:UPDATE_TIMEOUT) Res property value: 1800 (oracle1:oracle1-zfs) Res property name: VALIDATE_TIMEOUT (oracle1:oracle1-zfs:VALIDATE_TIMEOUT) Res property class: standard (oracle1:oracle1-zfs:VALIDATE_TIMEOUT) Res property description: Maximum execution time allowed for Validate method. (oracle1:oracle1-zfs:VALIDATE_TIMEOUT) Res property type: int (oracle1:oracle1-zfs:VALIDATE_TIMEOUT) Res property value: 1800 (oracle1:oracle1-zfs) Res property name: ZpoolsSearchDir (oracle1:oracle1-zfs:ZpoolsSearchDir) Res property class: extension (oracle1:oracle1-zfs:ZpoolsSearchDir) Res property description: Directory location to search devices for zpools (oracle1:oracle1-zfs:ZpoolsSearchDir) Res property pernode: False (oracle1:oracle1-zfs:ZpoolsSearchDir) Res property type: string

Command	/usr/cluster/bin/scrgadm -pvv
	(oracle1:oracle1-zfs:ZpoolsSearchDir) Res property value: (oracle1:oracle1-zfs) Res property name: FilesystemCheckCommand (oracle1:oracle1-zfs:FilesystemCheckCommand) Res property class: extension (oracle1:oracle1-zfs:FilesystemCheckCommand) Res property description: Command string to be executed for file system checks (oracle1:oracle1-zfs:FilesystemCheckCommand) Res property pernode: False (oracle1:oracle1-zfs:FilesystemCheckCommand) Res property type: stringarray (oracle1:oracle1-zfs:FilesystemCheckCommand) Res property value: <NULL> (oracle1:oracle1-zfs) Res property name: AffinityOn (oracle1:oracle1-zfs:AffinityOn) Res property class: extension (oracle1:oracle1-zfs:AffinityOn) Res property description: For specifying affinity switchover (oracle1:oracle1-zfs:AffinityOn) Res property pernode: False (oracle1:oracle1-zfs:AffinityOn) Res property type: boolean (oracle1:oracle1-zfs:AffinityOn) Res property value: TRUE (oracle1:oracle1-zfs) Res property name: FilesystemMountPoints (oracle1:oracle1-zfs:FilesystemMountPoints) Res property class: extension (oracle1:oracle1-zfs:FilesystemMountPoints) Res property description: The list of file system mountpoints (oracle1:oracle1-zfs:FilesystemMountPoints) Res property pernode: False (oracle1:oracle1-zfs:FilesystemMountPoints) Res property type: stringarray (oracle1:oracle1-zfs:FilesystemMountPoints) Res property value: <NULL> (oracle1:oracle1-zfs) Res property name: GlobalDevicePaths (oracle1:oracle1-zfs:GlobalDevicePaths) Res property class: extension (oracle1:oracle1-zfs:GlobalDevicePaths) Res property description:

Command	/usr/cluster/bin/scrgadm -pvv
	The list of HA global device paths (oracle1:oracle1-zfs:GlobalDevicePaths) Res property pernode: False (oracle1:oracle1-zfs:GlobalDevicePaths) Res property type: stringarray (oracle1:oracle1-zfs:GlobalDevicePaths) Res property value: <NULL> (oracle1:oracle1-zfs) Res property name: Zpools (oracle1:oracle1-zfs:Zpools) Res property class: extension (oracle1:oracle1-zfs:Zpools) Res property description: The list of zpools (oracle1:oracle1-zfs:Zpools) Res property pernode: False (oracle1:oracle1-zfs:Zpools) Res property type: stringarray (oracle1:oracle1-zfs:Zpools) Res property value: oracle1prod (oracle1) Res name: oracle1-lh (oracle1:oracle1-lh) Res R_description: (oracle1:oracle1-lh) Res resource type: SUNW.LogicalHostname:2 (oracle1:oracle1-lh) Res type version: 2 (oracle1:oracle1-lh) Res resource group name: oracle1 (oracle1:oracle1-lh) Res resource project name: user.oracle (oracle1:oracle1-lh{kvsdb1}) Res enabled: True (oracle1:oracle1-lh{kvsdb2}) Res enabled: True (oracle1:oracle1-lh{kvsdb1}) Res monitor enabled: True (oracle1:oracle1-lh{kvsdb2}) Res monitor enabled: True (oracle1:oracle1-lh) Res strong dependencies: <NULL> (oracle1:oracle1-lh) Res weak dependencies: <NULL> (oracle1:oracle1-lh) Res restart dependencies: <NULL> (oracle1:oracle1-lh) Res offline restart dependencies: <NULL> (oracle1:oracle1-lh) Res property name: Retry_interval (oracle1:oracle1-lh:Retry_interval) Res property class: standard (oracle1:oracle1-lh:Retry_interval) Res property description:

Command	/usr/cluster/bin/scrgadm -pvv
	Time in which monitor attempts to restart a failed resource Retry_count times. (oracle1:oracle1-lh:Retry_interval) Res property type: int (oracle1:oracle1-lh:Retry_interval) Res property value: 300 (oracle1:oracle1-lh) Res property name: Retry_count (oracle1:oracle1-lh:Retry_count) Res property class: standard (oracle1:oracle1-lh:Retry_count) Res property description: Indicates the number of times a monitor restarts the resource if it fails. (oracle1:oracle1-lh:Retry_count) Res property type: int (oracle1:oracle1-lh:Retry_count) Res property value: 2 (oracle1:oracle1-lh) Res property name: Thorough_probe_interval (oracle1:oracle1-lh:Thorough_probe_interval) Res property class: standard (oracle1:oracle1-lh:Thorough_probe_interval) Res property description: Time between invocations of a high-overhead fault probe of the resource. (oracle1:oracle1-lh:Thorough_probe_interval) Res property type: int (oracle1:oracle1-lh:Thorough_probe_interval) Res property value: 60 (oracle1:oracle1-lh) Res property name: Cheap_probe_interval (oracle1:oracle1-lh:Cheap_probe_interval) Res property class: standard (oracle1:oracle1-lh:Cheap_probe_interval) Res property description: Time between invocations of a quick fault probe of the resource. (oracle1:oracle1-lh:Cheap_probe_interval) Res property type: int (oracle1:oracle1-lh:Cheap_probe_interval) Res property value: 60 (oracle1:oracle1-lh) Res property name: Failover_mode (oracle1:oracle1-lh:Failover_mode) Res property class: standard (oracle1:oracle1-lh:Failover_mode) Res property description: Modifies recovery actions taken when the resource fails. (oracle1:oracle1-lh:Failover_mode) Res property type: enum

Command	/usr/cluster/bin/scrgadm -pvv
	(oracle1:oracle1-lh:Failover_mode) Res property value: HARD (oracle1:oracle1-lh) Res property name: PRENET_START_TIMEOUT (oracle1:oracle1-lh:PRENET_START_TIMEOUT) Res property class: standard (oracle1:oracle1-lh:PRENET_START_TIMEOUT) Res property description: Maximum execution time allowed for Prenet_Start method. (oracle1:oracle1-lh:PRENET_START_TIMEOUT) Res property type: int (oracle1:oracle1-lh:PRENET_START_TIMEOUT) Res property value: 300 (oracle1:oracle1-lh) Res property name: MONITOR_CHECK_TIMEOUT (oracle1:oracle1-lh:MONITOR_CHECK_TIMEOUT) Res property class: standard (oracle1:oracle1-lh:MONITOR_CHECK_TIMEOUT) Res property description: Maximum execution time allowed for Monitor_Check method. (oracle1:oracle1-lh:MONITOR_CHECK_TIMEOUT) Res property type: int (oracle1:oracle1-lh:MONITOR_CHECK_TIMEOUT) Res property value: 300 (oracle1:oracle1-lh) Res property name: MONITOR_STOP_TIMEOUT (oracle1:oracle1-lh:MONITOR_STOP_TIMEOUT) Res property class: standard (oracle1:oracle1-lh:MONITOR_STOP_TIMEOUT) Res property description: Maximum execution time allowed for Monitor_Stop method. (oracle1:oracle1-lh:MONITOR_STOP_TIMEOUT) Res property type: int (oracle1:oracle1-lh:MONITOR_STOP_TIMEOUT) Res property value: 300 (oracle1:oracle1-lh) Res property name: MONITOR_START_TIMEOUT (oracle1:oracle1-lh:MONITOR_START_TIMEOUT) Res property class: standard (oracle1:oracle1-lh:MONITOR_START_TIMEOUT) Res property description: Maximum execution time allowed for Monitor_Start method. (oracle1:oracle1-lh:MONITOR_START_TIMEOUT) Res property type:

Command	/usr/cluster/bin/scrgadm -pvv
	int (oracle1:oracle1-lh:MONITOR_START_TIMEOUT) Res property value: 300 (oracle1:oracle1-lh) Res property name: UPDATE_TIMEOUT (oracle1:oracle1-lh:UPDATE_TIMEOUT) Res property class: standard (oracle1:oracle1-lh:UPDATE_TIMEOUT) Res property description: Maximum execution time allowed for Update method. (oracle1:oracle1-lh:UPDATE_TIMEOUT) Res property type: int (oracle1:oracle1-lh:UPDATE_TIMEOUT) Res property value: 300 (oracle1:oracle1-lh) Res property name: VALIDATE_TIMEOUT (oracle1:oracle1-lh:VALIDATE_TIMEOUT) Res property class: standard (oracle1:oracle1-lh:VALIDATE_TIMEOUT) Res property description: Maximum execution time allowed for Validate method. (oracle1:oracle1-lh:VALIDATE_TIMEOUT) Res property type: int (oracle1:oracle1-lh:VALIDATE_TIMEOUT) Res property value: 300 (oracle1:oracle1-lh) Res property name: STOP_TIMEOUT (oracle1:oracle1-lh:STOP_TIMEOUT) Res property class: standard (oracle1:oracle1-lh:STOP_TIMEOUT) Res property description: Maximum execution time allowed for Stop method. (oracle1:oracle1-lh:STOP_TIMEOUT) Res property type: int (oracle1:oracle1-lh:STOP_TIMEOUT) Res property value: 300 (oracle1:oracle1-lh) Res property name: START_TIMEOUT (oracle1:oracle1-lh:START_TIMEOUT) Res property class: standard (oracle1:oracle1-lh:START_TIMEOUT) Res property description: Maximum execution time allowed for Start method. (oracle1:oracle1-lh:START_TIMEOUT) Res property type: int (oracle1:oracle1-lh:START_TIMEOUT) Res property value: 500 (oracle1:oracle1-lh) Res property name: CheckNameService (oracle1:oracle1-lh:CheckNameService) Res property class: extension (oracle1:oracle1-lh:CheckNameService) Res property description: Name service check flag

Command	/usr/cluster/bin/scrgadm -pvv
	(oracle1:oracle1-lh:CheckNameService) Res property pernode: False (oracle1:oracle1-lh:CheckNameService) Res property type: boolean (oracle1:oracle1-lh:CheckNameService) Res property value: TRUE (oracle1:oracle1-lh) Res property name: NetIfList (oracle1:oracle1-lh:NetIfList) Res property class: extension (oracle1:oracle1-lh:NetIfList) Res property description: List of IPMP groups on each node (oracle1:oracle1-lh:NetIfList) Res property pernode: False (oracle1:oracle1-lh:NetIfList) Res property type: stringarray (oracle1:oracle1-lh:NetIfList) Res property value: ipmp1@1 ipmp1@2 (oracle1:oracle1-lh) Res property name: HostnameList (oracle1:oracle1-lh:HostnameList) Res property class: extension (oracle1:oracle1-lh:HostnameList) Res property description: List of hostnames this resource manages (oracle1:oracle1-lh:HostnameList) Res property pernode: False (oracle1:oracle1-lh:HostnameList) Res property type: stringarray (oracle1:oracle1-lh:HostnameList) Res property value: oracle1 ...
Values taken	• Groups: ◦ Name ◦ Description ◦ Management state ◦ Mode (failover/scalable) ◦ Maximum primaries ◦ Desired primaries ◦ Nodes list ◦ Is system ◦ Autostart on new cluster ◦ Failback • Resources: ◦ Name

Command	/usr/cluster/bin/scrgadm -pvv
	◦ Description ◦ Type ◦ Failover mode ◦ Retry interval ◦ Retry count
Comments	Based on the extracted value, Discovery creates Resource Groups with attributes and Resources with attributes. LogicalHostname handling: for this type of resource Discovery extracts an additional **HostnameList** property that contains the host names that this resource manages. Host names are resolved to IPs. Resolved IPs are attached to the **ClusteredServer** CIT.

Get Cluster Interconnection Information

Command	/usr/cluster/bin/scstat -W

Example of output	`-- Cluster Transport Paths --`
	`Endpoint Endpoint Status`
	`-------- -------- ------`
	`Transport path: node1:bge3 node2:nxge11 Path online`
	`Transport path: node1:nxge3 node2:nxge3 Path online`

Values taken	Output contains the list of transport paths with their statuses. For each path which is online we get source interface on a source node and target interface on a target node.
Comments	Such transport path will be reported with Layer2 links from source interface to target interface. To report the remote interface (located on a node which is not the one connected to), the MAC addresses described below are retrieved.

Command	/usr/cluster/bin/scconf -p
Example of output	... Cluster install mode: disabled Cluster private net: 172.2.0.0 Cluster private netmask: 255.255.255.192 Cluster maximum nodes: 6 Cluster maximum private networks: 4 Cluster new node authentication: unix Cluster authorized-node list: <. - Exclude all nodes> Cluster transport heart beat timeout: 10000 Cluster transport heart beat quantum: 1000 Round Robin Load Balancing UDP session timeout: 480 Cluster nodes: node1 node2 Cluster node name: node1 Node ID: 1 Node enabled: yes Node private hostname: clusternode1-priv Node quorum vote count: 1 Node reservation key: 0x4A7ADDD300000001 Node zones: <NULL> CPU shares for global zone: 1 Minimum CPU requested for global zone: 1 Node transport adapters: nxge3 bge3 Node transport adapter: nxge3 Adapter enabled: yes Adapter transport type: dlpi Adapter property: device_name=nxge
Example of output (continued)	Adapter property: device_instance=3 Adapter property: lazy_free=1 Adapter property: dlpi_heartbeat_timeout=10000

	Adapter property: dlpi_heartbeat_quantum=1000 Adapter property: nw_bandwidth=80 Adapter property: bandwidth=70 Adapter property: ip_address=172.2.0.9 Adapter property: netmask=255.255.255.248 Adapter port names: 0 Adapter port: 0 Port enabled: yes Node transport adapter: bge3 Adapter enabled: yes Adapter transport type: dlpi Adapter property: device_name=bge Adapter property: device_instance=3 Adapter property: lazy_free=1 Adapter property: dlpi_heartbeat_timeout=10000 Adapter property: dlpi_heartbeat_quantum=1000 Adapter property: nw_bandwidth=80 Adapter property: bandwidth=70 Adapter property: ip_address=172.2.0.17 Adapter property: netmask=255.255.255.248 Adapter port names: 0 Adapter port: 0 Port enabled: yes ...
Values taken	Private network address. List of interfaces that are used in cluster interconnect: name and IP address assigned.

Command	/usr/sbin/arp 172.2.0.10
Example of output	`172.2.0.10 (172.2.0.10) at 0:21:a8:39:33:a9`
Values taken	MAC
Comments	Discovery resolves the MAC address of remote interface via arp. If it cannot be resolved, Discovery does not report the transport path as Layer2 link.

Get Quorum Configuration

Command	/usr/cluster/bin/scstat -q

Example of output	`-- Quorum Summary from latest node reconfiguration --`
	`Quorum votes possible: 3`
	`Quorum votes needed: 2`
	`Quorum votes present: 3`
	`-- Quorum Votes by Node (current status) --`
	`Node Name Present Possible Status`
	`--------- ------- -------- ------`
	`Node votes: node1 1 1 Online`
	`Node votes: node2 1 1 Online`
	`-- Quorum Votes by Device (current status) --`
	`Device Name Present Possible Status`
	`----------- ------- -------- ------`
	`Device votes: clusterquo1 1 1 Online`

Values taken	The quorum status information.
Comments	The details about quorum devices are appended to the Quorum Configuration config file.

Chapter 28: Veritas Discovery

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Overview

A Veritas Cluster group is a collection of dependent or related resources that is managed as a single unit. Each Veritas Cluster group is linked to a designated node, which is responsible for activating the resources contained in the group. If a failure occurs in the designated node, the responsibility for activating the resources is switched over to a different node.

Veritas Clusters are composed of several clustered servers. Each server is responsible for running certain services and applications. The servers are used as backups for one another. When a system components fails, another server takes over to provide the necessary service.

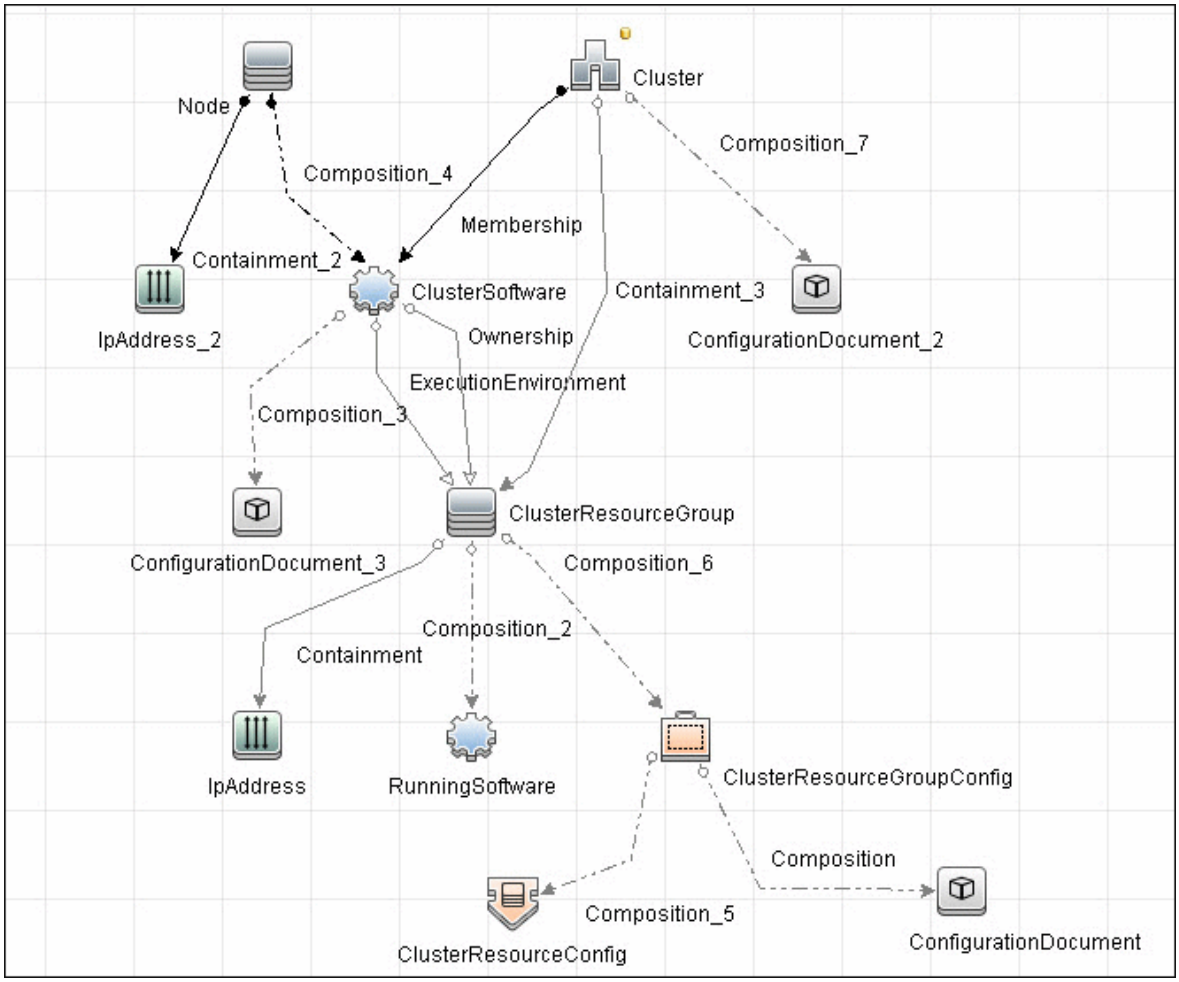
Supported Versions

Veritas Cluster Server (VCS) for UNIX 2.x, 3.x, 4.x, 5.x

Topology

This view shows the top layer of the Veritas Cluster topology. It displays the discovered Veritas Cluster and the clustered software resources that are members of that cluster. Each software resource is linked by a **membership** relationship to the Veritas Cluster.

> **Note:** For a list of discovered CITs, see "Veritas Cluster by Shell Job" on the next page.



How to Discover Veritas Cluster Servers

The Veritas Cluster discovery process enables you to discover Veritas Cluster Servers (VCS), and their member machines (also referred to as nodes), that activate the discovered resources provided by the cluster.

This task includes the following steps:

1. Prerequisite - Set up protocol credentials

   This discovery uses the SSH/Telnet protocols.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Run the discovery

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

   Run the following jobs in the following order:

   a. Run the **Host Connection by Shell** job.

   b. Run the **Host Applications by Shell** job.

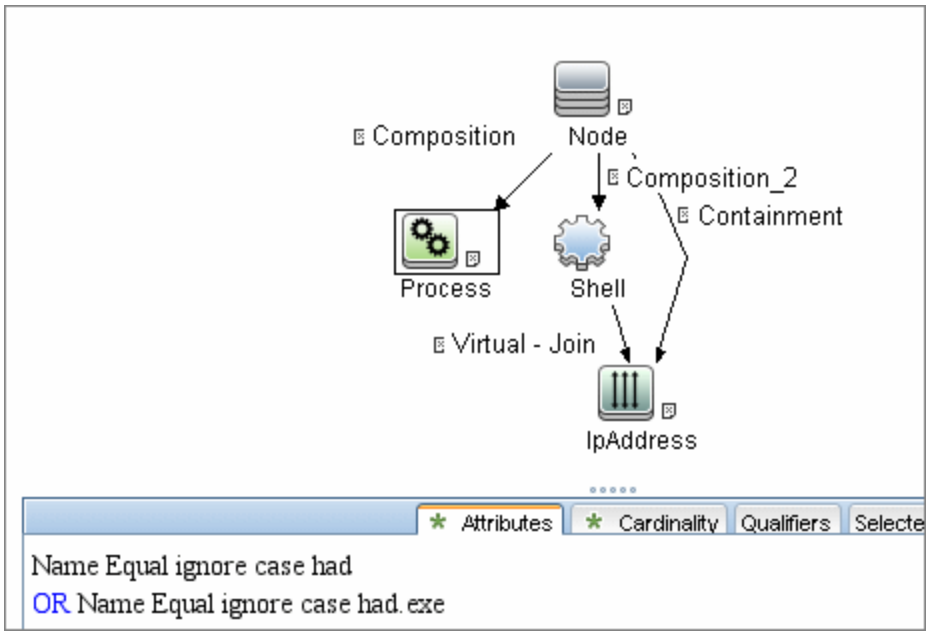
   c. Run the **Veritas Cluster by Shell** job. For job details, see "Veritas Cluster by Shell Job" below.

Veritas Cluster by Shell Job

This section includes details about the job.

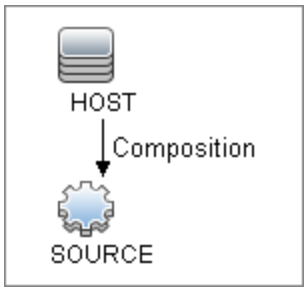
Trigger Query

- **Trigger query**:



Adapter

- **Input query**:



Used Scripts

- file_ver_lib.py
- Veritas_Cluster_Topology.py

Discovered CITs

- ClusterSoftware
- Composition
- ConfigurationDocument
- Containment
- Dependency
- IpAddress
- IpServiceEndpoint
- Membership
- Node
- Ownership
- RunningSoftware
- Usage
- VCS Resource Group
- VCS resource
- Veritas Cluster

> **Note:** To view the topology, see "Topology" on page 458.

Part 4: Clustering and Load Balancing > Load Balancers

Chapter 29: Load Balancer Discovery

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Overview

DFM discovers the following load balancers:

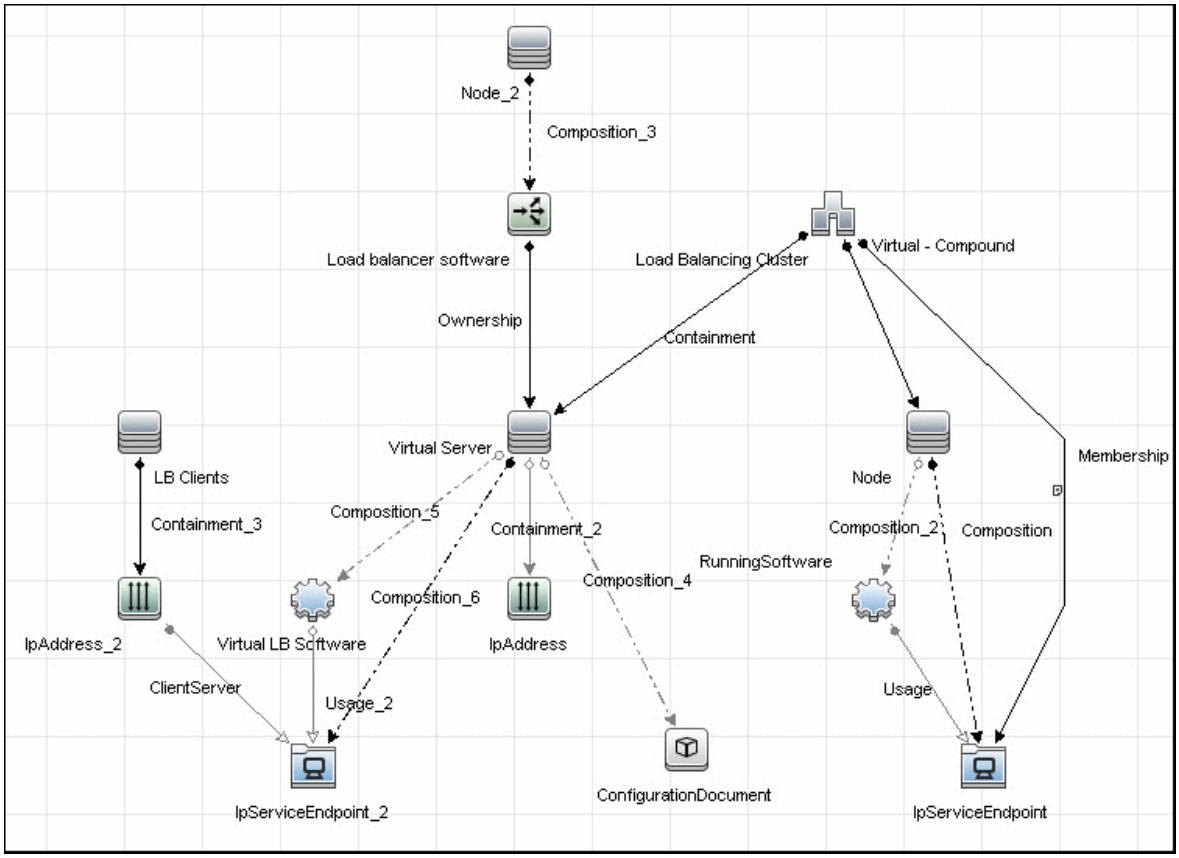
- F5 BIG-IP Local Traffic Manager (LTM)
- Nortel Application Switches (formerly known as Alteon Application Switches)
- Cisco Content Services Switches (CSS)
- Citrix NetScaler

Supported Versions

The supported version for each load balancer is as follows:

- **F5 BIG-IP Local Traffic Manager:** versions 4.6, 9.1, 10.x, 11.x, 12, and 13.
- **Nortel Application Switches:** no known limitations.
- **Cisco Content Services Switches:** no known limitations.
- **Citrix NetScaler:** no known limitations.

Topology



Note: For a list of discovered CITs, see "Discovered CITs" on page 487.

How to Discover Load Balancers

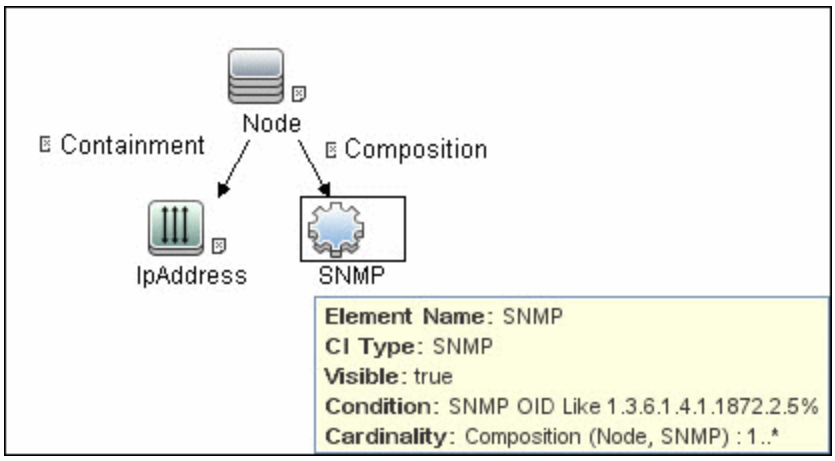
This task explains how to discover load balancers and includes the following steps:

- "Prerequisites" below
- "Run the discovery" on page 467

1. Prerequisites

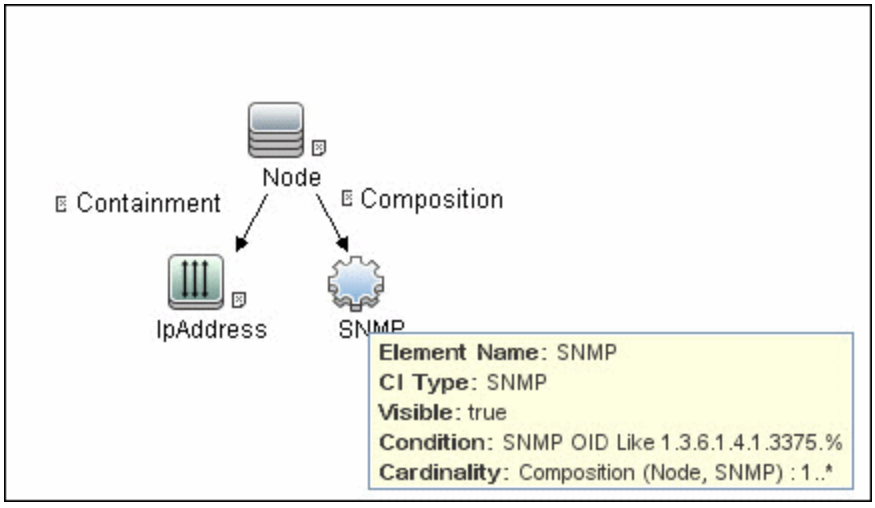
Run the **Host Connection by SNMP** job to discover and create SNMP CIs which answer the following requirements:

- To be the trigger query for the **Alteon application switch by SNMP** job with the following condition:



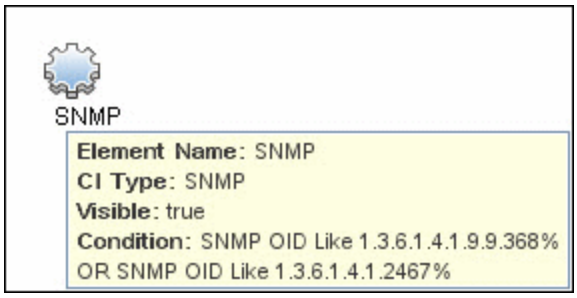

```
SNMP OID Like 1.3.6.1.4.1.1872.2.5%
```

- To be the trigger query for the **F5 BIG-IP LTM by SNMP** job with the following condition:



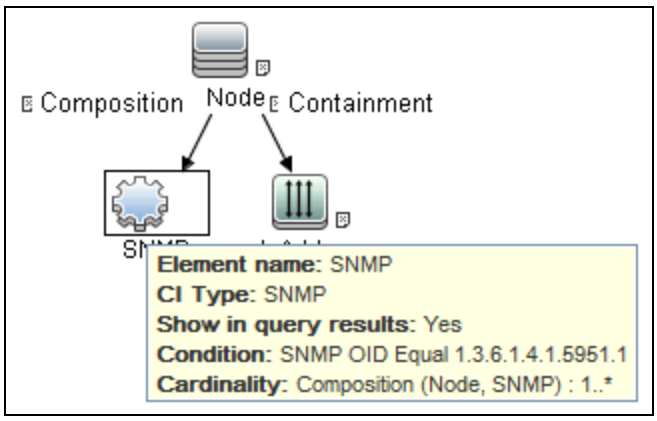

```
SNMP OID Like 1.3.6.1.4.1.3375%
```

- To be the trigger query for the **Cisco CSS by SNMP** job with the following condition:




```
SNMP OID Like 1.3.6.1.4.1.9.9.368% OR 1.3.6.1.4.1.2467%
```

- To be the trigger query for the **Citrix NetScaler by SNMP** job with the following condition:




```
SNMP OID Equal 1.3.6.1.4.1.5951.1
```

For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Run the discovery

- **Host Connection by SNMP.** For details on the prerequisites to running a load balancer job, see "Prerequisites" on page 465.
- Run any of the following jobs:
  - **F5 BIG-IP LTM by SNMP**
  - **Alteon application switch by SNMP**
  - **Cisco CSS by SNMP**
  - **Citrix NetScaler by SNMP**

  For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

A10 vThunder by SNMP Job

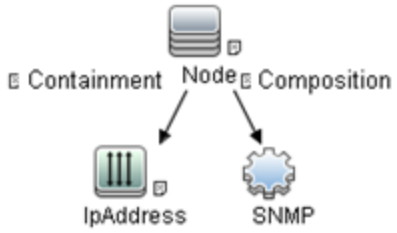
This job discovers A10 vThunder load balancers and all related CIs.

Queried SNMP Tables

The following SNMP tables are queried:

Table Name	Name From MIB	OID
Real servers	axServerPortEntry	1.3.6.1.4.1.22610.2.4.3.2.3.1.1
ServiceGroupMember	axServiceGroupMemberEntry	1.3.6.1.4.1.22610.2.4.3.3.3.1.1
Virtual servers	axVirtualServerPortEntry	1.3.6.1.4.1.22610.2.4.3.4.3.1.1

Trigger Query:



Node Name	Condition
IpAddress	NOT IP Probe Name Is null
SNMP	SNMP OID Like 1.3.6.1.4.1.22610%
Node	none

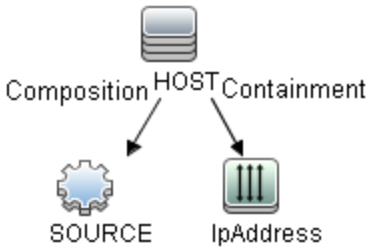
Adapter Information

This job uses the **A10_vThunder_by_SNMP** adapter.

Input CIT

SNMP

Input TQL Query



Node Name	Condition
SOURCE	None
IpAddress	IpAddressType Equal IPv4
HOST	None

Triggered CI Data

Name	Value
credentialsId	${SOURCE.credentials_id}
ip_address	${SOURCE.application_ip}
oid	${SOURCE.snmp_oid}

Used Scripts

snmputils.py

A10_vThunder_by_SNMP.py

Discovered CITs

- A10 vThunder
- Composition
- ConfigurationDocument
- Containment
- IpAddress
- IpServiceEndpoint
- Load Balancer
- Load Balancing Cluster
- Membership
- Node
- Ownership

Alteon Application Switch by SNMP Job

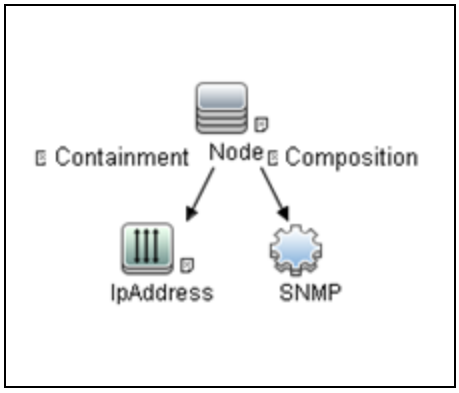
This job discovers Nortel (Alteon) load balancers and all related CIs.

Queried SNMP Tables

The following SNMP tables are queried:

Table Name	Name From MIB	OID
Virtual servers	slbCurCfgVirtServer Table	1.3.6.1.4.1.1872.2.5.4.1.1.4.2.1
Virtual services	slbCurCfgVirtServices Table	1.3.6.1.4.1.1872.2.5.4.1.1.4.5.1
Real groups	slbCurCfgGroupEntry	1.3.6.1.4.1.1872.2.5.4.1.1.3.3.1
Real servers	slbCurCfgRealServer Table	1.3.6.1.4.1.1872.2.5.4.1.1.2.2.1
Port links	slbCurCfgRealServPortTable	1.3.6.1.4.1.1872.2.5.4.1.1.2.5.1
Ports	slbCurCfgPortTable	1.3.6.1.4.1.1872.2.5.4.1.1.5.2.1

Trigger Query



Node Name	Condition
IpAddress	NOT IP Probe Name Is null
SNMP	SNMP OID Like 1.3.6.1.4.1.1872.2.5%
Node	none

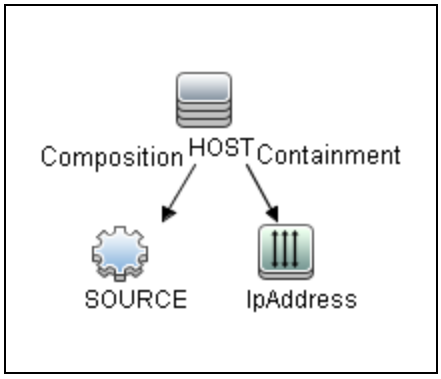
Adapter Information

This job uses the **Alteon_app_switch_by_SNMP** adapter.

Input CIT

SNMP

Input TQL Query



Node Name	Condition
SOURCE	None
IpAddress	IpAddressType Equal IPv4
HOST	None

Triggered CI Data

Name	Value
credentialsId	${SOURCE.credentials_id}
ip_address	${SOURCE.application_ip}
oid	${SOURCE.snmp_oid}

Used Scripts

- snmputils.py
- Alteon_app_switch_by_SNMP.py

Discovered CITs

- Alteon application switch
- Composition
- ConfigurationDocument
- Containment
- IpAddress
- IpServiceEndpoint
- Load Balancer
- Load Balancing Cluster
- Membership
- Node
- Ownership

F5 BIG-IP LTM by SNMP Job

This job discovers the F5 BIG-IP Local Traffic Manager (LTM) by SNMP. DFM chooses all SNMPs related to F5 and runs against them.

The package supports F5 BIG-IP LTM, versions 4, 9, 10, 11, 12, and 13.

Queried SNMP Tables

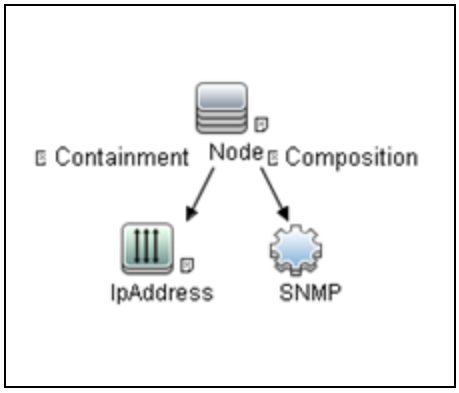
The following SNMP tables are queried for versions 10 and 9:

Table Name	Name From MIB	OID
General information	sysProduct	1.3.6.1.4.1.3375.2.1.4
Virtual servers	ltmVirtualServTable	1.3.6.1.4.1.3375.2.2.10.1.2.1
Pools	ltmPoolTable	1.3.6.1.4.1.3375.2.2.5.1.2.1
Pools to server	ltmVirtualServPool Table	1.3.6.1.4.1.3375.2.2.10.6.2.1
Pool members	ltmPoolMemberTable	1.3.6.1.4.1.3375.2.2.5.3.2.1
Rules to servers	ltmVirtualServRule Table	1.3.6.1.4.1.3375.2.2.10.8.2.1
Rules	ltmRuleTable	1.3.6.1.4.1.3375.2.2.8.1.2.1

The following SNMP tables are queried for version 4:

Table Name	Name From MIB	OID
General information	globalAttributes	1.3.6.1.4.1.3375.1.1.1.1
Virtual servers	virtualServerTable	1.3.6.1.4.1.3375.1.1.3.2.1
Pools	poolTable	1.3.6.1.4.1.3375.1.1.7.2.1
Pool members	poolMemberTable	1.3.6.1.4.1.3375.1.1.8.2.1

Trigger Query



Node Name	Condition
IpAddress	NOT IP Probe Name Is null
SNMP	SNMP OID Like 1.3.6.1.4.1.3375.%
Node	None

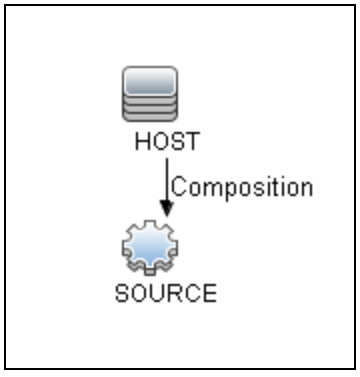
Adapter Information

This job uses the **F5_BIGIP_LTM_by_SNMP** adapter.

Input CIT

SNMP

Input TQL Query



Node Name	Condition
SOURCE	None
HOST	None

Triggered CI Data

Name	Value
credentialsId	${SOURCE.credentials_id}
ip_address	${SOURCE.application_ip}

Used Scripts

- snmputils.py
- F5_BIGIP_LTM_by_SNMP.py

Discovered CITs

- Composition
- ConfigurationDocument
- Containment
- F5 BIG-IP LTM
- IpAddress
- IpServiceEndpoint
- Load Balancer
- Load Balancing Cluster
- Membership
- Node
- Ownership

F5 BIG-IP LTM by Shell Job

This job discovers the F5 BIG-IP Local Traffic Manager (LTM) by Shell. Data Flow Management chooses all shells related to F5 and runs against them.

Versions

The package supports F5 BIG-IP LTM, versions 10.x, 11.x, 12, and 13.

Prerequisites

This adapter needs SSH protocol credentials which include username and password.

> **Note:**
>
> - Since the F5 configuration files are readable for all users and writable for root, the user is not required to login as root.
> - In the account of the F5 to be discovered, you need to disable the paging of the command line; otherwise, this job might fail.

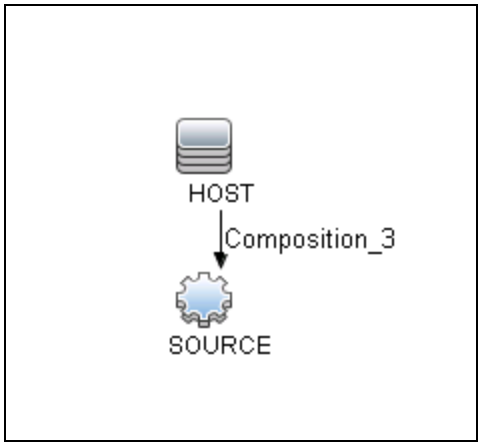
Adapter Information

This job uses the **F5_BIGIP_LTM_by_Shell** adapter. The adapter parses and fetches data from the configuration document of F5 BIG-IP LTM by using Shell command.

Input CIT

Shell

Input TQL Query



CI	Attribute Value
HOST	CI Type Equal lb

Triggered CI Data

Name	Value
Protocol	${SOURCE.root_class}
connected_os_credentials_id	${SOURCE.connected_os_credentials_id:NA}
credentialsId	${SOURCE.credentials_id}
hostId	${HOST.root_id}
ip_address	${SOURCE.application_ip}

Used Scripts

- F5_BIGIP_LTM_by_Shell.py

Discovered CITs

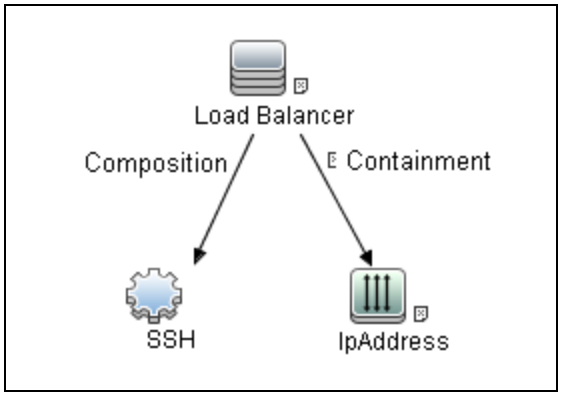
- Composition
- ConfigurationDocument

- Containment
- F5 BIG-IP LTM
- IpAddress
- IpServiceEndpoint
- Load Balancer
- Load Balancing Cluster
- Membership
- Node
- Ownership

Adapter Parameters

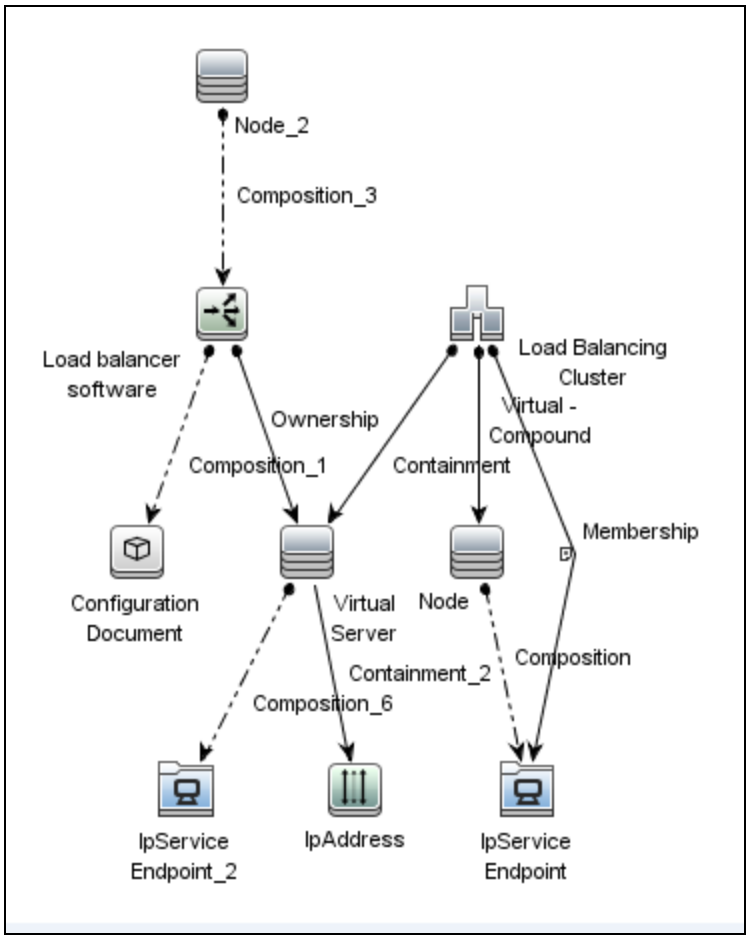
Parameter	Default Value	Description
f5CommandTimeOut	5000	The command timeout value for Traffic Management Shell (tmsh).
useServicesFile	false	Indicates whether to use the customer-provided services file **f5_services.conf** or UCMDB **portNumberToPortName.xml**. **false** (default)**.** Uses the **portNumberToPortName.xml** file in UCMDB. **true.** Uses the customer-provided services file **f5_services.conf** that is packaged under the **<*DataFlowProbe_Home*>\runtime\probeManager\discoveryResources** folder.

Trigger TQL



CI	Attribute Value
IpAddress	NOT IP Probe Name Is null

Topology



Cisco ACE by SNMP Job

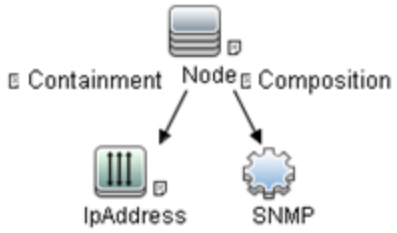
This job discovers Cisco ACE load balancers and all related CIs.

Queried SNMP Tables

The following SNMP tables are queried:

Table Name	Name From MIB	OID
Virtual servers	slbVirtualServerTableEntry	1.3.6.1.4.1.9.9.161.1.4.1.1
Farm	slbServerFarmTableEntry	1.3.6.1.4.1.9.9.161.1.2.1.1
Real servers	slbRealTableEntry	1.3.6.1.4.1.9.9.161.1.3.1.1

Trigger Query



Node Name	Condition
IpAddress	NOT IP Probe Name Is null
SNMP	SNMP OID Like 1.3.6.1.4.1.824% OR SNMP OID Like 1.3.6.1.4.1.729% OR SNMP OID Like 1.3.6.1.4.1.730% OR SNMP OID Like 1.3.6.1.4.1.1231% OR SNMP OID Like 1.3.6.1.4.1.1291%
Node	none

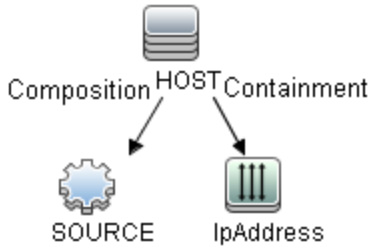
Adapter Information

This job uses the **Cisco_ACE_by_SNMP** adapter.

Input CIT

SNMP

Input TQL Query



Node Name	Condition
SOURCE	None
IpAddress	IpAddressType Equal IPv4
HOST	None

Triggered CI Data

Name	Value
credentialsId	${SOURCE.credentials_id}
ip_address	${SOURCE.application_ip}
oid	${SOURCE.snmp_oid}

Used Scripts

snmputils.py

Cisco_ACE_by_SNMP.py

Discovered CITs

- Cisco ACE
- Composition
- ConfigurationDocument

- Containment
- IpAddress
- IpServiceEndpoint
- Load Balancer
- Load Balancing Cluster
- Membership
- Node
- Ownership

Cisco CSS by SNMP Job

This job discovers Cisco Content Services Switches by SNMP. It supports all versions of Cisco CSS.

To run this discovery, activate the **Cisco CSS by SNMP** job. DFM chooses all SNMPs related to Cisco CSS and runs against them.

> **Note:** Some services may not be discovered by this package if no content rule is defined for them.

Discovery of CSS is based on three tables: **apCntTable**, **apSvcTable**, and **apCntsvcTable** (see the following table):

- **apCntTable** provides information about virtual addresses, virtual services, and pools.
- **apSvcTable** provides information about physical hosts included in the pool.
- **apCntsvcTable** describes which host is included in which pool.

apSvcTable can contain entries for which there is no corresponding row in **apCntsvcTable**. In this case, such hosts are skipped.

Table Name	Name from MIB	OID
CNT	apCntTable	1.3.6.1.4.1.2467.1.16.4.1 or 1.3.6.1.4.1.9.9.3681.16.4.1
SVC	apSvcTable	1.3.6.1.4.1.2467.1.15.2.1 or 1.3.6.1.4.1.9.9.3681.15.2.1
CNT to SVC	apCntsvcEntry	1.3.6.1.4.1.2467.1.18.2.1 or 1.3.6.1.4.1.9.9.3681.18.2.1

Trigger Query

Node Name	Condition
SNMP	SNMP OID Like 1.3.6.1.4.1.9.9.368% OR SNMP OID Like 1.3.6.1.4.1.2467%

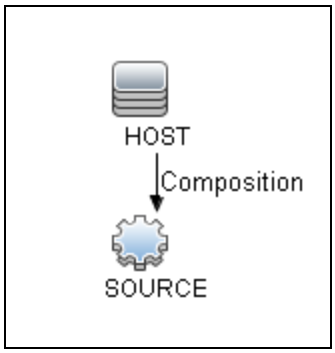
Adapter Information

This job uses the **Cisco CSS by SNMP** adapter.

Input CIT

SNMP

Input TQL Query



Node Name	Condition
SOURCE	None
HOST	None

Triggered CI Data

Name	Value
credentialsId	${SOURCE.credentials_id}
ip_address	${SOURCE.application_ip}
hostId	${HOST.root_id}

Used Scripts

- snmputils.py
- Cisco_CSS_by_SNMP.py

Discovered CITs

- Cisco CSS
- Composition
- Containment
- IpAddress
- IpServiceEndpoint
- Load Balancer
- Load Balancing Cluster
- Membership
- Node
- Ownership

Citrix NetScaler by SNMP Job

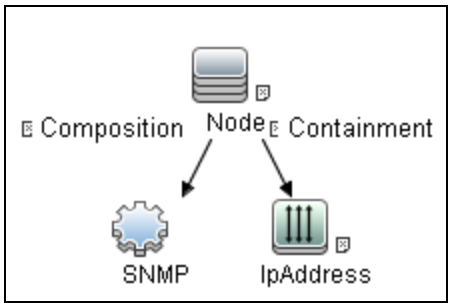
This job discovers the Citrix NetScaler topology by SNMP.

Queried SNMP Tables

The following SNMP tables are queried:

Table Name	Name from MIB	OID
Server	serverTable	1.3.6.1.4.1.5951.4.1.2.2
Service	serviceTable	1.3.6.1.4.1.5951.4.1.2.1
Service Group	serviceGroupMemberTable	1.3.6.1.4.1.5951.4.1.2.7
Virtual Server	vserverTable	1.3.6.1.4.1.5951.4.1.3.1
Virtual Service	vserverServiceTable	1.3.6.1.4.1.5951.4.1.3.2

Trigger TQL



Node Name	Condition
SNMP	SNMP OID equals 1.3.6.1.4.1.5951.1

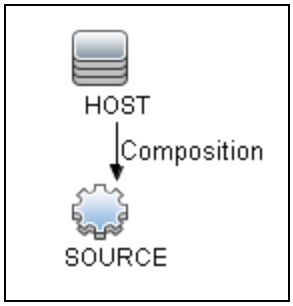
Adapter Information

This job uses the **Citrix NetScaler by SNMP** adapter.

Input CIT

SNMP

Input TQL



Node Name	Condition
SOURCE	None
HOST	None

Triggered CI Data

Name	Value
credentialsId	${SOURCE.credentials_id}
ip_address	${SOURCE.application_ip}

Used Scripts

- snmputils.py
- Citrix_NetScaler_by_SNMP.py

Discovered CITs

- Composition
- ClusterResourceGroup
- Containment
- Citrix NetScaler
- IpAddress

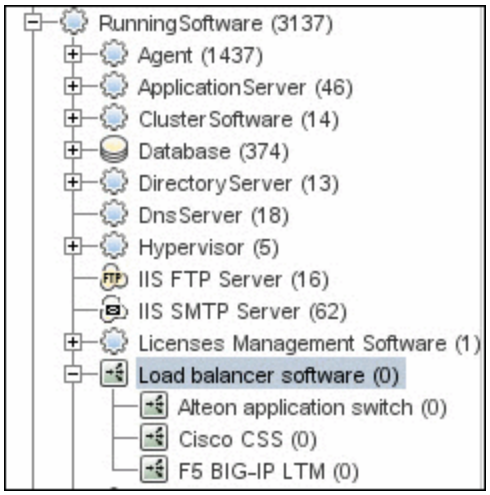
- IpServiceEndpoint
- Load Balancer
- Load Balancing Cluster
- Membership
- Node
- Ownership

Discovered CITs

The following CITs model load balancer topology:

- **Load Balancer Software**

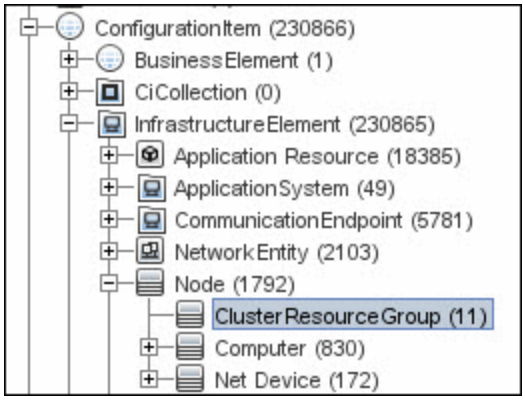
  This CIT represents software that provides load balancing solutions. For details on the supported load balancers, see "Overview" on page 464.



- **Clustered Server**

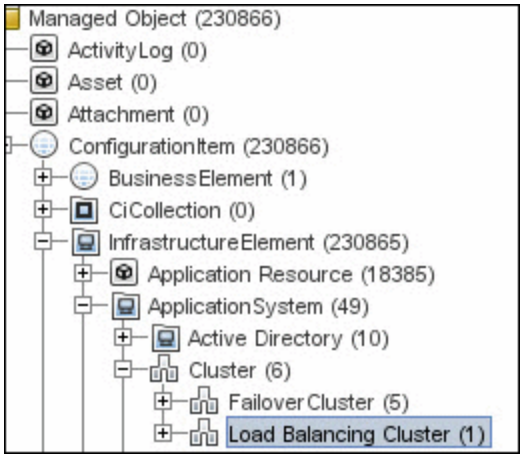
  A clustered server is a traffic-management object on the system that can balance traffic load across a pool of servers. Clustered servers increase the availability of resources for processing client requests. The primary function of a clustered server is to receive requests and distribute them to

pool members according to criteria you specify.



- **Load Balancing Cluster**

  A load balancing cluster (or pool) is a logical set of devices that are grouped together to receive and process traffic. Instead of sending client traffic to the destination IP address specified in the client request, the virtual server sends the request to any of the servers that are members of that pool. This helps to efficiently distribute the load on your server resources.



> **Note:** To view the topology, see "Topology" on page 465.

Chapter 30: Microsoft Network Load Balancing (NLB) Discovery

This chapter includes:

Overview 490
Supported Versions 490
Topology 491
How to Discover Microsoft Network Load Balancing Systems 492
How to Discover NLB Using Command Line Utility 493
MS NLB by NTCMD or UDA Job 494
MS NLB by NTCMD or UDA Adapter 496
Components of the Network Load Balancing Architecture 500
Glossary 501

Overview

Network Load Balancing (NLB) distributes IP traffic to multiple copies (or instances) of a TCP/IP service, such as a Web server, each running on a host within the cluster. NLB transparently partitions the client requests among the hosts and lets the clients access the cluster using one or more virtual IP addresses. From the client's point of view, the cluster appears to be a single server that answers these client requests. Each server receives all client requests, but NLB decides which server should respond.

All components responsible for the Microsoft NLB cluster are bundled in the **Microsoft_NLB_ Cluster.zip** package.

To discover MS-NLB, see "How to Discover Microsoft Network Load Balancing Systems" on page 492.

See also:

- "Components of the Network Load Balancing Architecture" on page 500
- "Glossary" on page 501

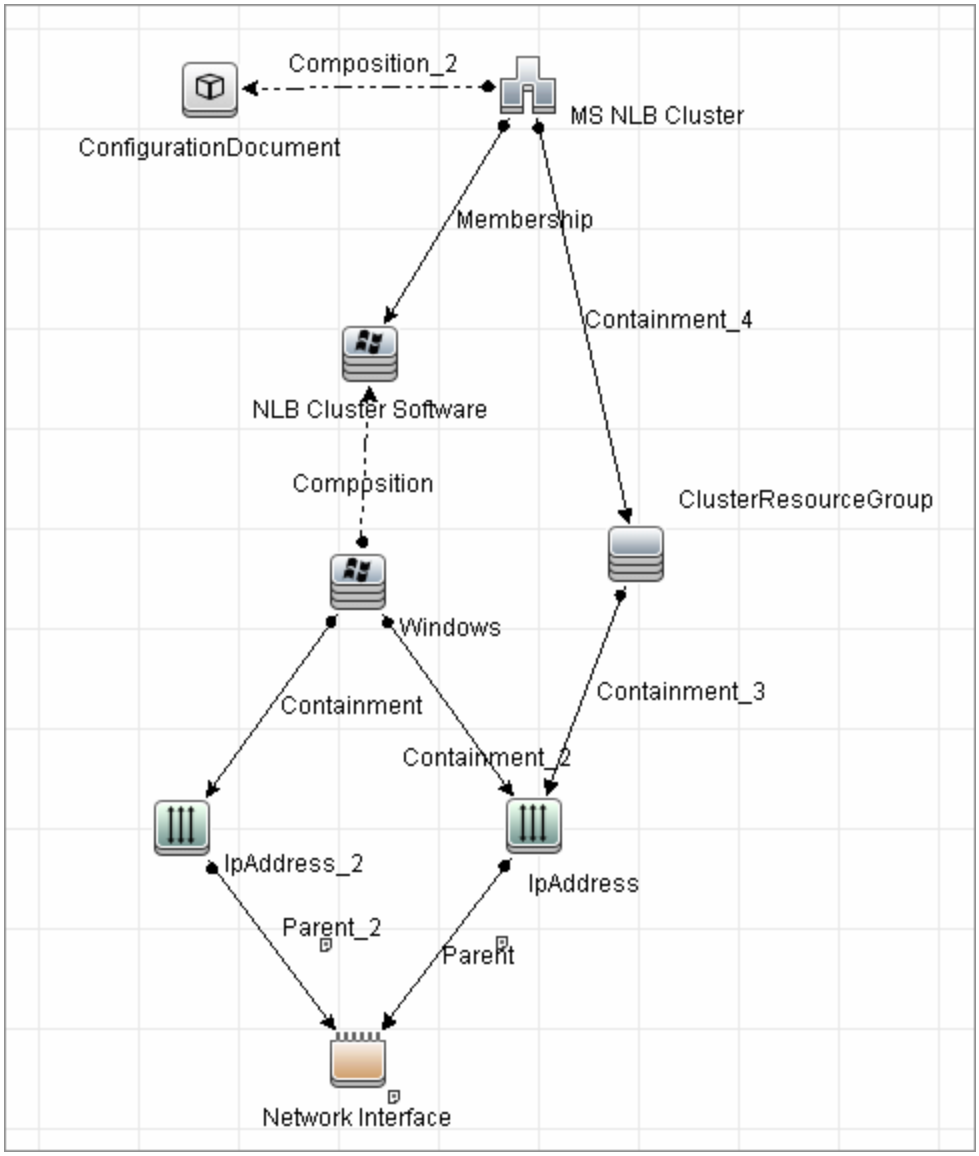
Supported Versions

This discovery supports Microsoft Network Load Balancer versions 2000, 2003, 2008, 2012, 2012 R2, and 2016.

Topology

The following image displays the topology of the MS NLB discovery:

Note: For a list of discovered CITs, see "MS NLB by NTCMD or UDA Job" on page 494.



How to Discover Microsoft Network Load Balancing Systems

This task includes the following steps:

1. Prerequisite - Set up protocol credentials

   This discovery uses the NTCMD protocol, or Universal Discovery protocol if UD Agent installed on the Exchange server.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

   Verify that the user defined in the NTCMD protocol is granted administration rights for Shell execution on the remote machine.

   The NTCMD protocol retrieves information about NLB by executing the **wlbs params** command.

2. Run the discovery

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

   Activate the following jobs in the following order:

   - The **Host Connection by Shell** job to discover Windows machines that act as the triggers for the NLB discovery.
   - The **MS NLB by NTCMD or UDA** job to connect to the host by NTCMD and retrieve the MS NLB Cluster topology. For job details, see "MS NLB by NTCMD or UDA Job" on page 494.

   For details on the discovery mechanism, see "MS NLB by NTCMD or UDA Job" on page 494.

How to Discover NLB Using Command Line Utility

You can discover NLB by running the **nlb.exe** command line utility.

This utility runs with the **params** key and outputs information about all NLB clusters on a discovered machine.

- If NLB is not installed on a Windows 2003 Server machine, the output is as follows:

```
WLBS Cluster Control Utility V2.4 (c) 1997-2003 Microsoft Corporation.
WLBS is not installed on this system or you do not have sufficient privileges to
administer the cluster.
```

- If an NLB cluster is set up on the machine, the output is as follows:

```
Cluster 192.168.0.222
Retrieving parameters
Current time              = 9/3/2009 1:02:38 PM
HostName                  = ddmvm-2k3-s
ParametersVersion         = 4
CurrentVersion            = 00000204
EffectiveVersion          = 00000201
InstallDate               = 4A9E51F5
HostPriority              = 1
ClusterIPAddress          = 192.168.0.222
ClusterNetworkMask        = 255.255.255.0
DedicatedIPAddress        = 192.168.0.2
DedicatedNetworkMask      = 255.255.255.0
McastIPAddress            = 0.0.0.0
ClusterName               = cluster2.domain.com
ClusterNetworkAddress     = 03-bf-c0-a8-00-de
IPToMACEnable             = ENABLED
MulticastSupportEnable    = ENABLED
IGMPSupport               = DISABLED
MulticastARPEnable        = ENABLED
MaskSourceMAC             = ENABLED
AliveMsgPeriod            = 1000
AliveMsgTolerance         = 5
NumActions                = 100
NumPackets                = 200
NumAliveMsgs              = 66
DescriptorsPerAlloc       = 512
MaxDescriptorAllocs       = 512
TCPConnectionTimeout      = 60
IPSecConnectionTimeout    = 86400
```

```
FilterICMP                = DISABLED
ClusterModeOnStart        = STARTED
HostState                 = STARTED
PersistedStates           = NONE
ScaleSingleClient         = DISABLED
NBTSupportEnable          = ENABLED
NetmonAliveMsgs           = DISABLED
IPChangeDelay             = 60000
ConnectionCleanupDelay    = 300000
RemoteControlEnabled      = DISABLED
RemoteControlUDPPort      = 2504
RemoteControlCode         = 00000000
RemoteMaintenanceEnabled  = 00000000
BDATeaming                = NO
TeamID                    =
Master                    = NO
ReverseHash               = NO
IdentityHeartbeatPeriod   = 10000
IdentityHeartbeatEnabled  = ENABLED
PortRules (1):
      VIP       Start  End  Prot   Mode   Pri Load Affinity
--------------- ----- ----- ---- -------- --- ---- --------
All                 0 65535 Both Multiple      Eql Single
```

No special rules are used for mapping the output to the CITs; all CI attributes repeat the output data names. Data is verified by comparing it to cluster nodes that have already been discovered.

MS NLB by NTCMD or UDA Job

This section includes details about the job.

Discovery Mechanism

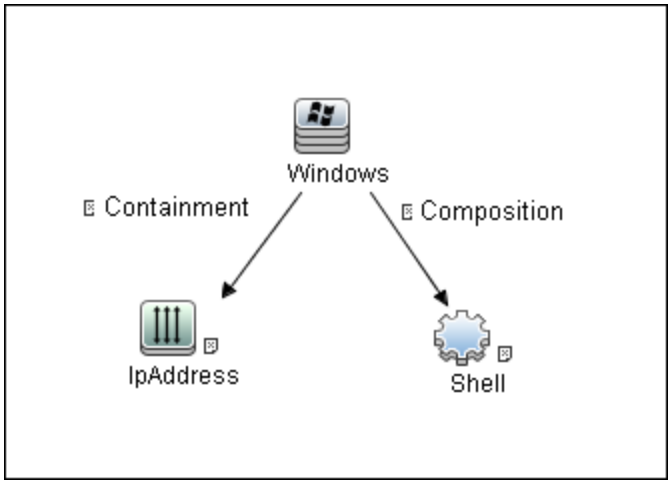
DFM triggers on Windows machines with more than one (two or more) IP addresses, and collects information using the **nlb.exe** command line utility. (In earlier versions of the Windows 2000 family, **wlbs.exe** is used.) These utilities enable the retrieval of all NLB-related information. For details, see "MS NLB by NTCMD or UDA Adapter" on page 496.

There is no need for DFM to collect information from every participating node to verify that an MS NLB cluster system exists: even one single machine running the software is considered a cluster machine. If more machines are discovered that include the NLB service (with the same settings as the first machine), the NLB cluster begins the convergence process.

Furthermore, cluster information is collected by discovering one node at a time because nodes participating in a cluster do not include information about the other participants.

Trigger Query

- Trigger CIT: **NTCMD**
- Trigger query:



- **CI Attribute Condition:** NTCMD or UDA running on a Windows machine with at least two IP addresses.

Name	Category	Description
ntcmd_with_2_IP	Trigger	Used by the **MS NLB by NTCMD or UDA** job
MS NLB topology	View	Used by the **MS NLB Topology** view

Adapter

This job uses the **MS NLB by NTCMD or UDA** adapter. For details, see "MS NLB by NTCMD or UDA Adapter" on the next page.

Views

- Microsoft NLB topology

Used Scripts

- ms_nlb_report_utils.py
- ms_nlb_ntcmd.py

Discovered CITs

- Composition
- ConfigurationDocument. For details, see "MS NLB by NTCMD or UDA Adapter" below.
- Containment
- IpAddress
- Membership
- MS NLB Cluster. For details, see "MS NLB by NTCMD or UDA Adapter" below.
- NLB Cluster Software. For details, see "MS NLB by NTCMD or UDA Adapter" below.
- Node

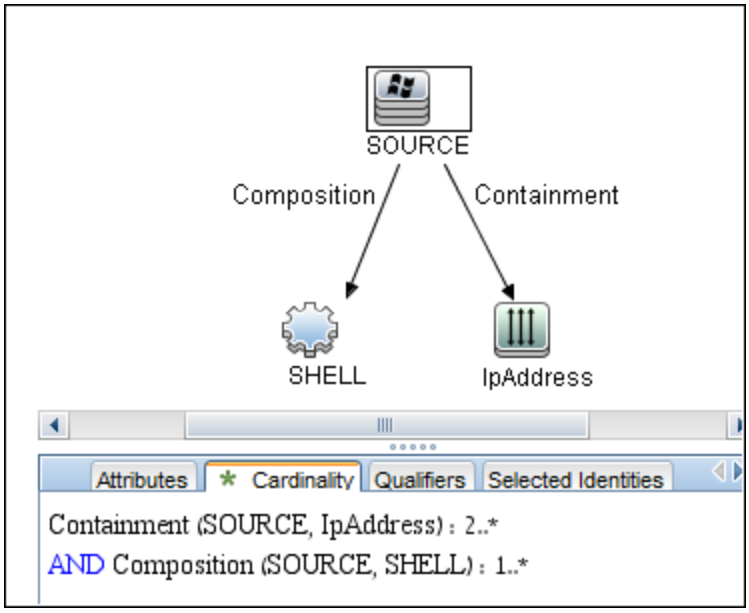
> **Note:** To view the topology, see "Topology" on page 491.

MS NLB by NTCMD or UDA Adapter

This section contains details about the adapter.

Input Query

NTCMD or UDA running on a Windows machine with at least two IP addresses:



Triggered CI Data

Name	Value
credentialsId	${SHELL.credentials_id}
ip_address	${IpAddress.name}

MS NLB Cluster CIT

The CIT represents information regarding the NLB cluster.

- CIT name: **ms_nlb_cluster**
- Parent CIT name: **loadbalancecluster**
- Relationships

Start Node	Start Node Cardinality	Name	End Node	End Node Cardinality
ms_nlb_ cluster	1..*	membership	nlb_ clustersoftware	1..*

The Cluster IP address is a key field, as this is the most reliable way of discovering NLB. By comparison, discovering NLB through the Cluster network address is less reliable as it is dependent

on the IP address and the operating mode—Unicast, Multicast, or IGMP. The Cluster domain name is retrieved for the Cluster name.

- Attributes

  The following attributes are specific to the MS NLB Cluster CIT:

Key	Display Name	Attribute Name	Type
X	ClusterIPAddress	cluster_ip_address	String(15)
	ClusterNetworkMask	cluster_network_mask	String(15)
	McastIPAddress	mcast_ip_address	String(15)
	ClusterDomainName	cluster_domain_name	String(256)
	ClusterNetworkAddress	cluster_network_address	MAC Address
	IPToMACEnable	ip_to_mac_enable	Boolean
	MulticastSupportEnable	multicast_support_enable	Boolean
	IGMPSupport	igmp_support	Boolean
	RemoteControlEnabled	remote_control_enabled	Boolean
X	Name	name	String (modified for this CIT)

NLB Cluster Software CIT

The CIT represents information regarding a single machine configuration that is part of an NLB cluster.

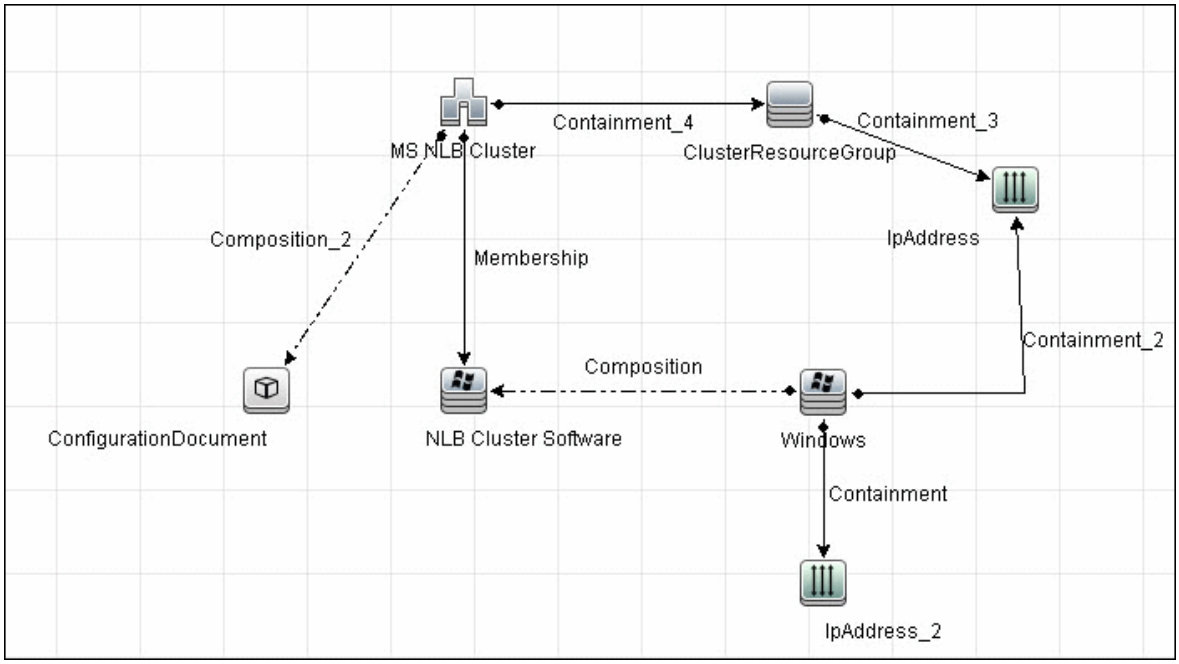
- CIT name: **nlb_clustersoftware**
- Parent CIT name: **failoverclustersoftware**
- Relationships

Start Node	Start Node Cardinality	Name	End Node	End Node Cardinality
ms_nlb_ cluster	1..*	membership	nlb_ clustersoftware	1..*
nt	1..*	composition	nlb_ clustersoftware	1..*

- Attributes

Key	Display Name	Type
	ClusterIPAddress	String(15)
	HostPriority	int (1-32)
	ClusterModeOnStart	Started, Suspended, Stopped
	Name	String (NLB Cluster SW)
	Composition	String (32)

ConfigurationDocument (NLB Port Rule)



This CIT retrieves information about each port rule defined for NLB clusters.

Since the Port Rule entity cannot clearly define key attributes, the port rules properties are stored in the properties file (key=value pairs) as follows:

```
portRule1.ServingIP=All
portRule1.StartPort=0
portRule1.EndPort=100
portRule1.Protocol=Both
portRule1.FilteringMode=Multiple
portRule1.Affinity=Single
portRule1.LoadWeight=40
```

Relationships

Start Node	Start Node Cardinality	Name	End Node	End Node Cardinality
nt	1..*	composition	nlb_ clustersoftware	1..*
ms_nlb_ cluster	1..*	membership	nlb_ clustersoftware	1..*

Components of the Network Load Balancing Architecture

Component	Description
Nlb.exe	The Network Load Balancing control program. You use Nlb.exe from the command line to start, stop, and administer Network Load Balancing, as well as to enable and disable ports and to query cluster status.
Nlbmgr.exe	The Network Load Balancing Manager control program. Use this command to start Network Load Balancing Manager.
Wlbs.exe	The former Network Load Balancing control program. This has been replaced by **Nlb.exe**. However, you can still use **Wlbs.exe** rather than **Nlb.exe** if necessary, for example, if you have existing scripts that reference **Wlbs.exe**.
Wlbsprov.dll	The Network Load Balancing WMI provider.
Nlbmprov.dll	The Network Load Balancing Manager WMI provider.
Wlbsctrl.dll	The Network Load Balancing API DLL.
Wlbs.sys	The Network Load Balancing device driver. **Wlbs.sys** is loaded onto each host in the cluster and includes the statistical mapping algorithm that the cluster hosts collectively use to determine which host handles each incoming request.

Glossary

Cluster

A group of independent computers that work together to run a common set of applications and provide the image of a single system to the client and application. The computers are physically connected by cables and programmatically connected by cluster software. These connections allow computers to use problem-solving features such as failover in Server clusters and load balancing in Network Load Balancing (NLB) clusters. For details, refer to http://technet.microsoft.com/en-us/library/cc784941(WS.10).aspx.

Dedicated IP Address

The IP address of a NLB host used for network traffic that is not associated with the NLB cluster (for example, Telnet access to a specific host within the cluster). This IP address is used to individually address each host in the cluster and therefore is unique for each host.

NLB Node

Machine-participant of an NLB cluster. For details, refer to http://technet.microsoft.com/en-us/library/cc758834(WS.10).aspx.

Operating Mode

The NLB cluster has two operating modes:

- In its default unicast mode of operation, NLB reassigns the station (MAC) address of the network adapter for which it is enabled and all cluster hosts are assigned the same MAC (media access control) address.
- In multicast mode, NLB assigns a layer 2 multicast address to the cluster adapter instead of changing the adapter's station address. For details, refer to http://technet.microsoft.com/en-us/library/cc783135(WS.10).aspx.

Port Rules

The NLB driver uses port rules that describe which traffic to load-balance and which traffic to ignore. By default, the NLB driver configures all ports for load balancing. You can modify the configuration of the

NLB driver that determines how incoming network traffic is load-balanced on a per-port basis by creating port rules for each group of ports or individual ports as required. Each port rule configures load balancing for client requests that use the port or ports covered by the port range parameter. How you load-balance your applications is mostly defined by how you add or modify port rules, which you create on each host for any particular port range.

Virtual IP Address

An IP address that is shared among the hosts of a NLB cluster. A NLB cluster may also use multiple virtual IP addresses, for example, in a cluster of multihomed Web servers. For details, refer to http://technet.microsoft.com/en-us/library/cc756878(WS.10).aspx.

Part 5: Database

Chapter 31: Database Connections by Host Credentials Discovery

This chapter includes:

- Overview 505
- Supported Versions 505
- Topology 506
  - Oracle 506
  - Microsoft SQL 506
- How to Discover Database Connections by Host Credentials 507
- DB Connections by Shell Job 507
- DB Connections by WMI Job 510
- Troubleshooting and Limitations – Database Connections by Host Credentials Discovery 511

Overview

The purpose of this package is to enable database auto-discovery using host level credentials in Universal CMDB (UCMDB). In certain cases, a DFM user or administrator does not have detailed information about the database, such as its name or SID, listener port number, and so on. The solution in this package discovers this information with minimal inputs, and enables end-to-end discovery of databases.

DFM extracts database information from various sources, for example, from running process names, Windows service names, the Windows registry, and configuration files, on the database server and build CIs. Discovered Database CIs can be used as triggers for the Database Connection by SQL jobs (for example, the **Oracle Database Connection by SQL** job), to populate database credentials, thus enabling deep discovery using out-of-the-box database topology discovery jobs.

DFM triggers for jobs in this package are set up so that these jobs are seamlessly included in the UCMDB spiral discovery schedule.

The **DB Connections by Shell** and **DB Connections by WMI** jobs in this package use a Shell (NTCMD/SSH/Telnet) or agent (WMI) CI as a trigger, to search for database signatures on a host. These jobs create database CIs with available information, such as instance name or SID and the listener port of the database server. Since database credentials are not used, the username and credentials ID attributes of these CIs are empty.

For more details about these jobs, see:

- "DB Connections by Shell Job" on page 507
- "DB Connections by WMI Job" on page 510

Supported Versions

Database Connections by Host Credentials Discovery supports the following database servers:

- Oracle 9i, 10g, 11g, 12c
- Microsoft SQL Server 2000, 2005, 2008, 2008 R2, 2012, 2012 SP2, 2014, 2016

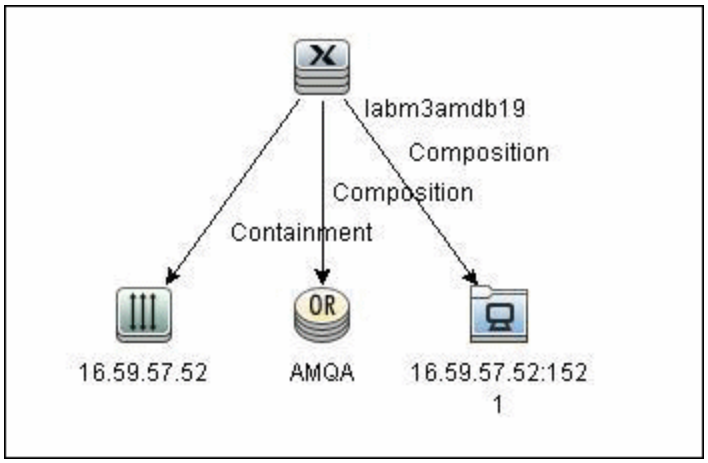
> **Note:** For CP 13.0 and later versions, discovery of DB2 database servers is not supported.

Topology

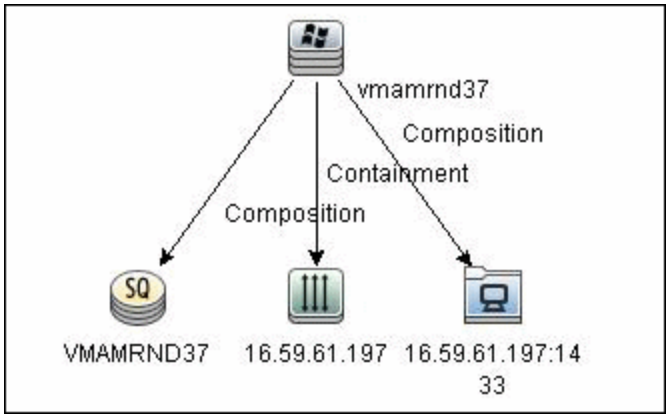
The following images display the topology of the Database Connections by Host Credentials discovery with sample output:

> **Note:** For a list of discovered CITs, see "DB Connections by Shell Job" on the next page and "DB Connections by WMI Job" on page 510.

Oracle



Microsoft SQL



How to Discover Database Connections by Host Credentials

This task includes the following steps:

1. Prerequisite - Set up protocol credentials

   This discovery uses the following protocols:

   - WMI protocol
   - NTCMD protocol
   - SSH protocol
   - Telnet protocol

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Discover Host Credentials

   a. Run the **Range IPs by ICMP** job.

   b. Run the **Host Connection by Shell** job.

   c. Run the **Host Connection by WMI** job.

   d. Run the **DB Connections by Shell** job. For details, see "DB Connections by Shell Job" below.

   e. Run the **DB Connections by WMI** job. For details, see "DB Connections by WMI Job" on page 510.

DB Connections by Shell Job

This section includes details about the job.

Discovery Mechanism

This discovery job attempts to identify configured databases on a host using a Shell client

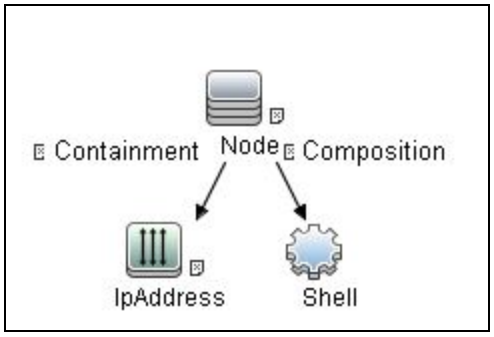
(NTCMD/SSH/Telnet). Once connected, the job creates a list of running processes and server ports associated with each process. On Microsoft Windows operating systems, this job adds a list of installed Windows services to the list.

The job then looks for known database signatures in this list of processes and services, to create database CIs.

Mapping ports to processes can require specific privileges depending on the operating system in use. If the necessary privileges are not available, this job attempts to create database CIs using the available information. However, details may be missing, for example, the database port. In such cases, you may need to run the job again after entering new credentials with the necessary privileges. For details on adding credentials, see "Credentials Data Methods" in the *HPE Universal CMDB Developer Reference Guide*.

After identifying databases using the above information, this job attempts to retrieve additional information on configured (but not running) instances from registry keys (on Microsoft Windows only) and by parsing well known configuration files.

Trigger Query



Adapter

This job uses the **Database Connections by Shell** adapter.

- Input Query: None.
- CI Attributes conditions:

CI	Attribute Value
Shell	NOT Reference to the credentials dictionary entry Is null.
IpAddress	NOT IP Probe Name Is null

- Adapter Parameters

Parameter	Default Value	Description
discover_mssql	true	DFM discovers Microsoft SQL database servers.
discover_oracle	true	DFM discovers Oracle database servers.
filterByDiscoveredProcesses	false	This parameter should always be set to **false** because this script uses out-of-the-box process discovery on some platforms, and database processes are not included in the filters. However, since this job does not create Process CIs, setting this parameter to **false** has no adverse effects.
use_lsof	false	Since process to port mapping on Solaris and AIX platforms requires root privileges, set this flag to **true** if the LSOF program is available on these platforms. Using LSOF does not require root privileges.
use_sudo	false	Since process to port mapping on some UNIX platforms requires elevated privileges, set this flag to **true** if **sudo** is configured for **netstat**, **ps**, **pfiles**, **kdb**, or **lsof**.

Discovered CITs

- Composition
- Containment
- IpAddress
- IpServiceEndpoint
- Node
- Oracle
- SQL Server
- Unix
- Windows

Note: To view the topology, see "Topology" on page 506.

DB Connections by WMI Job

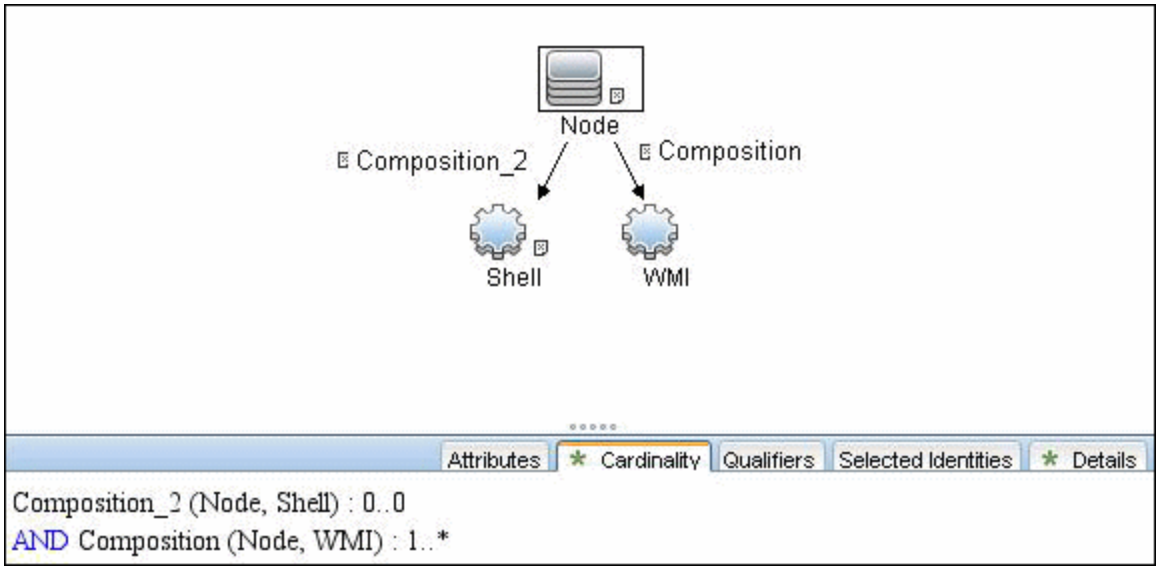
This section includes details about the job.

Discovery Mechanism

Similarly to the **DB Connections by Shell** job, this job attempts to create a list of processes and services, and parses them for database signatures.

Since an agent does not have access to output of commands such as **netstat**, this job is limited in that the listener ports of database servers are not always identified. Port information for databases such as Microsoft SQL Server is available in the Windows registry, and this job queries that information when connected through WMI.

Trigger Query



Adapter

This job uses the **Database Connections by Agent** adapter.

- Input query: None
- Adapter parameters:

Parameter	Default Value	Description
discover_mssql	true	DFM discovers Microsoft SQL database servers.
discover_oracle	true	DFM discovers Oracle database servers.

Discovered CITs

- Composition
- Containment
- IpAddress
- IpServiceEndpoint
- Node
- Oracle
- SQL Server
- Windows

> **Note:** To view the topology, see "Topology" on page 506.

Troubleshooting and Limitations – Database Connections by Host Credentials Discovery

This section describes troubleshooting and limitations for Database Connections by Host Credentials discovery.

- **DB Connections by WMI discovery:** To improve performance, the trigger query for the DB Connections by WMI job has been disabled by default and you should manually select servers against which this job should run.

Chapter 32: IBM DB2 Database Discovery

This chapter includes:

- Supported Versions 513
- IBM DB2 Topology 513
- How to Discover Full DB2 Topology 514
- Databases TCP Ports Job 518
  - Adapter Information 520
- DB2 Topology by SQL Job 522
- DB2 Universal Database Connection by SQL Job 524
- DB2 Topology by SQL Adapter 527
- DB2 Connection by SQL Adapter 531
- Application Signatures and Plugins 534
  - Application Signatures 534
  - Plugins 535
  - PortNumberToPortName Configuration 535
- Troubleshooting and Limitations – IBM DB2 Database Discovery 535
  - Troubleshooting 535
  - Limitations 535

Supported Versions

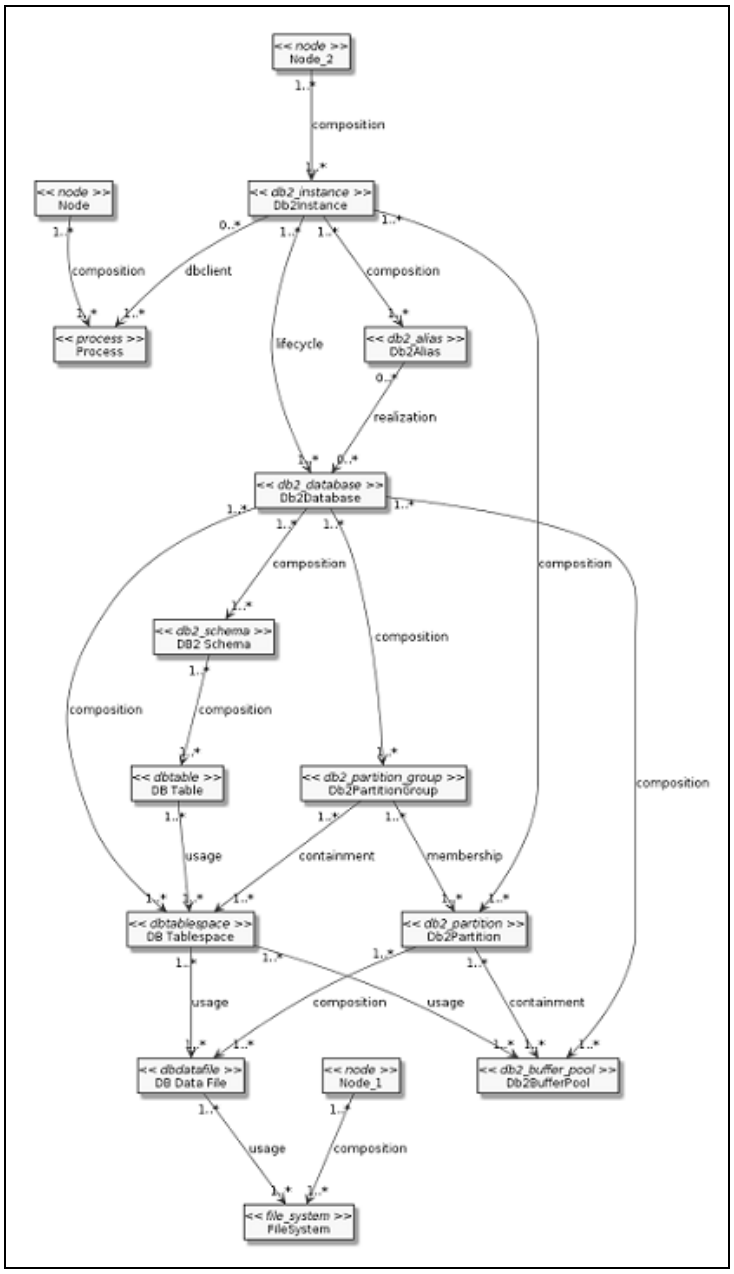
This discovery supports the following versions:

IBM DB2 Universal Database (UDB) versions 9.1, 9.5, 9.7, 9.8, 10.1, 10.5, and 11.1; for Linux, UNIX and Windows platforms.

IBM DB2 Topology

The diagram below depicts the topology of the IBM DB2 Server view. It shows a host (Node_2) on which IBM DB2 Server and its resources are installed, the processes that communicate with the server (connected by DB Client links), and tablespace containers modeled as a DB Data File.

> **Note:** For a list of discovered CITs, see "DB2 Universal Database Connection by SQL Job" on page 524, "DB2 Topology by SQL Job" on page 522, and "Databases TCP Ports Job" on page 518.



How to Discover Full DB2 Topology

This task discovers IBM DB2 Server databases and their components on the network, and includes the following steps.

1. Prerequisite - Set up protocol credentials

   - **For SQL-based Discovery:** The IBM DB2 SQL-based Discovery uses the Generic DB Protocol (SQL).

     When setting up protocol credentials:

     - In the Database Type box, choose **db2**.
     - Verify the user name, password, and port used by IBM DB2 Server.

       For more information on configuring the Generic DB Protocol (SQL), see "Supported Protocols" in the *Universal CMDB Discovery and Integration Content Guide - Supported Content* document.

   - **For Shell-based Discovery:**

     - Configure the appropriate shell protocol. For more information, see "Supported Protocols" in the *Universal CMDB Discovery and Integration Content Guide - Supported Content* document.
     - All possible ports used by IBM DB2 Databases must be added to **portNumberToPortName.xml** file. Make sure that **portName="db2"**.

2. Prerequisites - Miscellaneous

   - To perform an IBM DB2 discovery, copy the following files from the directory **<db2_home_directory>\IBM\SQLLIB\java** (for windows) or **/opt/ibm/db2/<version>/java** (for UNIX-like systems) to the Data Flow Probe machine:

     - **db2java.zip**
     - **db2jcc.jar**
     - **db2jcc_license_cisuz.jar**
     - **db2jcc_license.jar**

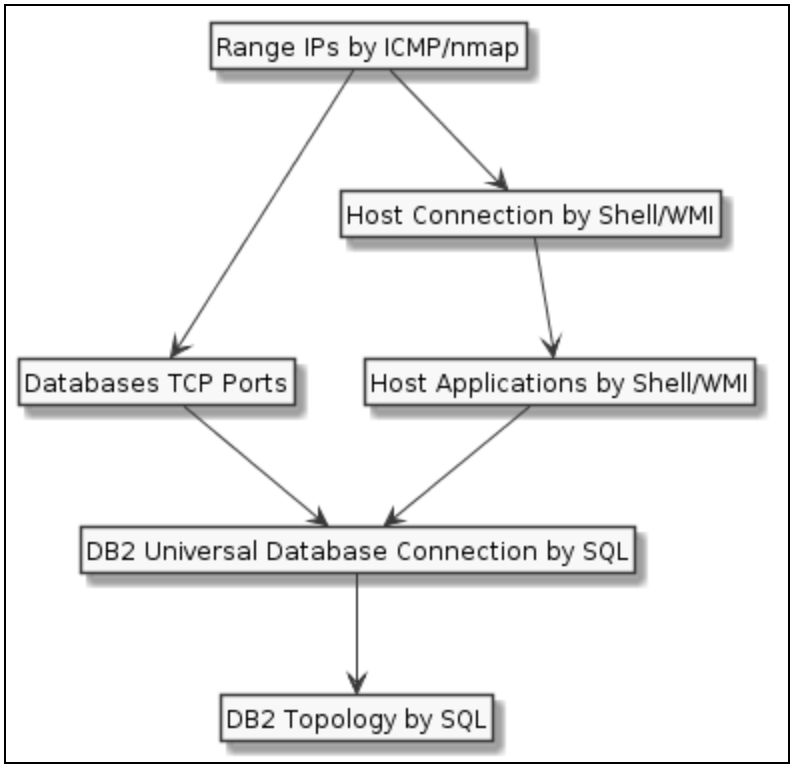
     On the Data Flow Probe machine, place the files in the following folder: **<hp>\UCMDB\DataFlowProbe\runtime\probeManager\discoveryResources\db\db2** and restart the Data Flow Probe.

3. Run the discovery

   The jobs that you need to execute to perform this discovery are determined by whether shell access is provided to DB2 destinations. If shell access is provided, then perform discovery according to the instructions in the section below "DB2 Discovery with Shell Access Provided to

DB2 Destinations" on the next page. If shell access is not provided to DB2 destinations, perform discovery according to the instructions in the section below "DB2 Discovery without Shell Access Provided to DB2 Destinations" on the next page.

The two possible approaches to discovering full DB2 Topology are depicted in the following diagram:



DB2 Discovery with Shell Access Provided to DB2 Destinations

> **Note:** When shell access is provided to DB2 destinations, DB2 Discovery can be performed in either shallow mode or deep mode. To perform a shallow discovery where the basic topology is discovered (Db2Instance, Db2Database, and Db2Alias CITs), carry out steps a-c below. To perform a deep discovery, carry out all the steps below.

To perform the DB2 Discovery:

a. In the Universal Discovery window, execute the **Range IPs by ICMP** job. This job discovers all reachable IPs.

b. Execute the job **Host Connection by Shell.** Discovers host's connectivity by shell protocol to the DB2 servers.

c. Execute the job **Host Applications by Shell.** Discovers DB2 instances, their databases and

aliases.

d. To perform a deeper discovery, execute the following jobs in the order listed:

   i. **DB2 Universal Database Connection by SQL.** This job discovers the **credentials_id** attribute of **Db2Databases** and **Db2Aliases**. The discovered **credentials_ids** are used in the **DB2 Topology By SQL** job (for the list of discovered CITs see "Discovered CITs" on page 534).

   > **Note:** This job is triggered when one of the following conditions is true:
   >
   > - A **Node** has **Db2Instance** and **Db2Aliases** that are not linked with a realization link to any **Db2Databases** (discovered by the **Host Applications by Shell** job.
   > - A **Db2Database**has DB2 **IpServiceEndpoint** (discovered by the **Host Applications by Shell** job).
   > - A **Node** is linked to DB2 **IpServiceEndpoint** (discovered by the **Host Applications by Shell** job).
   >
   >   DB2 **IpServiceEndpoint** is an endpoint with **db2** in the **service_names** attribute or with the **ip_service_name** attribute equal to **db2**.

   ii. **DB2 Topology By SQL**. This job discovers the full DB2 topology, including the CITs listed in "Discovered CITs" on page 530.

   > **Note:** This job is triggered when one of the following conditions is true:
   >
   > - A **Db2Alias** with the **credentials_id** attribute is reported.
   > - A **Db2Database** with the **credentials_id** attribute is reported.

DB2 Discovery without Shell Access Provided to DB2 Destinations

To perform the DB2 Discovery:

a. In the Universal Discovery window, execute the **Range IPs by ICMP** job. This job discovers all reachable IPs.

b. Execute the job **Databases TCP Ports**. This job discovers the DB2 **IpServiceEndpoint**, which is a trigger for the **DB2 Universal Database Connection by SQL** job.

c. Execute the following jobs in the order listed:

   - **DB2 Universal Database Connection by SQL.** This job discovers **credentials_ids** for both **Db2Databases** and **Db2Aliases**. The discovered **credentials_ids** are used in the **DB2 Topology By SQL** job (for the list of discovered CITs see "Discovered CITs" on page 534).

> **Note:** This job is triggered when a **Node** is linked to DB2 **IpServiceEndpoint** (discovered by the **Databases TCP Ports** job). DB2 **IpServiceEndpoint** is an endpoint with **db2** in the **service_names** attribute or with the **ip_service_name** attribute equal to **db2**.

- **DB2 Topology by SQL**. This job discovers the full DB2 topology, including the CITs listed in "Discovered CITs" on page 530.

> **Note:** This job is triggered when one of the following conditions is true:
>
> - A **Db2Alias** with the **credentials_id** attribute is reported.
> - A **Db2Database** with the **credentials_id** attribute is reported.

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

Databases TCP Ports Job

This section includes details about the job.

Adapter

This job uses the **TCP Ports Discovery** adapter.

Trigger Query

Node Conditions

Node Name	Condition
IpAddress	`NOT IP Probe Name Is null`

Job Parameters

Name	Default Value	Description
checkIfIpIsReachable	true	This flag indicates whether the job should check if the discovered IP is reachable before the job starts to check availability of the host's ports.
checkOnlyKnownPorts	true	This flag indicates whether the job should discover only known ports. This flag does not cancel the **ports** or **UDPports** parameters. Setting this flag to **false** is applicable only with a real port range in the **ports** or **UDPports** parameter.
connectTimeOut	5000	The timeout (in milliseconds) when connecting to an IP and port.
nmapPath		The full path to the nmap executable file (for example: **C:\Program Files (x86)\Nmap\nmap.exe**).
pingTimeOut	2000	The ICMP ping timeout (in milliseconds).
ports	**For JEE TCP Ports job:** • weblogic, weblogicSSL, websphere_jmx, rmi **For Databases TCP Ports job:** • oracle, db2, sybase, sql, mysql **For SAP TCP Ports job:** • sap, sap_jmx, sap_http, sap_https **For SAP TCP Ports job:** no default value	This parameter contains a list of TCP ports on which discovery is performed. This list can include ranges, separate port numbers, and known protocol names (such as http, ftp, etc.) and must be comma separated. If this list is empty or contains the value *****, discovery is performed only on all known TCP ports. If a port range is entered (such as 1000-1100), discovery is performed only on all known ports in that range if **checkOnlyKnownPorts=true**.

Name	Default Value	Description
scanUDP	false	This flag indicates whether or not to scan UDP ports. **Note:** UDP scanning is supported only if **useNMap=true** (see below).
UDPports		This parameter contains a list of UDP ports on which discovery is performed. This list can include ranges, separate port numbers, and known protocol names (such as http, ftp, etc.) and must be comma separated. If this list is empty or contains the value *****, discovery is performed only on all known UDP ports. If a port range is entered (such as 1000-1100), discovery is performed only on all known ports in that range if **checkOnlyKnownPorts=true**.
useNMap	**For Databases TCP Ports and JEE TCP Ports jobs:** false **For SAP TCP Ports and TCP Ports jobs:** true	This flag indicates whether or not to use nmap during port scanning. **Note:** If no path is specified for **nmapPath** (see above), the nmap from the system path is used.

Note: Only ports on which a port name has been assigned to it in the **ports** or **UDPports** parameters and which are marked as 'discoverable' (**isDiscovered=1**) in the **portNumberToPortName.xml** configuration file are discovered.

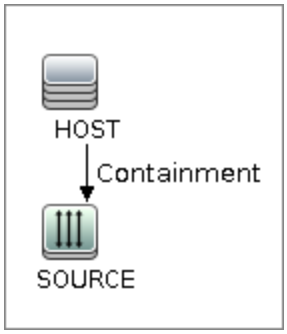
Adapter Information

This adapter discovers TCP ports.

Input CIT

IpAddress

Input Query



Triggered CI Data

Name	Value
ip_address	${SOURCE.name}
ip_domain	${SOURCE.routing_domain}

Used Scripts

- TcpPortScanner.py
- nmap.py

Global Configuration File

portNumberToPortName.xml

Discovered CITs

- Composition
- Containment
- IpAddress
- IpServiceEndpoint
- Node

DB2 Topology by SQL Job

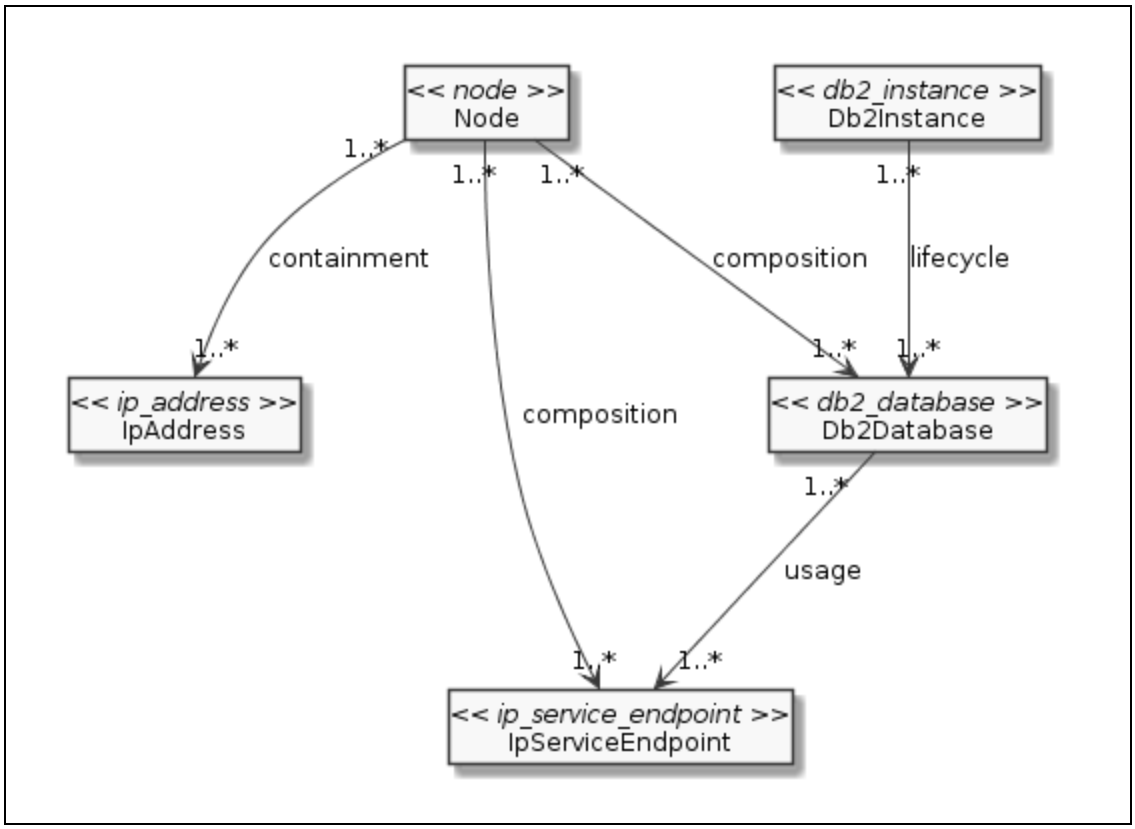
This job discovers the physical elements within a DB2 database.

Adapter

ID: **SQL_APP_Dis_Db2**

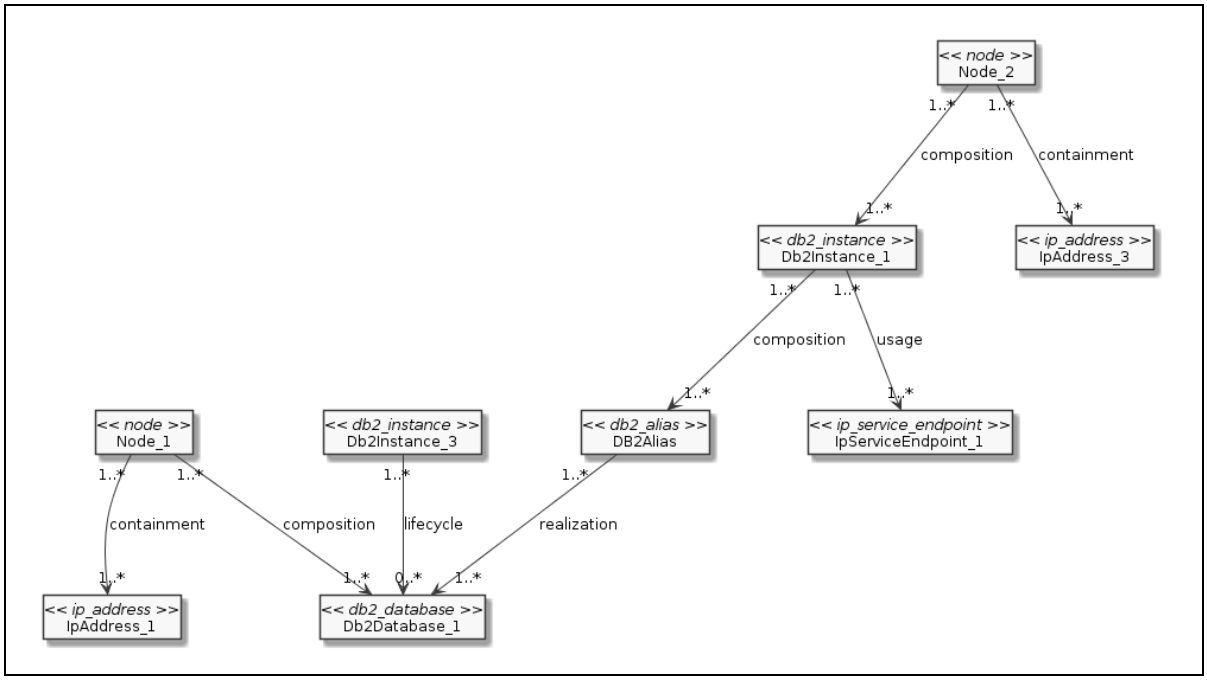
Trigger TQL

db2withuser.xml



In the diagram above, **Db2Database** should have reported credentials dictionary entry(**credentials_id**).

db2_alias_with_user.xml



In the diagram above;

- **Db2Database_1** should not have reported credentials dictionary entry(**credentials_id**).
- **Db2Alias** should have reported credentials dictionary entry(**credentials_id**).

Prerequisites

- **Set up credentials.**

  This job uses SQL credentials defined for the DB2 database.

Discovery Flow

If a connection is established, discovery occurs in the following order:

1. This job retrieves DB2 major and minor versions (the `SERVICE_LEVEL` field of `TABLE (sysproc.env_get_inst_info())`).
2. This job instantiates the discoverer of the appropriate DB2 version (the 9x discoverer is used if the discoverer of the provided version is not available).
3. This job retrieves the full DB2 version information (`RELEASE_NUM, SERVICE_LEVEL, BLD_LEVEL, PTF, FIXPACK_NUM` fields of `TABLE(sysproc.env_get_inst_info())`) and the full version is

reported to the `application_version` attribute of **DB2**.

4. This job retrieves **DB Data File**(`SYSIBMADM.CONTAINER_UTILIZATION`). **FileSystem** is also modeled if **DB Data File** is located on a Windows host (the disk name of the path is taken from the path of **DB Data File** and assigned to the `mountpoint` attribute of **FileSystem**).
5. This job retrieves opened sessions (`TABLE(SNAP_GET_APPL_INFO(db_name, partition_number))`).
   - The address and port of the client are parsed from `APPL_ID` field.
   - `APPL_NAME` is used as a process name.
   - Sessions with client `APPL_NAME=db2jcc_application` or `APPL_NAME=db2jccThread` are considered to be default client name and not reported.
6. This job retrieves the following CITs:
   - **Db2 Schemas** (`SYSCAT.SCHEMATA`)
   - **Db2PartitionGroups** (`SYSCAT.DBPARTITIONGROUPS`)
   - **Db2Partitions** (`TABLE(DB_PARTITIONS())`)
   - **Db2Partition** to **Db2PartitionGroup** relation (`SYSCAT.DBPARTITIONGROUPDEF`)
   - **Db2BufferPools**(`SYSCAT.BUFFERPOOLS`). Data is also taken from the table `SYSCAT.BUFFERPOOLDBPARTITIONS` to report correctly customized **Db2BufferPools**.
   - **DB Table** (`SYSCAT.TABLES`). Only `Table (untyped)` and `Typed table` types are discovered.

> **Note:** To view the topology, see "IBM DB2 Topology" on page 513.

DB2 Universal Database Connection by SQL Job

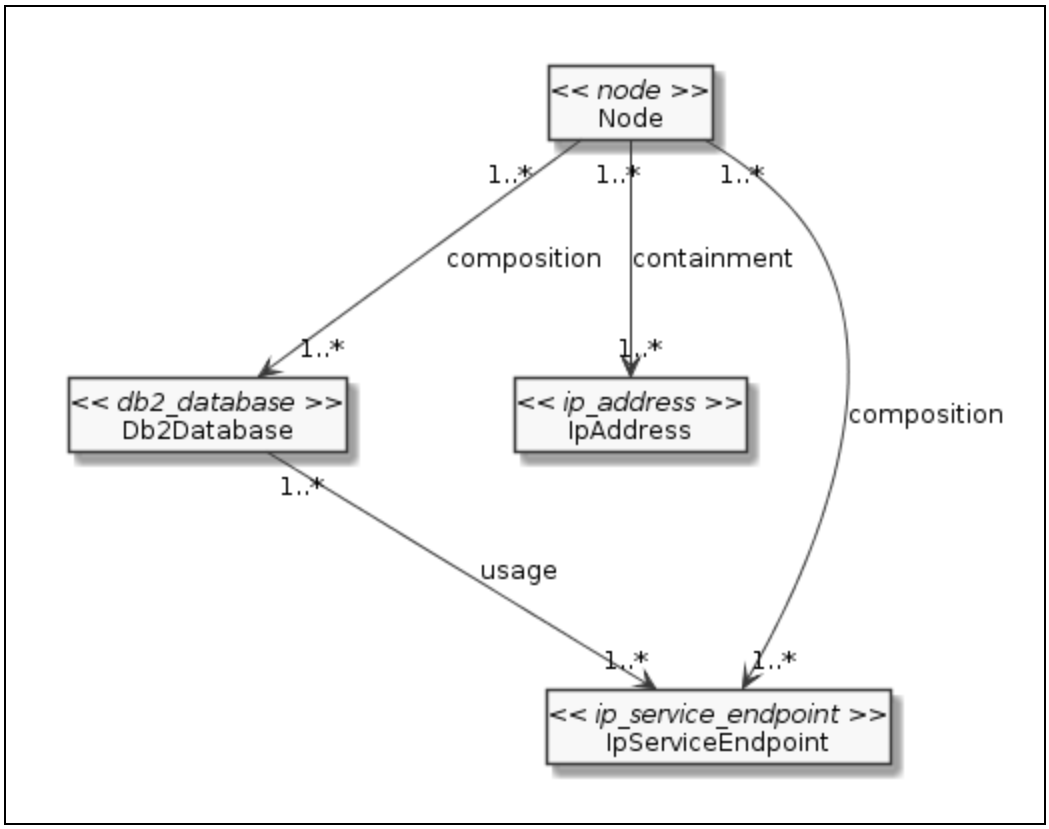
This job discovers DB2 databases using the SQL protocol.

Adapter

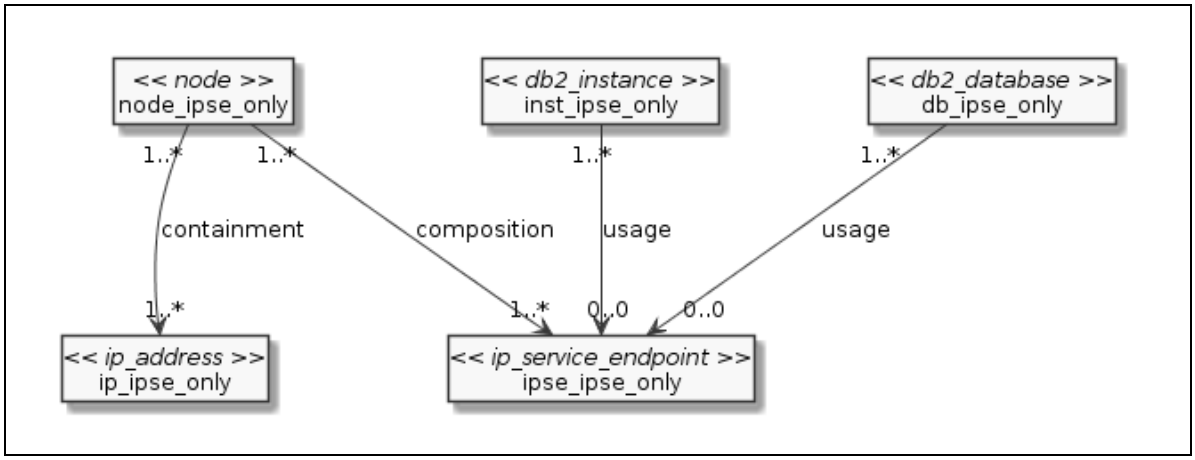
ID: **SQL_NET_Dis_Connection_DB2**

Trigger TQL

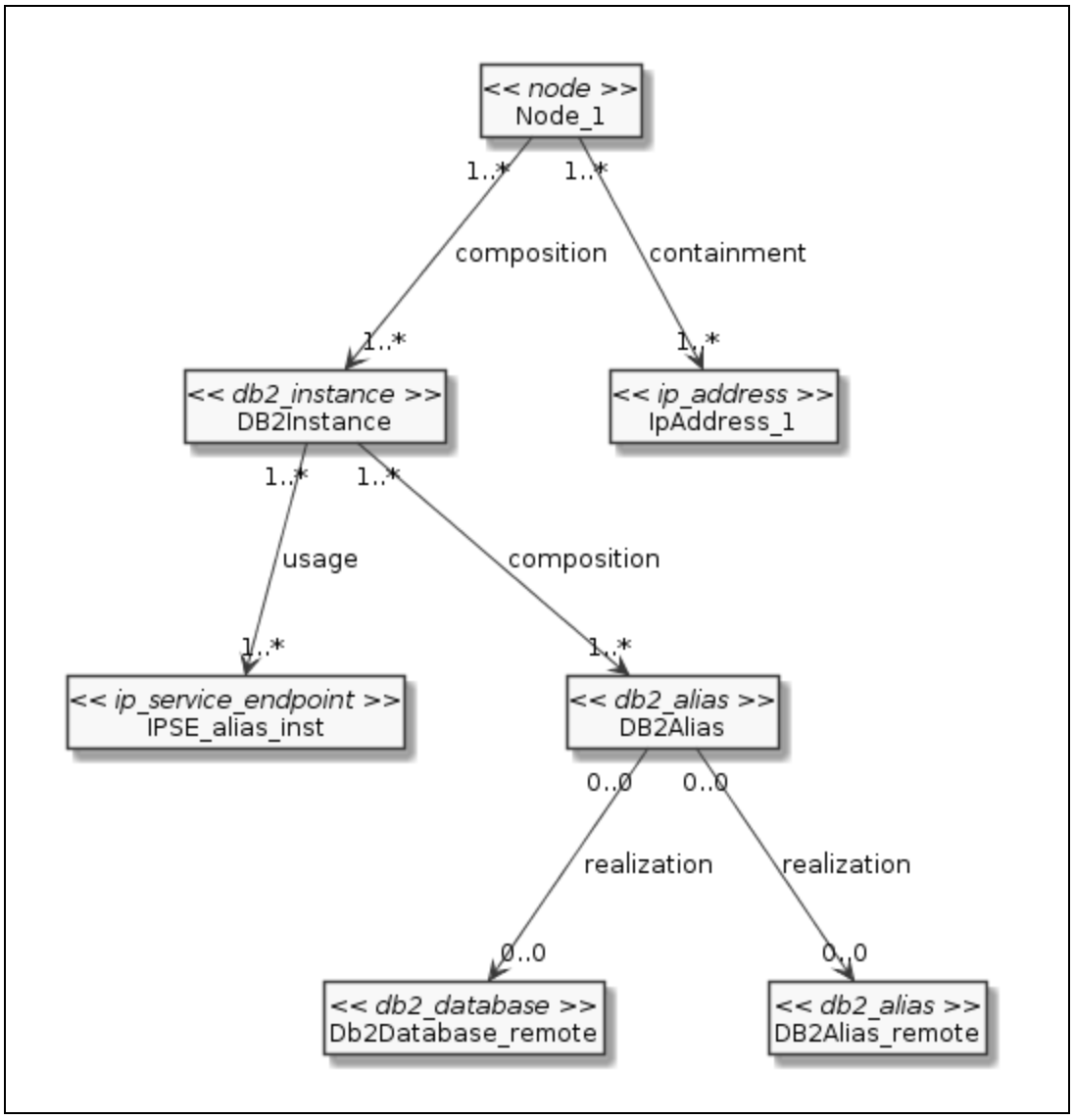
db2_db_port_sa.xml



db2_ipse_only.xml



db2_alias_no_realizaiton_.xml



Parameters

None

Prerequisites

- **Set up credentials.**

  This job uses SQL credentials defined for the DB2 database.

> **Note:** Port and database name are optional for DB2 credentials and if they are not set they are considered as candidates to be used during connection.

Discovery Flow

This job iterates over available Generic DB Protocol credentials of type **db2**. Credential entries are considered applicable if they do not contain port or database name information. If they do contain port or database name information, they are additionally compared with the port and database name provided from the triggered CI data (**port** and **db_name**, respectively).

As a result of this job, **Db2Database** or **Db2Alias** (depending on the trigger) is modeled with the appropriate **credentials_id** field.

DB2 Topology by SQL Adapter

This section includes details about the adapter.

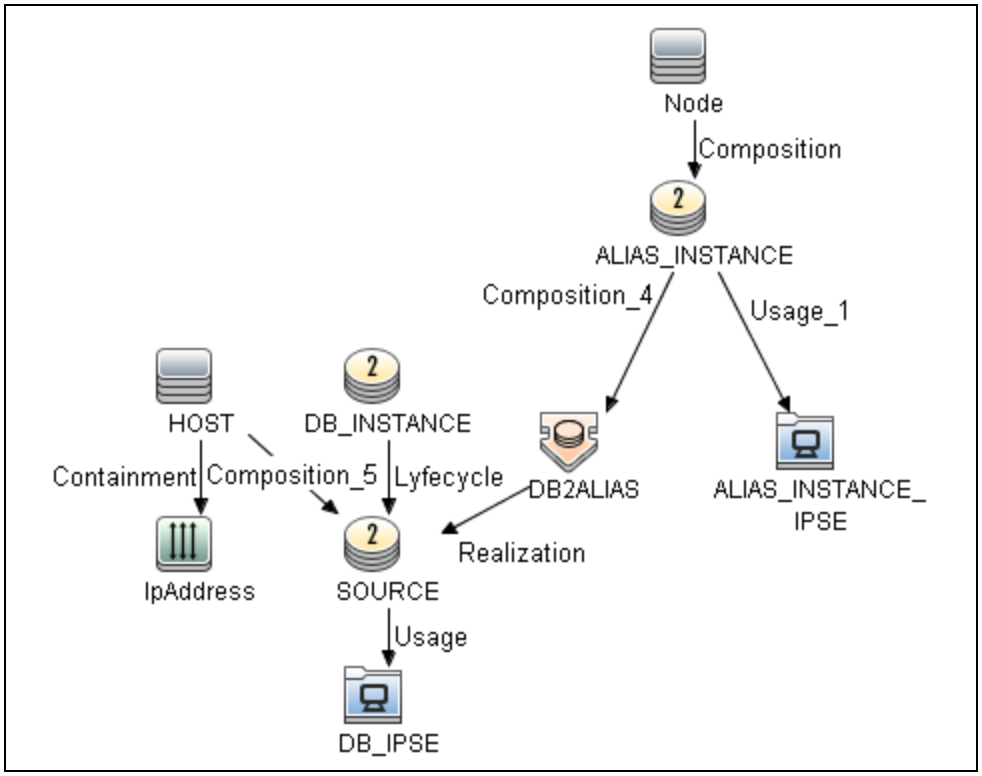
ID

```
SQL_APP_Dis_Db2
```

Input CIT

```
Db2Database
```

Input TQL



Triggered CI Data

Name	Value	Description
alias_ inst_ip_ address	${ALIAS_ INSTANCE.application_ ip:!NA!}	The IP address of the DB2 instance owning the corresponding alias, in the case when the trigger is **Db2Alias** with **credentials_id** reported.
alias_ inst_ ipse_ip_ address	${ALIAS_INSTANCE_ IPSE.bound_to_ip_ address:!NA!}	The **IpServiceEndpoint** IP address used for establishing the SQL connection, in the case when the trigger is **Db2Alias** with **credentials_id** reported
alias_ inst_ ipse_port	${ALIAS_INSTANCE_ IPSE.network_port_ number:!NA!}	The **IpServiceEndpoint** port used for establishing the SQL connection, in the case when the trigger is **Db2Alias** with **credentials_id** reported.
alias_ inst_port	${ALIAS_ INSTANCE.application_ port:!NA!}	The port number used by the DB2 instance owning the corresponding alias, in the case when the trigger is **Db2Alias** with **credentials_id** reported.

Name	Value	Description
alias_ cred_id	${DB2ALIAS.credentials_ id:!NA!}	The **credentials_id** used for establishing the SQL connection, in the case when the trigger is **Db2Alias** with **credentials_id** reported.
alias_ name	${DB2ALIAS.name:!NA!}	The alias name used as a DB name for establishing SQL connection, in the case when the trigger is **Db2Alias** with **credentials_id** reported.
db_ instance_ id	${DB_INSTANCE.root_ id:!NA!}	The **Db2Instance** CMDB ID, in the case when the trigger is **Db2Database** with **credentials_id** reported.
db_ipse_ id	${DB_IPSE.root_id:!NA!}	The **IpServiceEndpoint** CMDB ID, in the case when the trigger is **Db2Database** with **credentials_id** reported.
db_ipse_ ip_ address	${DB_IPSE.bound_to_ip_ address:!NA!}	The **IpServiceEndpoint** IP address used for establishing the SQL connection, in the case when the trigger is **Db2Database** with **credentials_id** reported.
db_ipse_ port	${DB_IPSE.network_ port_number:!NA!}	The **IpServiceEndpoint** port used for establishing the SQL connection, in the case when the trigger is **Db2Database** with **credentials_id** reported.
host_id	${HOST.root_id}	The Node CMDB ID containing the target DB2 database.
db_node_ ip_ address	${IpAddress.ip_ address:!NA!}	The Node IP address of **Db2Database** used for establishing a connection, in the case when the trigger is **Db2Database** with **credentials_id** reported.
db_cred_ id	${SOURCE.credentials_ id:!NA!}	The DB2Database **credentials_id** used for establishing the SQL connection, in the case when the trigger is **Db2Database** with **credentials_id** reported.
db_id	${SOURCE.root_id}	The **Db2Database** CMDB ID used to restore a CI, in the case when the trigger is **Db2Database** with **credentials_id** reported.
db_name	${SOURCE.name}	The **Db2Database** name used for establishing the SQL connection, in the case when the trigger is **Db2Database** with **credentials_id** reported.
db_port	${SOURCE.application_ port:!NA!}	The **Db2Database** port used for establishing the connection, in the case when the trigger is **Db2Database** with **credentials_id** reported.

Used Scripts

- iteratortools.py
- db2_pyarg_validator.py
- db2_flow.py
- db2_host.py
- db.py
- command.py
- db_platform.py
- process.py
- db_builder.py
- db2_discoverer.py
- db2_sql_base_discoverer.py
- db2_base_parser.py
- db2_model.py
- db2_sql_v9x_discoverer.py
- db2_sql_discoverer.py
- db2_topology.py
- db2_topology_by_sql.py

Discovered CITs

- Composition
- Containment
- DB Data File
- DB Table
- DB Tablespace
- DB2 Schema

- Db2Alias
- Db2BufferPool
- Db2Database
- DB2Instance
- Db2Partition
- Db2PartitionGroup
- IpAddress
- IpServiceEndpoint
- Membership
- Node
- Process
- Resource
- Usage

Parameters

Name	Type	Description
discoverTables	boolean	This flag indicates whether the job should discover tables.
discoverSystemTables	boolean	This flag indicates whether job should discover system tables. If **discoverTables** is false, this flag is considered false as well.

DB2 Connection by SQL Adapter

This section includes details about the adapter.

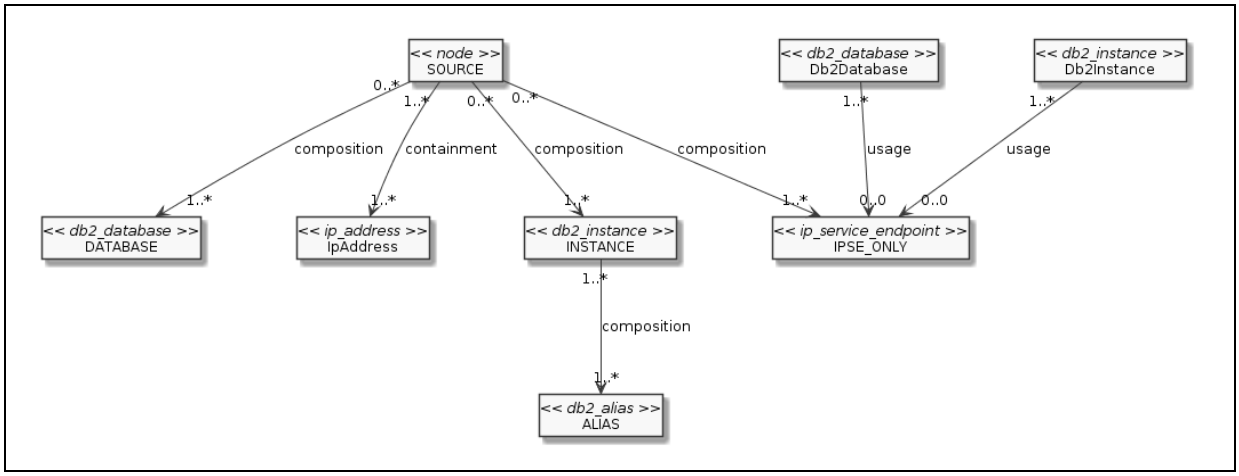
ID

```
SQL_NET_Dis_Connection_DB2
```

Input CIT

Node

Input TQL



Triggered CI Data

Name	Value	Description
alias_ container	${ALIAS.root_ container:!NA!}	A list of **Db2Alias** container CMDB ids, in the case when the trigger is **Db2Alias** without an outgoing realization link.
alias_id	${ALIAS.root_id:!NA!}	A list of **Db2ALias** CMDB ids, in the case when the trigger is **Db2Alias** without an outgoing realization link.
alias_name	${ALIAS.name:!NA!}	A list of **Db2ALias** names, used for establishing connections, in the case when the trigger is **Db2Alias** without an outgoing realization link.
db_ application_ ip	${DATABASE.application_ ip:!NA!}	A list of **Db2Database** IP addresses, used for establishing connections, in the case when the trigger is **Db2Database** with db2 **IpServiceEndpoint**.
db_ application_ port	${DATABASE.application_ port:!NA!}	A list of **Db2Database** ports, used for establishing connections, in the case when the trigger is **Db2Database** with db2 **IpServiceEndpoint**.
db_id	${DATABASE.root_	A list of **Db2Database** CMDB ids from which CIs are

Name	Value	Description
	id:!NA!}	restored, in the case when the trigger is **Db2Database** with db2 **IpServiceEndpoint**.
db_name	${DATABASE.name:!NA!}	A list of **Db2Database** names, used for establishing connections, in the case when the trigger is **Db2Database** with db2 **IpServiceEndpoint**.
credentials_id	${DATABASE.credentials_id:!NA!}	A list of Db2Database **credentials_ids**, used for establishing connections, in the case when the trigger is **Db2Database** with db2 **IpServiceEndpoint**.
inst_application_port	${INSTANCE.application_port:!NA!}	A list of **Db2Instance** ports, used for establishing connections, in the case when the trigger is **Db2Alias** without an outgoing realization link.
inst_id	${INSTANCE.root_id:!NA!}	A list of **Db2Instance** CMDB ids, in the case when the trigger is **Db2Alias** without an outgoing realization link.
ipse_only_id	${IPSE_ONLY.root_id:!NA!}	A list of **IpServiceEndpoint** CMDB IDs from which CIs are restored, in the case when the trigger is db2 **IpServiceEndpoint**.
ipse_only_port	${IPSE_ONLY.network_port_number:!NA!}	A list of **IpServiceEndpoint** ports, used for establishing connections, in the case when trigger is db2 **IpServiceEndpoint**.
ip_address	${IpAddress.ip_address}	The current **Node** IP address.
host_id	${SOURCE.root_id}	The current Node CMDB id, from which CIs are restored.

Used Scripts

- iteratortools.py
- db2_pyarg_validator.py
- db2_flow.py
- db2_host.py
- db.py
- command.py
- db_platform.py
- process.py

- db_builder.py
- db2_discoverer.py
- db2_sql_base_discoverer.py
- db2_base_parser.py
- db2_model.py
- db2_sql_v9x_discoverer.py
- db2_sql_discoverer.py
- db2_topology.py
- db2_connection_by_sql.py

Discovered CITs

- Composition
- Db2Alias
- Db2Database
- Db2Instance
- IpServiceEndpoint
- Node
- Usage

Parameters

None

Application Signatures and Plugins

Application Signatures

The Db2 package has two signatures:

- **IBM DB2 on Unix.** Discovers the Db2Instance by presence of the **db2sysc** process. If the port is recognized according to configuration in **PortNumberToPortName**, it is reported with the service name db2. By default the configuration file for port to name mapping declares 50000 and 6789 ports.
- **IBM DB2 on Windows.** Discovers the Db2Instance by presence of **db2syscs.exe** process. If the port is recognized according to the configuration in PortNumberToPortName, it is reported with service name db2. By default the configuration file for port to name mapping declares 50000 port.

Plugins

Additional topology is reported by the following plugins:

- **db2_instances_on_windows.** Discovers **Db2Databases**, **Db2Instances**, and **Db2Aliases** on a Windows host.
- **db2_instances_on_unix.** Discovers **Db2Databases**, **Db2Instances**, and **Db2Aliases** on a Unix host.

`PortNumberToPortName` Configuration

The **portNumberToPortName.xml** file contains all the possible ports that are used by IBM DB2 Databases across the target discovery range. These ports are named **"db2"**.

Troubleshooting and Limitations – IBM DB2 Database Discovery

Troubleshooting

Problem: If the target DB2 instance port was not added to the **portNumberToPortName.xml** file (which means that it is not recognized as **db2**), the "Multiple Match" warning may appear in UCMDB UI (which means that the target CI is not reported) after running of 'Host Applications by Shell' job.

Solution: Add the target port to **portNumbertToPortName.xml** file as a db2 port entry.

Limitations

Limitation when performing DB2 Discovery without Shell Access

The DB2 platform allows specifying a network service name as a listening port for the instance. This network service name is an alias that should be resolved with an appropriate mapping file (/etc/services on Unix and %SystemRoot%\system32\drivers\etc\services on Windows) and needs shell access to get the content of this file. In the case when there is no shell access and only SQL-based access, it is not possible to expand the service name string to a port number. This causes **IpServiceEndpoint** to not be reported for the connected database. The only workaround for this is to use a real port number when configuring the DB2 instance instead of the service name.

Chapter 33: HP NonStop Discovery

This chapter includes:

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Supported Versions 538

Topology 539

How to Discover HP NonStop 540

HP NonStop Topology by Shell Job 541

HP NonStop Discovery Commands 542

Overview

Since its inception in the mid-1970s, the NonStop server has held an important role in helping global business run smoothly, effectively, and successfully. Today, NonStop servers process the overwhelming majority of credit card, automated teller machine (ATM), and securities transactions. The world's leading enterprises rely on NonStop servers, including 106 of the 120 largest stock and commodity exchanges and 135 public telephone companies. Innovative solutions based on the NonStop platform help customers achieve a competitive advantage in multiple industry sectors, including financial services, telecommunications, healthcare, retail, public sector, and manufacturing. Based on studies by The Standish Group, the NonStop server delivers the lowest total cost of ownership (TCO) in the industry for servers of its class.

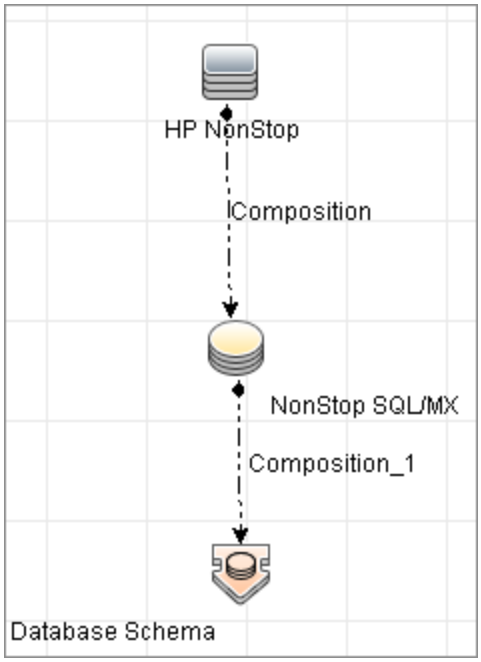
Supported Versions

This discovery solution supports:

- NonStop H06.x, J06.x, K06.x, L06.x
- NonStop SQL/MX 2.3
- NonStop SQL/MP H01 series.

> **Note:** The discovery is expected to work on all available versions of NonStop.

Topology


HP NonStop
Composition
NonStop SQL/MX
Composition_1
Database Schema

How to Discover HP NonStop

The following steps describes how to perform HP NonStop discovery.

1. Prerequisites

   Before starting the discovery, ensure that the discovery user was granted all of the required permissions to run the following commands:

   - **gtacl -p scf info lif '$zzlan.*'**
   - **gtacl -p scf info subnet '$*.*'**
   - **mxci**
     - **set schema nonstop_sqlmx_<node_name>.system_schema**
     - **select cat_name, cat_uid from catsys**
     - **select schema_name, cat_uid from schemata**
   - **gtacl -p sqlci**
     - **fileinfo $system.system.sqlci2, detail**
     - **select catalogname from <catalog_file_name>.catalogs**

2. Set up network and protocol credentials

   The HP NonStop discovery solution is based on the SSH protocol. The corresponding credentials must be provided in order to use this protocol.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

3. Run the Discovery

   To discover the topology:

   a. Run the **Range IPs by ICMP** or **Range IPs by nmap** job to discover the HP NonStop system IP addresses.

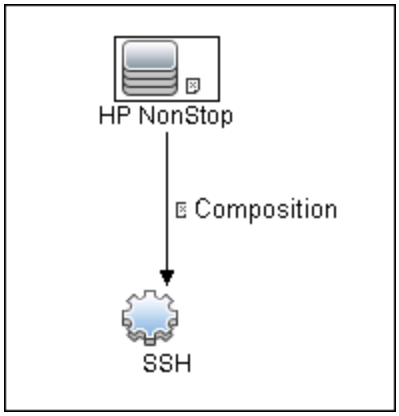
   b. Run the **Host Connection by Shell** job to discover the HP NonStop system with the SSH agent and networking topology connected.

   c. Run the **HP NonStop Topology by Shell** job to discover the shallow SQL MP/MX topology.

HP NonStop Topology by Shell Job

This section includes details about the job.

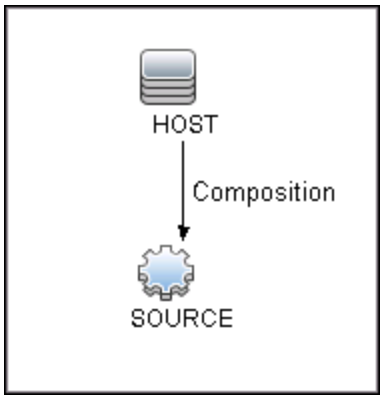
Trigger Query



Adapter

This job uses the **hp_nonstop_topology_by_shell** adapter.

- Input CIT: **Shell**
- Input Query:



- Used Scripts
  - hpnonstop_topology_by_shell.py

> **Note:** This job may also use library scripts supplied in the AutoDiscoveryContent package.

- Created/Changed Entities:

Entity Name	Entity Type	Entity Description
hp_nonstop	CIT	New CIT which represents HP NonStop System
nonstop_sql_mx	CIT	New CIT which represents SQL/MX database
HP NonStop Topology by Shell	Job	New topology job
hp_nonstop_ topology_by_shell	Adapter	Discovery adapter
Host_Connection_ By_Shell	Adapter	Adding HP NonStop support caused the adapter used by Host Connection by Shell job to change.
hpnonstop_ topology_by_ shell.py	Script	Discovery Jython script
hp_nonstop_ shell.xml	TQL	Trigger TQL
TTY_Connection_ Utils	Script	Main script used by Host Connection by Shell job has changed in order to support HP NonStop systems
hp_nonstop_ networking.py	Script	Jython script that discovers HP NonStop networking information

Discovered CITs

- Composition
- Database
- Database Schema
- HP NonStop
- NonStop SQL/MX

HP NonStop Discovery Commands

This section describes each of the commands used by HP NonStop discovery.

This section includes:

- "Command: gtacl -p scf info lif ';$zzlan.*';" below
- "Command: gtacl -p scf info subnet ';$*.*';" on the next page
- "Command: mxci" on the next page
- "Command: set schema nonstop_sqlmx_measyos.system_schema;" on the next page
- "Command: select cat_name, cat_uid from catsys;" on page 545
- "Command: select schema_name, cat_uid from schemata;" on page 545
- "Command: exit" on page 546
- "Command: gtacl -p sqlci" on page 546
- "Command: fileinfo $system.system.sqlci2, detail;" on page 546
- "Command: select catalogname from $QA1.SQL.catalogs;" on page 547

Command: gtacl -p scf info lif ';$zzlan.*';

- **Sample Output**

```
SCF - T9082H01 - (16JUL10) (30MAR10) - 11/08/2010 01:32:10 System \NON_STOP_
SYSTEM
(C) 1986 Tandem (C) 2006 Hewlett Packard Development Company, L.P.
SLSA Info LIF
Name               Associated Object     MAC Address         Type
$ZZLAN.LANA        G4SA0.0.A             01:01:01:01:01:01   Ethernet
$ZZLAN.LANB        G4SA0.0.B             02:02:02:02:02:02   Ethernet
$ZZLAN.LANC        G4SA0.0.C             03:03:03:03:03:03   Ethernet
$ZZLAN.LAND        G4SA0.0.D             04:04:04:04:04:04   Ethernet
Total Errors = 0    Total Warnings = 0
```

- **Modeled CITs: Interface**

Attribute	Value	Comment
Name	**LANA**	
Interface MAC Address	**01:01:01:01:01:01**	
Interface Description	**G4SA0.0.A**	

Command: gtacl -p scf info subnet ';$*.*';

- **Sample Output (partial)**

```
SCF - T9082H01 - (16JUL10) (30MAR10) - 11/08/2010 04:05:58 System \MEASYOS
(C) 1986 Tandem (C) 2006 Hewlett Packard Development Company, L.P.
TCPIP Info SUBNET \MEASYOS.$ZSM1.*
Name     Devicename     *IPADDRESS       TYPE     *SUBNETMASK  SuName   QIO *R
#SN01    \MEASYOS.LANC   10.10.10.10   ETHERNET  %HFFFFFC00           ON  N
#LOOP0                   127.0.0.1       LOOP-BACK %HFF000000           OFF N
TCPIP Info SUBNET \MEASYOS.$ZTC0.*
Name     Devicename     *IPADDRESS       TYPE     *SUBNETMASK  SuName   QIO *R
#SN01    \MEASYOS.LANC   10.10.10.10   ETHERNET  %HFFFFFC00           ON  N
#LOOP0                   127.0.0.1       LOOP-BACK %HFF000000           OFF N
```

- **Modeled CITs: IP, Network**

Attribute	Value	Comment
IP Address	**10.10.10.10**	Only "ETHERNET" type is considered
IP Network Mask	**%HFFFFFC00**	A network mask represented in HEX format
Container	**LANC**	The name of the interface where this IP is connected to

> **Note:** The Network CIT is also created from this command.

Command: mxci

- **Sample Output**

```
Hewlett-Packard NonStop(TM) SQL/MX Conversational Interface 2.3.4
(c) Copyright 2003, 2004-2010 Hewlett-Packard Development Company, LP.
```

- **Values Taken**

  SQL/MX version value is taken from the output. In this case, it is 2.3.4.

Command: set schema nonstop_sqlmx_measyos.system_schema;

- **Sample Output**

```
--- SQL operation complete.
```

- **Modeled CITs**

  None

Command: select cat_name, cat_uid from catsys;

- **Sample Output**

```
CAT_NAME                                                                CAT_UID
------------------------------------------------------------------  -------------
-------
C
0101010101010101010
NONSTOP_SQLMX_MEASYOS
0202020202020202020
--- 2 row(s) selected.
```

- **Modeled CITs - NonStop SQL/MX**

Attribute	Value	Comment
Name	NonStop SQL/MX	This value is a constant
Catalog UUID	0101010101010101010	
The Database instance name	NONSTOP_SQLMX_MEASYOS	

Command: select schema_name, cat_uid from schemata;

- **Output**

```
SCHEMA_NAME                                                             CAT_UID
------------------------------------------------------------------  -------------
-------
DEFINITION_SCHEMA_VERSION_1200
0101010101010101010
S
0202020202020202020
DEFINITION_SCHEMA_VERSION_1200
0202020202020202020
--- 7 row(s) selected.
```

- **Modeled CITs: Database Schema**

Attribute	Value	Comment
Name	DEFINITION_SCHEMA_VERSION_1200	This is the schema ID
Container	0101010101010101010	

Command: exit

- **Sample Output**

```
End of MXCI Session
```

Command: gtacl -p sqlci

- **Sample Output**

```
SQL Conversational Interface - T9191H01^ACM - (01OCT09)
(C) 1987 COMPAQ (C) 2006 Hewlett Packard Development Company, L.P.
```

Command: fileinfo $system.system.sqlci2, detail;

- **Sample Output**

```
$SYSTEM.SYSTEM.SQLCI2                 8 Nov 2010,  6:22
    ENSCRIBE ( VALID SQL PROGRAM )
    CATALOG $QA1.SQL
    PROGRAM CATALOG VERSION 1
    PROGRAM FORMAT VERSION  350
    TYPE U
    FORMAT 1
    CODE 100
    EXT ( 56 PAGES, 56 PAGES, MAXEXTENTS 978 )
    ODDUNSTR
    NO AUDITCOMPRESS
    OWNER -1
    SECURITY (RWEP): NUNU
    MODIF: 21 Dec 2008, 23:22, OPEN
    CREATION DATE: 21 Dec 2008, 23:21
    LAST OPEN:  8 Nov 2010,  6:22
    EOF 364544 (0.3% USED)
    EXTENTS ALLOCATED: 4
```

- **Values Taken**

```
QA1.SQL
```

Command: select catalogname from $QA1.SQL.catalogs;

- **Sample Output**

```
CATALOGNAME
------------------------
\MEASYOS.$QA1.H03SQLMP
\MEASYOS.$QA1.SQL
\MEASYOS.$QA2.PERSNL
\MEASYOS.$SFF04.SALES
\MEASYOS.$SGT01.INVENT
\MEASYOS.$SGT01.PERSNL
\MEASYOS.$SGT02.SALES
\MEASYOS.$SGT03.INVENT
\MEASYOS.$SYSTEM.SRK
\MEASYOS.$SYSTEM.VIMAL
--- 10 row(s) selected.
```

- **Modeled CITs: Database**

Attribute	Value	Comment
Name	NonStop SQL/MX	This value is a constant
Database instance name	$QA1.H03SQLMP	

Chapter 34: SAP HANA Database Discovery

This chapter includes:

Overview 549
Supported Versions 549
Topology 549
Discovery Mechanism 552
How to Discover SAP HANA Database 553
How to Discover SAP HANA Database by Shell 553
How to Discover SAP HANA Database by SQL 554
HanaDb by Shell Job 555
HanaDb by Shell Adapter 556
HanaDb Connection by SQL Job 558
HanaDb Connection By SQL Adapter 559
HanaDb Topology by SQL Job 561
HanaDb Topology by SQL Adapter 561

Overview

SAP HANA (High Performance Analytic Appliance) is SAP's database technology. It is distributed as an appliance, a combination of hardware approved by SAP, and as in-memory database software.

Supported Versions

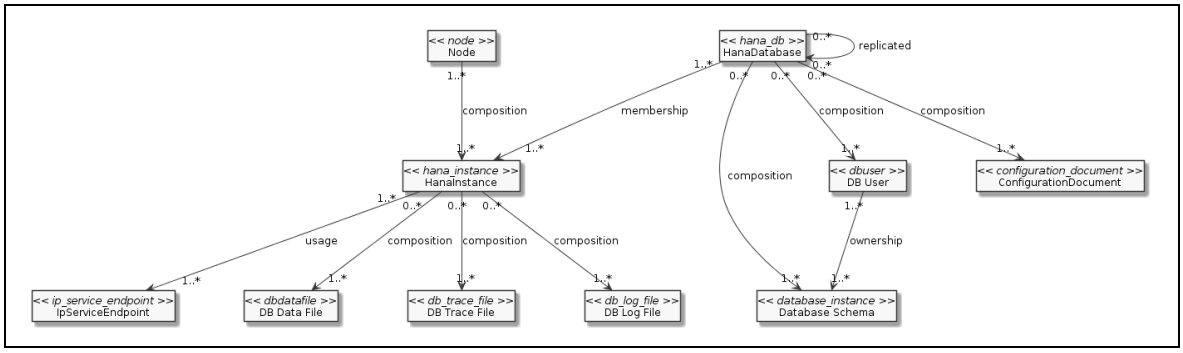
This discovery supports SAP HANA 1.0 and 1.5 running in a UNIX environment.

Topology

This section shows the topologies of the SAP HANA Database discovery.

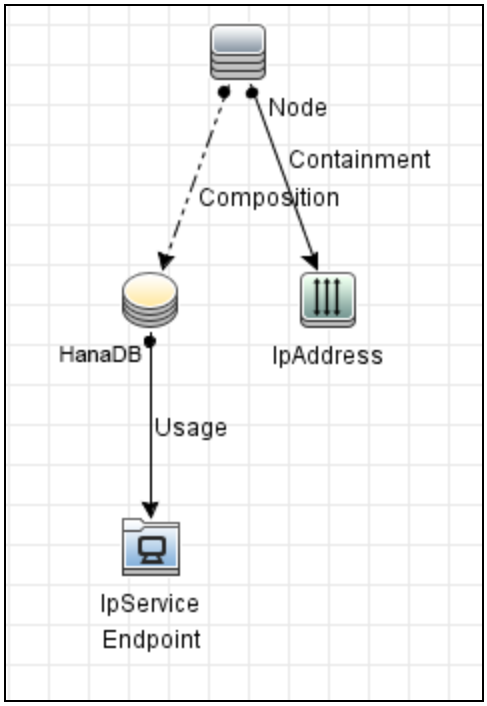
HanaDb by Shell discovery topology

For a list of discovered CITs, see "Discovered CITs" on page 558.

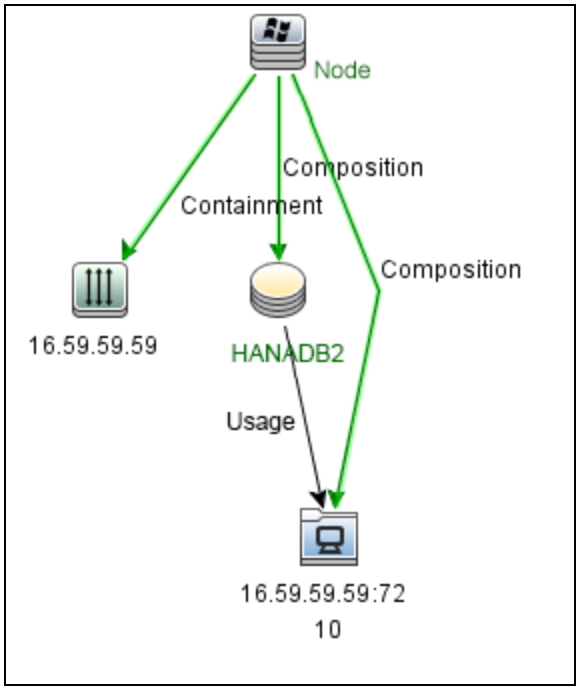


HanaDb Connection by SQL discovery topology

For a list of discovered CITs, see "Discovered CITs" on page 560.

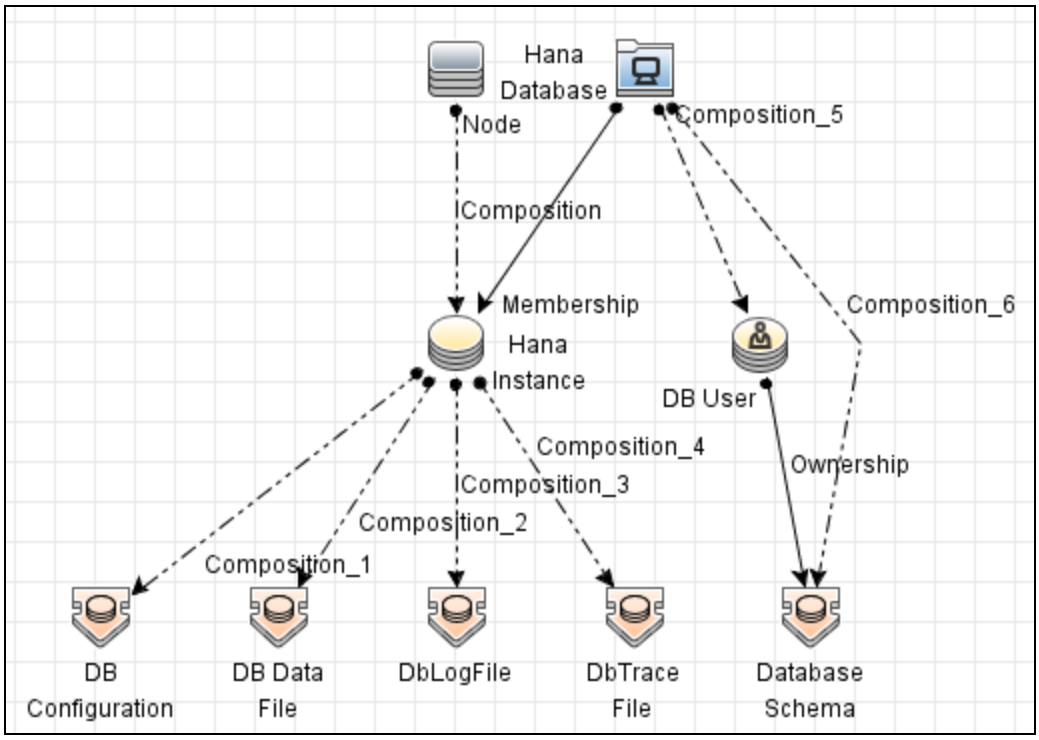


The following image shows an example of the HanaDb Connection by SQL discovery.

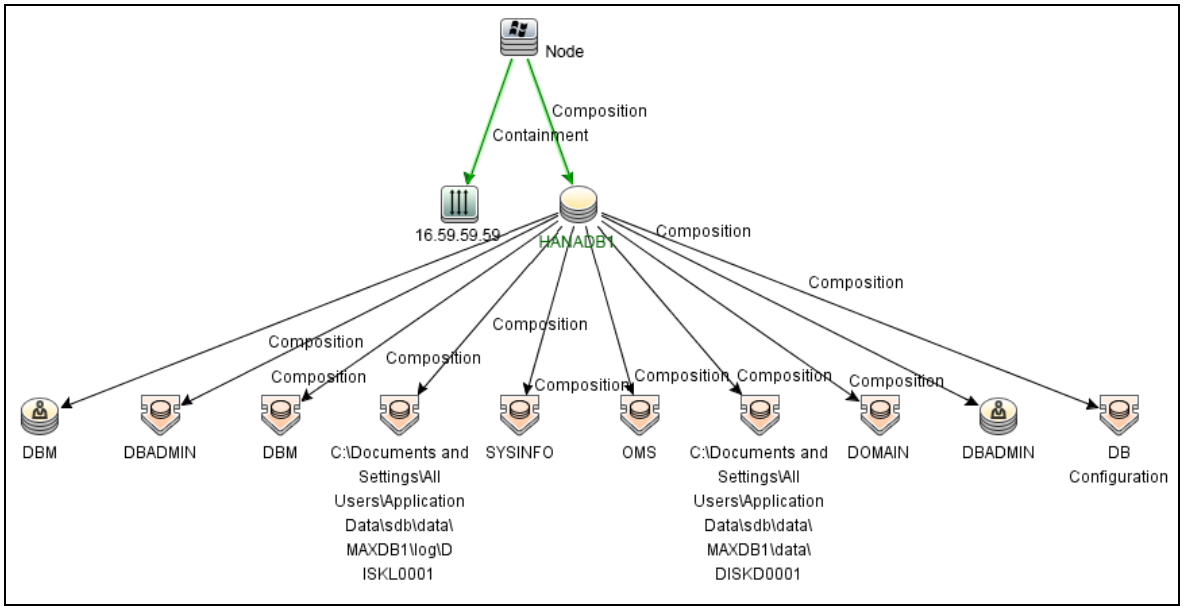


HanaDb Topology by SQL discovery topology

For a list of discovered CITs, see "Discovered CITs" on page 563.



The following image shows an example of the HanaDb Topology by SQL discovery.



Discovery Mechanism

Signatures

The **HanaDb** package has one signature: **SAP HanaDB**, which discovers Hana instances by the presence of a process that starts with **HDB.sap** (HDB daemon). The database name and instance number are parsed from the HDB daemon name using the **hanadb_instance_name** parsing rule.

Plugins

Additional topology is reported by the **hanadb** plugin, which discovers HanaDatabase and other Hana instances and used SQL ports that are modeled as **IpServiceEndpoints**.

How to Discover SAP HANA Database

This section includes:

How to Discover SAP HANA Database by Shell 553
How to Discover SAP HANA Database by SQL 554

How to Discover SAP HANA Database by Shell

This section describes how to discover the topology of SAP HANA Database by Shell.

This task includes the following steps:

1. Prerequisite - Set up protocol credentials

   Configure the Shell protocol credential.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Run the hdbsql command line tool

   Shell-based HANA discovery uses the `hdbsql` command line tool to execute SQL queries. The following paths are searched:

   - **<*installation_path*>/hdbclient/hdbsql**
   - **/usr/sap/hdbclient/hdbsql**
   - **/usr/sap/<*db_sid*>/hdbclient/hdbsql**
   - **/usr/sap/<*db_sid*>/exe/linuxx86_64/hdb/hdbsql**
   - **/usr/sap/<*db_sid*>/SYS/global/hdbclient/hdbsql**
   - **/sapmnt/<*db_sid*>/hdbclient/hdbsql**
   - **/sapmnt/<*db_sid*>/global/hdbclient/hdbsql**

   where <***db_sid***> is the SID of the HANA database.

   If the tool is not available in any of those paths, then its presence is checked in the PATH variable. Otherwise, the discovery process throws a **NoHdbsqlException** and stops discovery for the current HANA database.

3. Configure the HDB User Store

   To perform shallow or deep discovery, you must properly configure the HDB user store for the destination being discovered. The current discovery mechanism uses cmdb <*db_sid*> HDB User Storename, where <*db_sid*> is the SID of the HANA database.

   > **Note:** The hdbsql tool requires a valid HDB user store entry to be specified with the -U option.

4. Run the discovery

   Activate the following jobs:

   - Run the **Range IPs by ICMP** job to discover which of the machines in the IP range are up

     To perform a shallow discovery where the basic topology is discovered (HanaDatabase, HanaInstance, and IpServiceEndpoint CITs), execute only the following two jobs and do not proceed to the following step:

     - Run the **Host Connection by Shell** job to discover a host's connectivity by shell protocol to HANA servers.
     - Run the **Host Applications by Shell** job to discover a HANA database, its instances, and the instance's IP service endpoints.

   - To perform a deep discovery, also run the **HanaDb by Shell** job to discover the topology of the target HANA Database. This job also discovers all HANA Database resources (schemas, database users, and configuration files) and HANA instances resources (data, trace files, and log files).

How to Discover SAP HANA Database by SQL

This section describes how to discover the topology of SAP HANA Database by SQL.

This task includes the following steps:

1. Prerequisite - Set up protocol credentials

   This discovery uses the Generic DB protocol (SQL).

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

Copy the **ngdbc.jar** file to the following Data Flow Probe resource folder: **<DataFlowProbe install folder>\runtime\probeManager\discoveryResources\db\hanadb**.

2. Run the discovery

If the instance name is configured in the protocol credentials, activate the following jobs in the listed order:

a. **Range IPs by ICMP**
b. **Databases TCP Ports**
c. **DNS Resolver** - Run this job only when you select **SSL** as the **Encryption Method** in Generic DB Protocol (SQL)
d. **HanaDb Connection by SQL**
e. **HanaDb Topology by SQL**

Or activate the following jobs in the listed order:

a. **Range IPs by ICMP**
b. **Host Connection by Shell**
c. **Host Applications by Shell**
d. **DNS Resolver** - Run this job only when you select **SSL** as the **Encryption Method** in Generic DB Protocol (SQL)
e. **HanaDb Connection by SQL**
f. **HanaDb Topology by SQL**

HanaDb by Shell Job

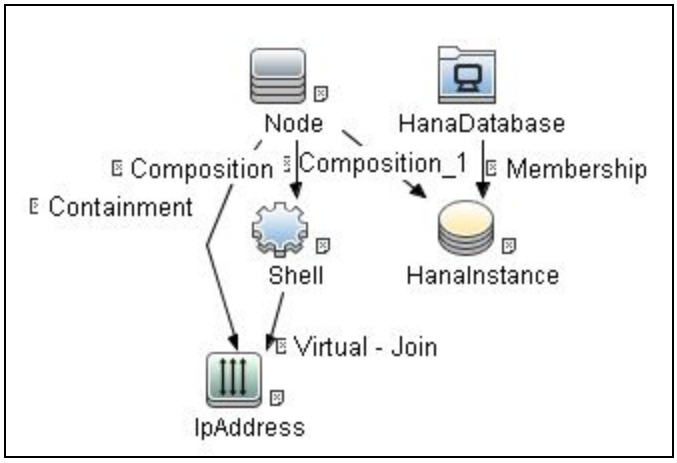
This section includes:

Adapter

This job uses the **HanaDb_by_Shell** adapter.

Trigger Query

Name: hanadb



CI	Attribute Value
Shell	NOT Reference to the credentials dictionary entry Is null
HanaInstance	NOT Application Installed Path is null
IpAddress	NOT IP Probe Name Is null

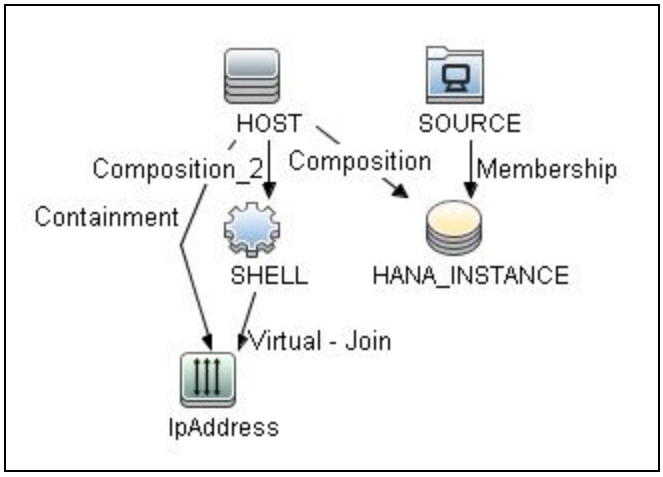
HanaDb by Shell Adapter

This section includes:

Input CIT

Hana Database.

Input Query



CI	Attribute Value
IpAddress	NOT IP Probe Name Is null
SHELL	NOT Reference to the credentials dictionary entry Is null
HANA_INSTANCE	NOT Application Installed Path Is null

Triggered CI Data

Name	Value	Description
installpath	${HANA_ INSTANCE.application_ path}	List of installation paths for each HanaInstance connected to the current HanaDatabase.
Protocol	${SHELL.root_class}	List of protocol names, one for each existing HanaInstance shell.
credentialsId	${SHELL.credentials_id}	List of references to the credentials dictionary to be used for the connection.
ip_address	${SHELL.application_ip}	List of IP addresses for each shell connected to the HanaInstance.
sid	${SOURCE.name}	The SID of the HanaDatabase CI.
hanadb_ cmdbid	${SOURCE.root_id}	The CMDB ID of the HanaDatabase CI.

Discovered CITs

- Composition
- ConfigurationDocument
- Containment
- Database Schema
- DB Data File
- DB User
- DbLogFile
- DbTraceFile
- Dependency
- HanaDatabase
- HanaInstance
- IpAddress
- IpServiceEndpoint
- Node
- Ownership
- Usage

HanaDb Connection by SQL Job

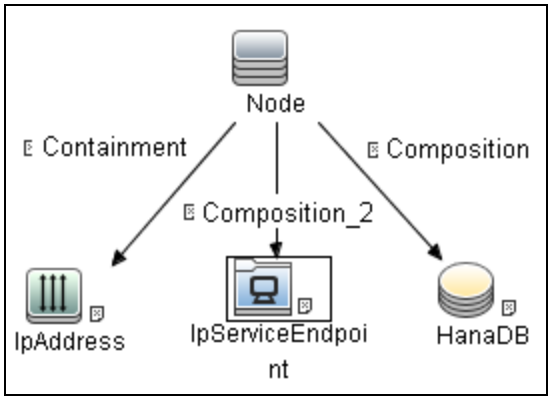
This section includes:

Adapter

This job uses the **SQL_NET_Dis_Connection_HanaDB** adapter.

Trigger Query

Name: hanadb_port_sa



CI	Attribute Value
IpServiceEndpoint	IpServiceName Equal ignore case hanadb OR ServiceNames Contains hanadb
IpAddress	NOT IP Probe Name Is null

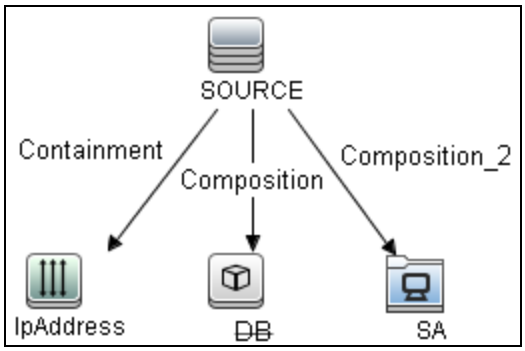
HanaDb Connection By SQL Adapter

This section includes:

Input CIT

Node.

Input Query



CI	Attribute Value
IpAddress	NOT IP Probe Name Is null
SA	IpServiceName Equal ignore case postgresql OR ServiceNames Contains postgresql

Triggered CI Data

Name	Value
application_ip	${DB.application_ip:NA}
application_port	${DB.application_port:NA}
ip_address	${IpAddress.name}
sa_ip	${SA.bound_to_ip_address:NA}
sa_port	${SA.network_port_number:NA}
sid	${DB.name:NA}

Used Scripts

- file_ver_lib.py
- SQL_Connection.py

Discovered CITs

- Composition
- Containment
- HanaInstance
- IpAddress
- IpServiceEndpoint
- Node
- Usage

Adapter Parameters

Name	Default Value	Description
protocolType	HanaDB	The used protocol type.

HanaDb Topology by SQL Job

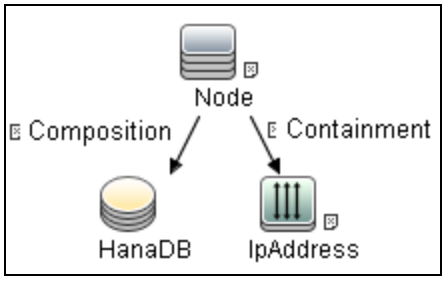
This section includes:

Adapter

This job uses the **HanaDb Topology by SQL** adapter.

Trigger Query

Name: hanadb_sql



CI	Attribute Value
Node	None
HanaDB	NOT Reference to the credentials dictionary entry Is null
IpAddress	NOT IP Probe Name Is null

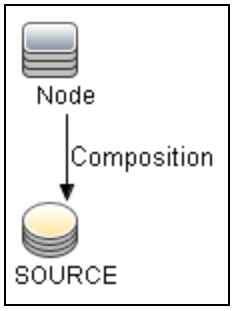
HanaDb Topology by SQL Adapter

This section includes:

Input CIT

HanaInstance.

Input Query



CI	Attribute Value
SOURCE	NOT Reference to the credentials dictionary entry Is null

Triggered CI Data

Name	Value
credentialsId	${SOURCE.credentials_id:NA}
ip_address	${SOURCE.application_ip:}
port	${SOURCE.application_port:}
sid	${SOURCE.name:NA}

Used Scripts

- hana_queries.py
- hana_sql_topology.py
- hanadb_by_sql.py

Discovered CITs

- Composition
- DB Configuration
- DB Data File
- DB User
- Database Schema
- DbLogFile
- DbTraceFile
- HanaDatabase
- IpAddress
- Membership
- Node
- Ownership
- Replicated

Adapter Parameters

Name	Default Value	Description
discoverAllUsersSchemas	false	Indicates whether to discover all DB Users.
discoverDataFiles	true	Indicates whether to discover DB Data Files.
discoverDatabaseConfigurations	false	Indicates whether to discover HanaDB configurations.
discoverInstanceConfigurations	false	Indicates whether to discover HanaDB instance configurations.
discoverLicenses	false	Indicates whether to discover DB Licenses.
discoverLogFiles	false	Indicates whether to discover DB Log Files.
discoverReplication	false	Indicates whether to discover DB Replication.

Name	Default Value	Description
discoverSchemas	true	Indicates whether to discover DB Schemas.
discoverTraceFiles	false	Indicates whether to discover DB Trace Files.
discoverUsers	true	If true, DB Users are retrieved, except external users.

Chapter 35: MS-SQL Discovery

This chapter includes:

Overview 566

Supported Versions 566

Topology 566

How to Discover Microsoft SQL Server Database Application 569

How to Discover Microsoft SQL Server Always On Failover Cluster Instances 570

How to Discover MS SQL Server Components Using OS Credentials 572

Microsoft SQL Server Database Application Discovery 572

SQL Server by OS Credentials Discovery 574

Overview

MS SQL Discovery discovers MS SQL database servers, database, and Always On Failover Cluster Instances topology.

MS SQL Server Always On Failover Cluster Instances leverages Windows Server Failover Clustering (WSFC) functionality to provide local high availability through redundancy at the server-instance level. The Always On Failover Cluster Instances is introduced in MS SQL version 2012. The topology of Always On Failover Cluster Instances leverages the topology of WSFC.

MS SQL database servers can be discovered either by Generic DB Protocol (SQL) or by OS credentials. MS SQL database and Always On Failover Cluster Instances topology can be discovered by Generic DB Protocol (SQL) only.

Supported Versions

This discovery supports Microsoft SQL Server versions 2000, 2005, 2008, 2008 R2, 2012, 2012 SP2, 2014, and 2016.

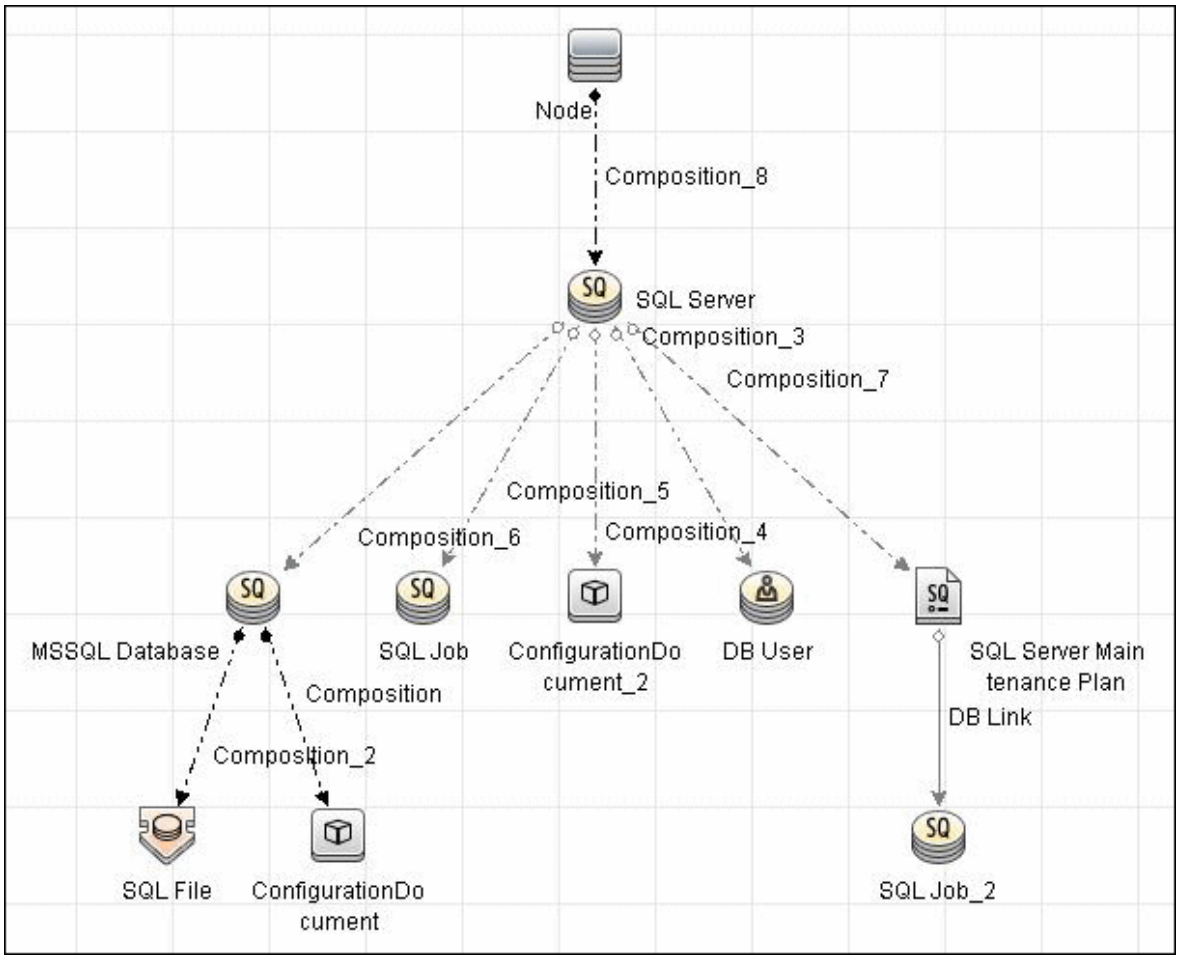
This discovery supports Microsoft SQL Server Always On Failover Cluster Instances.

Topology

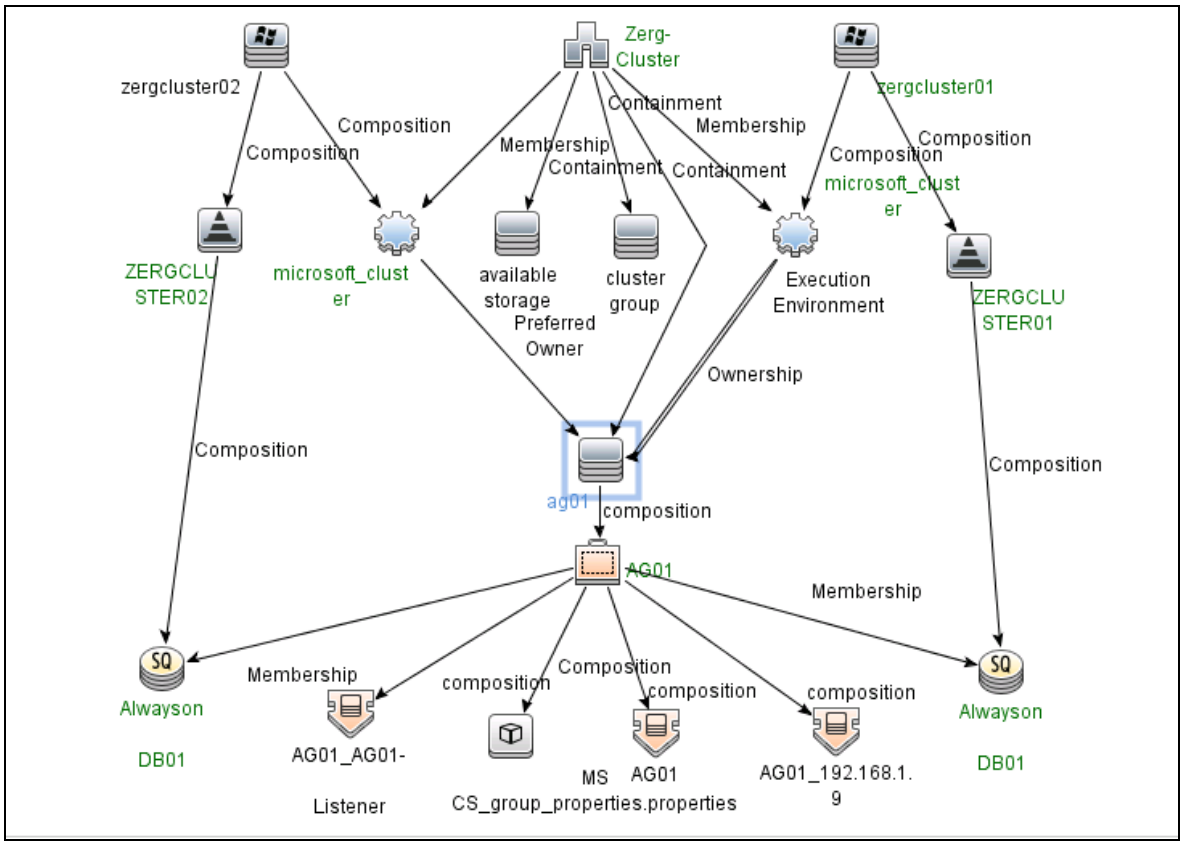
The following image displays the topology of the Microsoft SQL Server Database discovery.

This view shows the hosts on which Microsoft SQL Server is installed. Microsoft SQL Server contains the databases, users, SQL jobs, and configuration files of this database, and maintenance plans.

> **Note:** For a list of discovered CITs, see "Discovered CITs" on page 573.


Node
Composition_8
SQL Server
Composition_3
Composition_7
Composition_5
Composition_6
Composition_4
MSSQL Database
SQL Job
ConfigurationDocument_2
DB User
SQL Server Maintenance Plan
Composition
DB Link
Composition_2
SQL File
ConfigurationDocument
SQL Job_2

The following image displays an example of the MS SQL Always On Failover Cluster Instances topology:



How to Discover Microsoft SQL Server Database Application

This task describes how to discover the Microsoft SQL Server database application.

This task includes the following steps:

1. Prerequisite - Set up protocol credentials

   Microsoft SQL Server uses the Generic DB Protocol (SQL). This protocol for Microsoft SQL Server contains:

   - Microsoft SQL Server protocol; the database login and password used for authentication.
   - Microsoft SQL Server NTLM protocol; the OS login and password used for authentication.
   - Microsoft SQL Server NTLMv2 protocol; version 2 of the protocol with the OS login and password used for authentication.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Prerequisite - Verify the user on the Microsoft SQL Server

   Verify the user name, password, and port used by Microsoft SQL Server.

3. Run the discovery

   In the Universal Discovery window, activate the jobs in the following order:

   - **Databases TCP Ports**
   - **MSSQL Server Connection by SQL**
   - **MSSQL Topology by SQL**

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

How to Discover Microsoft SQL Server Always On Failover Cluster Instances

This task describes how to discover the Microsoft SQL Server Always On Failover Cluster Instances.

This task includes the following steps:

1. Prerequisite - Set up protocol credentials

   Microsoft SQL Server Always On Failover Cluster Instances is based on Windows Server Failover Clustering (WSFC). To discover the topology of WSFC, define credentials for one of the following protocols :

   - NTCMD Protocol
   - Universal Discovery Protocol

   To discover the topology of the Microsoft SQL Server Always On Failover Cluster Instances, define the Generic DB Protocol (SQL) only. This protocol for Microsoft SQL Server contains:

   - Microsoft SQL Server protocol; the database login and password used for authentication.
   - Microsoft SQL Server NTLM protocol; the OS login and password used for authentication.
   - Microsoft SQL Server NTLMv2 protocol; version 2 of the protocol with the OS login and password used for authentication.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Prerequisite - Verify the user on the Microsoft SQL Server

   Verify the user name, password, and port used by Microsoft SQL Server.

3. Run the discovery

   In the Universal Discovery window, activate the jobs in the following order:

   - **Range IPs by ICMP**
   - **Host Connection by Shell**
   - **Host Applications by Shell**

- **MSSQL Server Connection by SQL**
- **MSSQL Topology by SQL**

If you need more information about the WSFC, you can run the **MS Cluster by NTCMD or UDA** job after the preceding jobs finish.

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

How to Discover MS SQL Server Components Using OS Credentials

1. Run the discovery

   The following jobs discover MS SQL Server components using OS credentials:

   - **Host Applications by Shell**
   - **Host Applications by WMI**
   - **DB connections by Shell**
   - **DB connections by WMI**

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

Microsoft SQL Server Database Application Discovery

Adapter

Adapter Parameters for the MSSQL Topology by SQL job

Parameter	Default Value	Description
discoverConfigs	true	Server configuration ('mssql database configuration.txt') is retrieved.
discoverDbUser	false	DB User entities for MS SQL Server are not retrieved.
discoverInternalProcedures	false	Internal MS SQL stored procedures are filtered during discovery and are not reported to the UCMDB. **Note:** Internal MS SQL stored procedures come from MSDB and Master databases and begin with suffixes: **sp_**, **xp_**, **ms_** and **sysmail_**.

Parameter	Default Value	Description
discoverSqlFile	false	SQL File entities for MS SQL Server are not retrieved.
discoverSqlJob	false	SQL Job entities for MS SQL Server are not retrieved.
discoverStoredProcedures	false	Do not discover stored procedures from the MS SQL Database Server.

Adapter Parameters for the MSSQL Server Connection by SQL job

Parameter	Default Value	Description
handleSQLBrowserMappings	false	If MS SQL Browser Service is running, the job will connect with SQL instances without the default port but actually will forward to the real port. This will cause all instances to relate to the default IP service endpoint. Setting this parameter to **true** will result in proper filtering of such cases and reporting only really listened ports of the service.
protocolType	MicrosoftSQLServer	The used protocol type.
tryAllCredentials	false	Specifies whether to try more credentials if one DB instance is connected successfully with one credential. If **false**, the job will store the first connected credential and stop trying other credentials. If **true**, the job will try all credentials and store the last connected one.

Discovered CITs

To view discovered CITs, select a specific adapter in the Resources pane. For details, see "Discovered CITs Pane" in the *HPE Universal CMDB Data Flow Management Guide*.

For details on the CIs that are discovered, see the section describing discovery progress and results in the *HPE Universal CMDB Data Flow Management Guide*.

> **Note:** To view the topology, see "Topology" on page 566.

SQL Server by OS Credentials Discovery

Universal Discovery can discover MS SQL Server CIs using operating system (OS) credentials. Universal Discovery creates an identifiable SQL Server CI, rather than a generic RunningSoftware CI.

Previously, SQL Server discovery assumed the existence of a process with the name of **sqlservr.exe**. Once Universal Discovery found this process, generic running software with a **MSSQL DB** value in the **name** attribute was reported to UCMDB.

The Data Flow Probe can report multiple SQL Server instances, each of them linked by a dependency link to its own **sqlservr.exe** process.

Universal Discovery supports SQL Server named instances.

There are two approaches to identifying MS SQL Server instance names by OS credentials. The changes appear in the **Host_Resources_Basic** package:

- **By Process Command Line**. The SQL Server process usually includes the MS SQL Server instance name in its command line. Universal Discovery extracts this instance name to a CI.

  > **Note:** A process command line cannot be retrieved by the SNMP protocol. Therefore, SNMP cannot be used to discover the MS SQL Server instance name, and Universal Discovery reports the generic running software CI instead.

- **Using Windows Services**. Universal Discovery checks existing services for those that include **sqlservr.exe** in the command line and extracts the instance name from the service name (because the service name reflects the instance name).

Chapter 36: SAP MaxDB Discovery

This chapter includes:

Overview 576
Supported Versions 576
Topology 576
How to Discover SAP MaxDB 580
How to Discover SAP MaxDB by Shell 580
How to Discover SAP MaxDB by SQL 581
MaxDb by Shell Job 582
MaxDb by Shell Adapter 583
MaxDb Connection by SQL Job 585
MaxDb Connection By SQL Adapter 586
MaxDb Topology by SQL Job 587
MaxDb Topology by SQL Adapter 588

Overview

SAP MaxDB is an ANSI SQL-92 (entry level) compliant relational database management system (RDBMS) from SAP AG. The MaxDB discovery package provides shallow and deep discovery of MaxDB resources.

Supported Versions

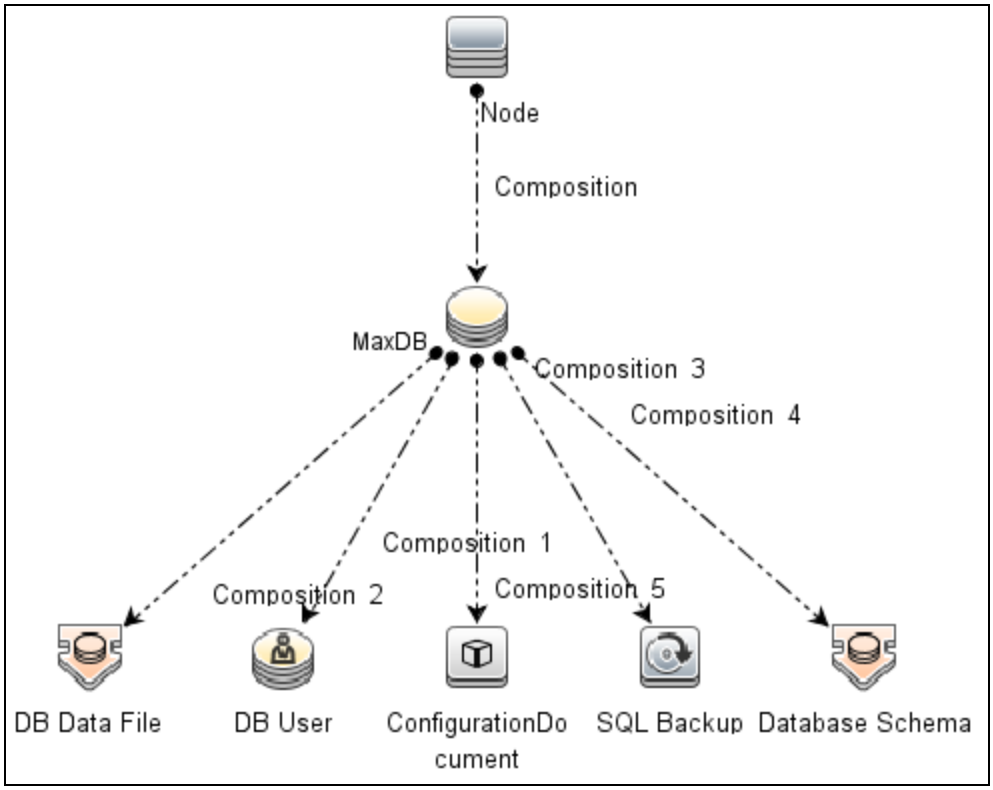
This discovery supports SAP MaxDB 7.x.

Topology

This section shows the topologies of the SAP MaxDB Database discovery.

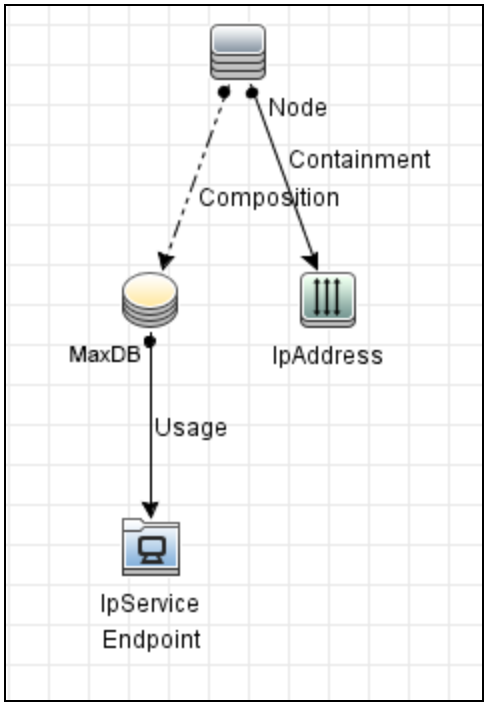
MaxDB by Shell discovery topology

For a list of discovered CITs, see "Discovered CITs" on page 584.

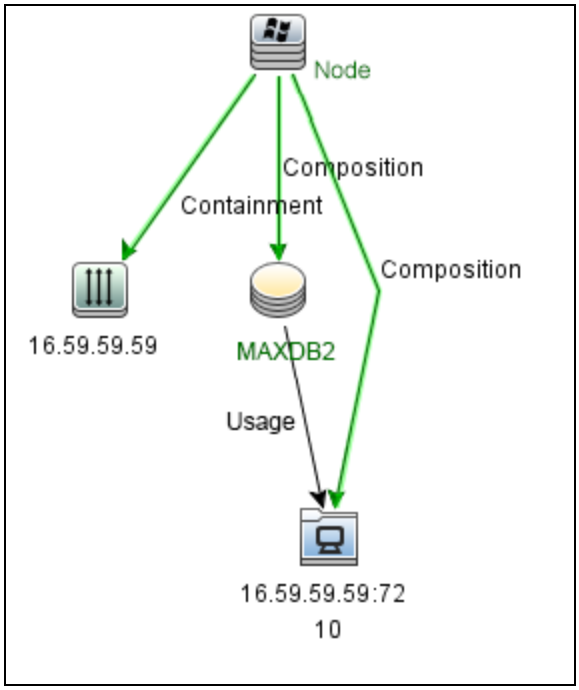


MaxDb Connection by SQL discovery topology

For a list of discovered CITs, see "Discovered CITs" on page 587.

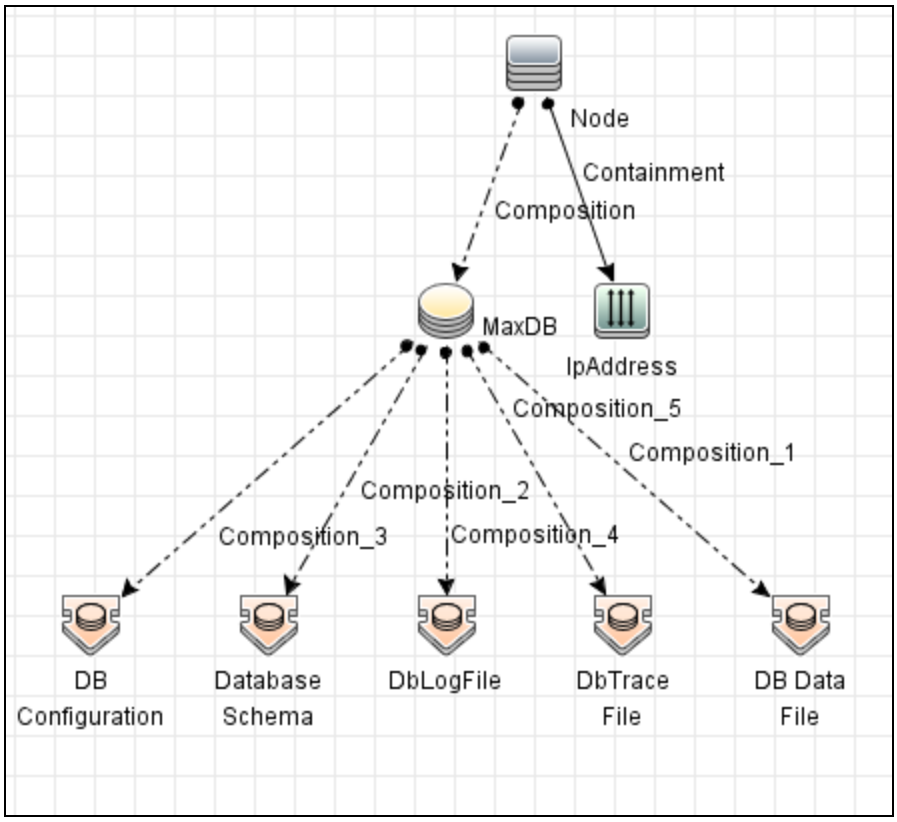


The following image shows an example of the MaxDb Connection by SQL discovery.

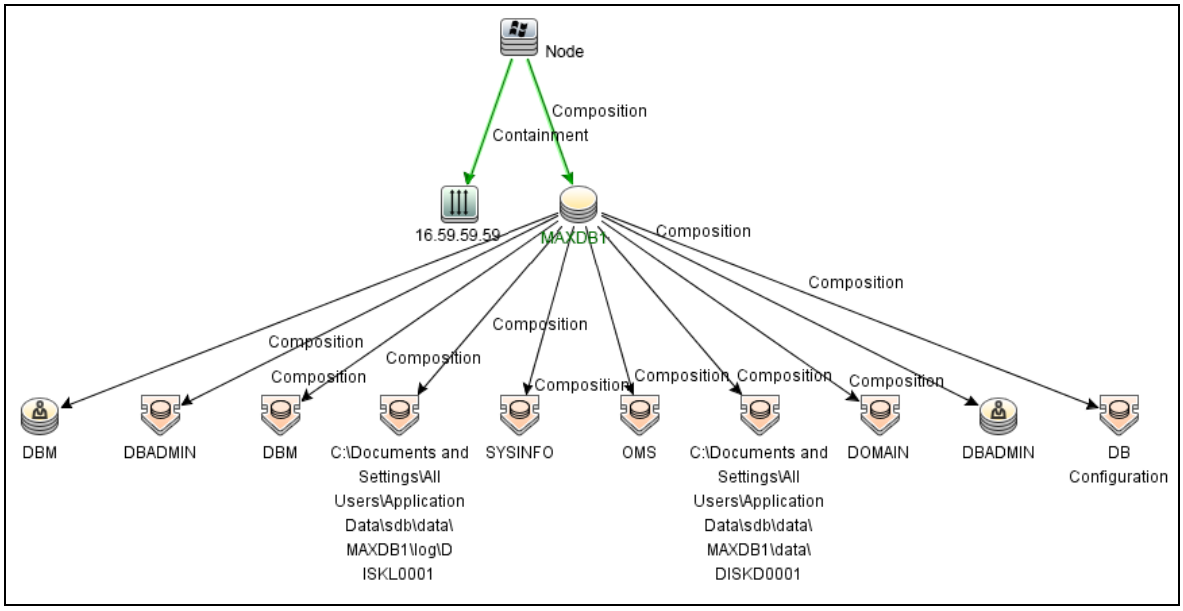


MaxDb Topology by SQL discovery topology

For a list of discovered CITs, see "Discovered CITs" on page 589.



The following image shows an example of the MaxDB Topology by SQL discovery.



How to Discover SAP MaxDB

This section includes:

How to Discover SAP MaxDB by Shell 580
How to Discover SAP MaxDB by SQL 581

How to Discover SAP MaxDB by Shell

This section describes how to discover the topology of SAP MaxDB by Shell.

This task includes the following steps:

1. Prerequisite - Connectivity and user store
   a. Shell connectivity to a MaxDB Node.
   b. Properly configured key store containing one key for each MaxDB instance being discovered.

   > **Note:** Because the command **xuser** is used to run the **dbmcli** tool, you must create a key store on the destination so the call for the tool is properly authenticated.

2. Prerequisite - Set up protocol credentials

Define one of the following credentials, depending on the platform:

- SSH
- Telnet
- NTCMD

For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

3. Run the discovery

   a. Run the **Range IPs by ICMP** job to discover the target IPs.

   b. Run the **Host Connection by Shell** job to discover the target host and shell connectivity to it.

   c. Run the **Host Applications by Shell** job to discover the resources of the target host, including MaxDB software and relevant processes.

   d. Run the **MaxDb by Shell** job to discover the topology of the target MaxDB database.

How to Discover SAP MaxDB by SQL

This task includes the following steps:

1. Prerequisite - Set up protocol credentials

   This discovery uses the Generic DB protocol (SQL).

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

   Copy the **sapdbc.jar** file to the following Data Flow Probe resource folder: **<DataFlowProbe install folder>\runtime\probeManager\discoveryResources\db\maxdb**.

2. Run the discovery

   If the instance name is configured in the protocol credentials, activate the following jobs in the listed order:

   a. **Range IPs by ICMP**

   b. **Databases TCP Ports**

c. **MaxDb Connection by SQL**

d. **MaxDb Topology by SQL**

If the instance name is not configured in the protocol credentials, activate the following jobs in the listed order:

a. **Range IPs by ICMP**

b. **Host Connection by Shell**

c. **Host Application by Shell**

d. **MaxDb Connection by SQL**

e. **MaxDb Topology by SQL**

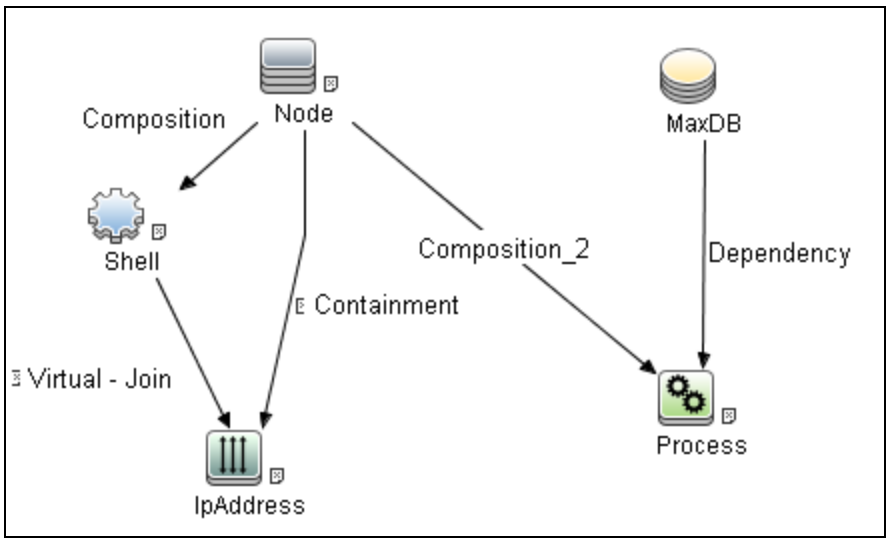
MaxDb by Shell Job

This section contains details about the job.

Adapter

This job uses the **MaxDb by Shell** adapter.

Trigger Query



CI	Attribute Value
IpAddress	NOT IP Probe Name Is Null
Process	(Name Equal kernel OR Name Equal kernel.exe) AND NOT Process Path Is null
Shell	NOT Reference to the credentials dictionary entry Is null

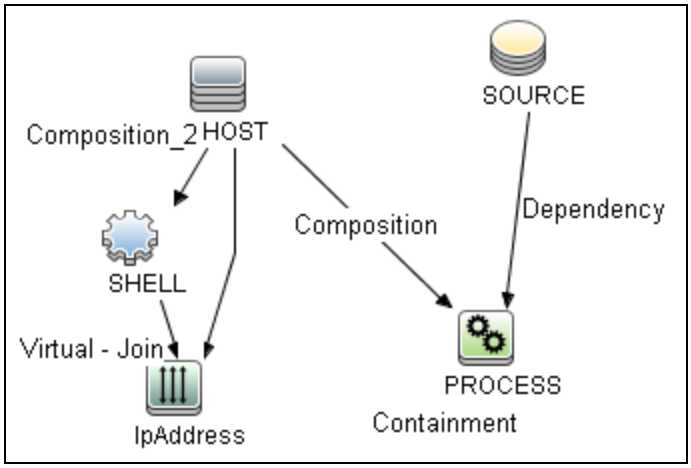
MaxDb by Shell Adapter

This section contains details about the adapter.

Input CIT

MaxDB

Input Query



CI	Attribute Value
IpAddress	NOT IP Probe Name Is null
PROCESS	Name Equal kernel OR Name Equal kernel.exe

Triggered CI Data

Name	Value
Protocol	${SHELL.root_class}
credentialsId	${SHELL.credentials_id}
dbDataPath	${SOURCE.data_path}
dbPort	${SOURCE.application_port:}
dbProgramPath	${SOURCE.program_path}
dbSid	${SOURCE.name}
dbVersion	${SOURCE.application_version}
ip_address	${SHELL.application_ip}
processParams	${PROCESS.process_parameters:}
processPath	${PROCESS.process_path:}

Used Scripts

- db_platform.py
- db.py
- db_builder.py
- maxdb.py
- maxdb_base_parser.py
- maxdb_base_discoverer.py
- maxdb_discoverer.py
- maxdb_xuser.py
- maxdb_by_shell.py

Discovered CITs

- Composition

- ConfigurationDocument
- Containment
- DB Data FIle
- DB User
- Database Schema
- IpAddress
- IpServiceEndpoint
- MaxDB
- Node
- SQL Backup

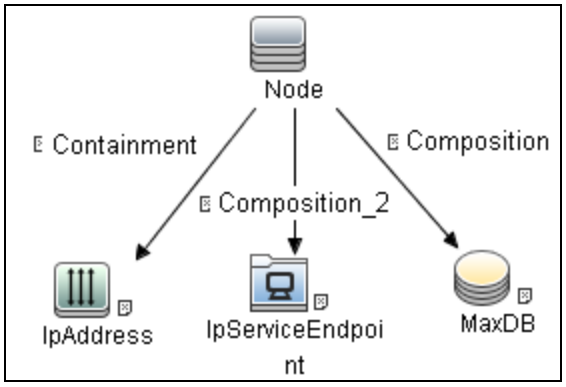
MaxDb Connection by SQL Job

This section contains details about the job.

Adapter

This job uses the **SQL_NET_Dis_Connection_MaxDB** adapter.

Trigger Query



CI	Attribute Value
IpAddress	NOT IP Probe Name Is null
IpServiceEndpoint	IpServiceName Equal ignore case maxdb OR ServiceNames Contains maxdb

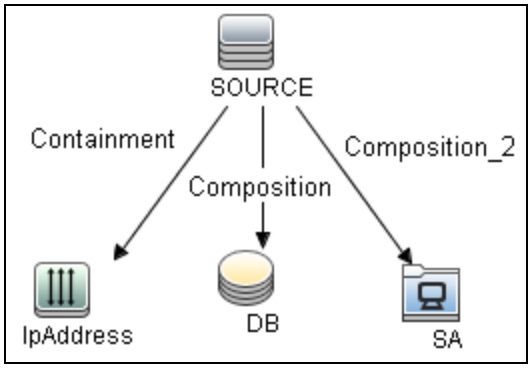
MaxDb Connection By SQL Adapter

This section contains details about the adapter.

Input CIT

Node

Input Query



CI	Attribute Value
IpAddress	NOT IP Probe Name Is null
SA	IpServiceName Equal ignore case postgresql OR ServiceNames Contains postgresql

Triggered CI Data

Name	Value
application_ip	${DB.application_ip:NA}

Name	Value
application_port	${DB.application_port:NA}
ip_address	${IpAddress.name}
sa_ip	${SA.bound_to_ip_address:NA}
sa_port	${SA.network_port_number:NA}
sid	${DB.name:NA}

Used Scripts

- file_ver_lib.py
- SQL_Connection.py

Discovered CITs

- Composition
- Containment
- IpAddress
- IpServiceEndpoint
- MaxDB
- Node
- Usage

Adapter Parameters

Name	Default Value	Description
protocolType	MaxDB	The used protocol type.

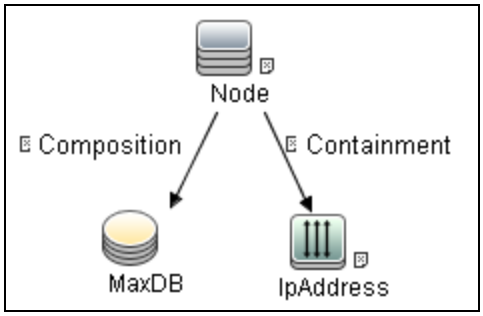
MaxDb Topology by SQL Job

This section contains details about the job.

Adapter

This job uses the **MaxDb Topology by SQL** adapter.

Trigger Query



CI	Attribute Value
IpAddress	NOT IP Probe Name Is null
MaxDB	NOT Reference to the credentials dictionary entry Is null

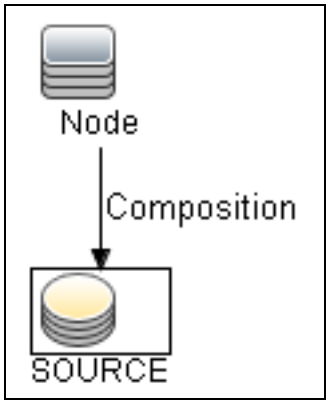
MaxDb Topology by SQL Adapter

This section contains details about the adapter.

Input CIT

MaxDB

Input Query



CI	Attribute Value
SOURCE	NOT Reference to the credentials dictionary entry Is null

Triggered CI Data

Name	Value
credentialsId	${SOURCE.credentials_id:NA}
ip_address	${SOURCE.application_ip:}
port	${SOURCE.application_port:}
sid	${SOURCE.name:NA}

Used Scripts

- maxdb_queries.py
- maxdb_topology.py
- maxdb_by_sql.py

Discovered CITs

- Composition

- DB Configuration
- DB Data File
- DB User
- Database Schema
- DbLogFile
- DbTraceFile
- IpAddress
- MaxDB
- Node
- Ownership

Global Configuration Files

errors_maxdbbysql.properties.errors

Adapter Parameters

Name	Default Value	Description
discoverDataFiles	true	Indicates whether to discover DB Data Files.
discoverDatabaseConfigurations	false	Indicates whether to discover MaxDB configurations.
discoverLogFiles	true	Indicates whether to discover DB Log Files.
discoverSchemas	true	Indicates whether to discover DB Schemas.
discoverTraceFiles	true	Indicates whether to discover DB Trace Files.
discoverUsers	true	If true, DB Users are retrieved, except external users.

Chapter 37: MySQL Replication Between Databases Discovery

This chapter includes:

Overview 592

Supported Versions 592

Topology 592

How to Discover MySQL Configuration and Replication Jobs 593

MySQL by Shell Job 594

Troubleshooting and Limitations – MySQL Replication Between Databases Discovery 599

Overview

This chapter explains how to discover MySQL database servers that replicate data in a master-slave relationship.

Replication enables data from one MySQL database server (the master) to be replicated to one or more MySQL database servers (the slaves). For details on replication, see the MySQL manual on the MySQL Web site: http://dev.mysql.com/doc/refman/5.0/en/replication-howto.html.

Currently all information about databases is retrieved through Shell protocols from the MySQL configuration file.

The job responsible for MySQL discovery is **MySQL by Shell**.

Supported Versions

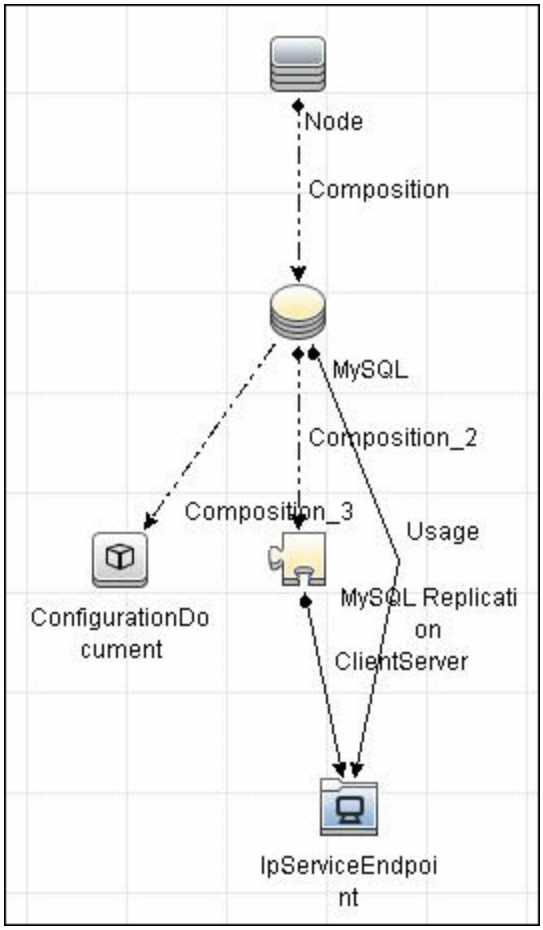
This discovery supports the following:

- MySQL versions 3.x, 4.x, 5.x
- Operating systems: Windows, Solaris, and Linux

Topology

> **Note:** For a list of discovered CITs, see "MySQL by Shell Job" on page 594.

MySQL Replication Job



How to Discover MySQL Configuration and Replication Jobs

This task describes how to discover the MySQL configuration and replication jobs and includes the following steps:

1. Prerequisites - Set up protocol credentials

   This discovery uses the following protocols:

   - SSH Protocol
   - Telnet Protocol

- NTCMD Protocol

For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Prerequisites - Retrieve information

To retrieve all relevant information, DFM must have read permissions for the $MYSQL_HOME directory and for executing **mysqld** (**mysqld.exe** or **mysqld-nt.exe** for Windows) with the following parameters:

```
mysqld --verbose --help
```

```
mysqld --version
```

If the **my.cnf** (**my.ini**) file is located outside the `$MYSQL_HOME` directory, you must add permissions for reading to it.

3. Run the discovery

a. Run the **Range IPs by ICMP** job to discover which of the machines in the IP range are up and running.

b. Run the **Host Connection by Shell** job to create Shell CITs.

c. Run any of host resources jobs to gather information about processes running on the host.

d. Run the **MySQL by Shell** job to retrieve information about MySQL configuration and replication jobs.

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

MySQL by Shell Job

This section includes details about the jobs.

Discovery Mechanism

This section explains how DFM discovers the MySQL server:

1. The MySQL by Shell job connects to the remote host using Shell credentials.
2. The job checks for the existence of the path of the MySQL configuration file by executing the following command:

   ```
   mysqld --verbose --help
   ```

3. If the job cannot find the configuration file with this command, it assumes the file is located in the default configuration file path:
   - UNIX or Linux: **/etc/my.cnf**
   - Windows: **../my.ini**
4. The job tries to retrieve the attribute values from the configuration file. The job either reads the attribute values from the command line, or reads the configuration file to find the values of the attributes that were not found in the command line.

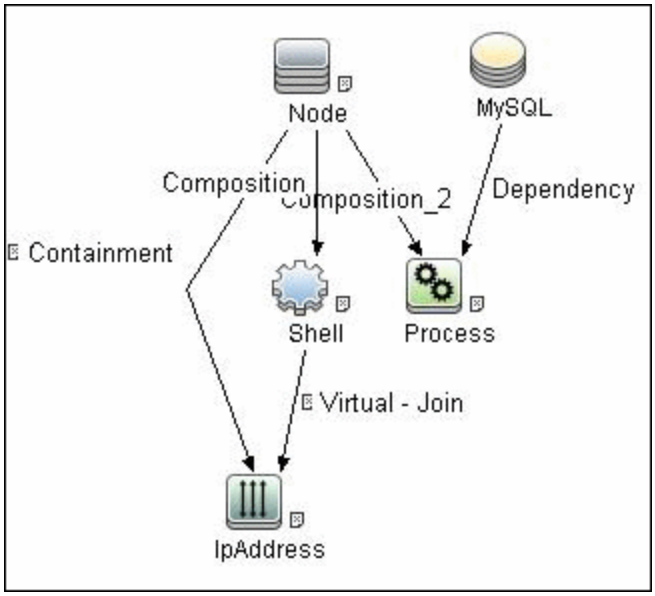
   Example of command line with attribute values:

   ```
   mysqld-nt.exe --defaults-file=C:\hp\UCMDB\DataFlowProbe\MySQL\my.ini DDM_Probe_
   DB
   ```

5. If the job does not find any attribute values, it takes the default values from the MySQL documentation.

   For details of the MySQL attributes, see "MySQL by Shell Job" on the previous page.
6. The job creates the MySQL CIs with appropriate attribute values and relationships.
7. The job now checks if this MySQL instance is a replica. If it is a replica, the job attempts to discover a master host and master user. The version of the MySQL engine is taken from the **mysqld --version** command output.
8. The job creates the MySQL replication CI with appropriate attribute values and relationships.

Trigger Query



Configuration Item Types

Name	Parent CIT	Uses Existing Attributes	Uses New Attributes	Description
MySQL	Database	database_ dbsid	server_id, database_ datadir, database_max_ connections	CIT represents the MySQL database
MySQL Replication	DB Scheduler Job		master_user, master_ connect_ retry	CIT represents the MySQL Replication job

CIT Attributes

- MySQL
  - server_id. The server ID is used in the replication job and must be unique for each server.
  - database_datadir. Path to the database root (datadir in the configuration file).
  - database_max_connections. The maximum number of concurrent sessions allowed by the MySQL server (max_connections in the my.ini file).

- database_dbsid. The unique identifier for running the MySQL instance-process port. The format is MySQL on port ####.

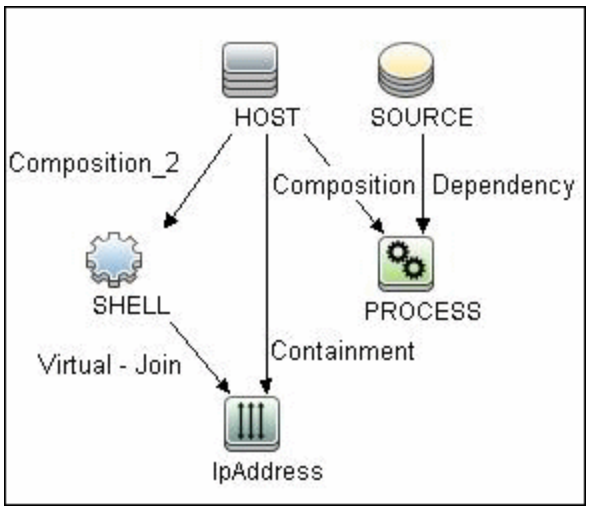
- MySQL Replication
  - master_user. A user name used when connecting to the master server.
  - master_connect_retry. The number of seconds that the slave thread sleeps before trying to reconnect to the master, if the master goes down or the connection is lost.

Relationships

Source	Destination	Relationship Type	Cardin-ality
mysql	configfile	Composition	1..1
mysql	mysql_replication	Composition	1..1
mysql_replication	IpServiceEndpoint	ClientServer	1..1

Adapter

- Input Query

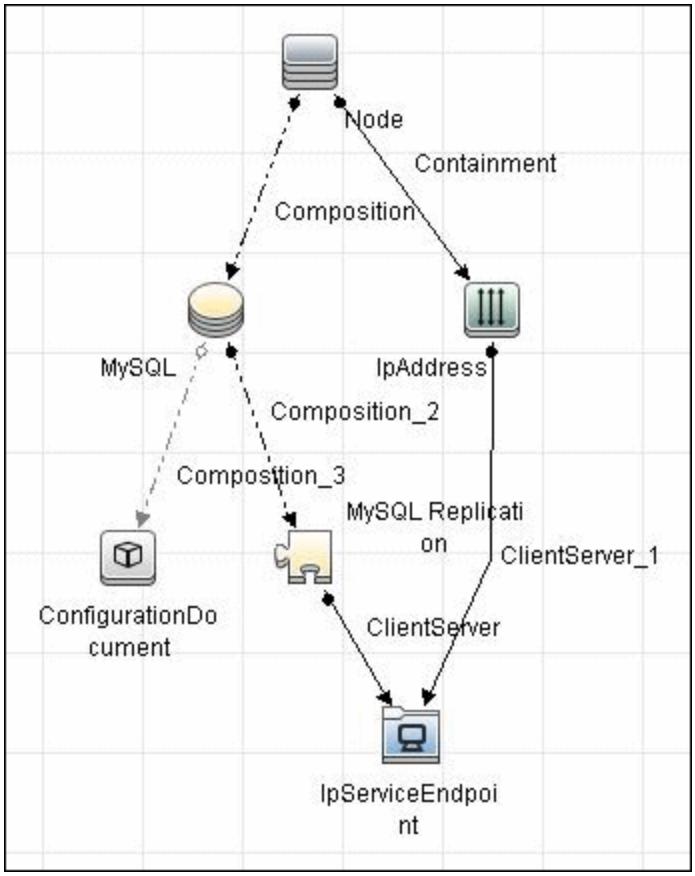


- Triggered CI Data

Name	Value
Protocol	${SHELL.root_class}
credentialsId	${SHELL.credentials_id}
dbport	${SOURCE.database_dbport}
dbsid	${SOURCE.database_dbsid}
ip_address	${SHELL.application_ip}
processParams	${PROCESS.process_parameters}
processPath	${PROCESS.process_path}

Discovered CITs

To view discovered CITs, select a specific adapter in the Resources pane.



- ClientServer
- Composition
- ConfigurationDocument
- Containment
- IpAddress
- IpServiceEndpoint
- MySQL
- MySQL Replication
- Node

> **Note:** To view the topology, see "Topology" on page 592.

Troubleshooting and Limitations – MySQL Replication Between Databases Discovery

This section describes troubleshooting and limitations for MySQL Replication Between Databases discovery.

- There are two main approaches to running several active MySQL instances on one host:
  - Two MySQL instances are each run on a different port, for example, one on 134.44.1.1:3306 and the second on 134.44.1.1:3307.
  - A host has several IPs, and each MySQL process is bound to its own IP, for example, 134.44.1.1:3306 and 134.44.1.2:3306.

  In the second case, as the key identifier that differentiates one MySQL CI from another is a port number (without an IP), the job cannot differentiate between the two MySQL instances and merges them into one CI.

Chapter 38: Oracle Database Server Discovery

This chapter includes:

- Overview 601
- Supported Versions 601
- Topology 602
- How to Discover Oracle Database Servers by SQL 603
- How to Discover Oracle Data Guard 604
  - Discovery Mechanism 604
  - Discovery Steps 605
- How to Discover Oracle TNS Names Topology 606
- How to Discover Oracle Database Servers- Lightweight 606
- Oracle Connection by Shell Job 607
- Oracle Connection by Shell Adapter 608
- Oracle Database Connection by SQL- Lightweight Job 610
- Oracle Connection by SQL- Lightweight Adapter 611
- Oracle Database Connection by SQL Job 612
- Oracle Connection by SQL Adapter 614
- Oracle TNS Names by LDAP Job 615
- Oracle TNS Names by LDAP Adapter 617
- Oracle Topology by SQL Job 618
- Oracle Database Topology by SQL Adapter 619
- Oracle Topology by SQL- Service Name Job 622
- Oracle Database Topology by SQL - Service Name Adapter 623
- Troubleshooting and Limitations – Oracle Database Server Discovery 627

Overview

There are two types of Oracle Database Server discoveries:

- The general Oracle Database Server discovery, which discovers all the Oracle Database Servers on the network. There are two methods available:
  - **Thorough Discovery**. This is a comprehensive discovery method that uses Node CI as an input trigger CIT. For information on this type of discovery, see "How to Discover Oracle Database Servers by SQL" on page 603.
  - **Lightweight Discovery**. This is a lightweight method of discovery that uses IPServiceEndpoint as an input trigger CIT. For information on this type of discovery, see "How to Discover Oracle Database Servers- Lightweight" on page 606.
- Oracle TNS Names Topology discovery, which discovers all the Oracle Database Servers that are stored in the Active Directory using the LDAP protocol. For more information on this type of discovery, see "How to Discover Oracle TNS Names Topology" on page 606.

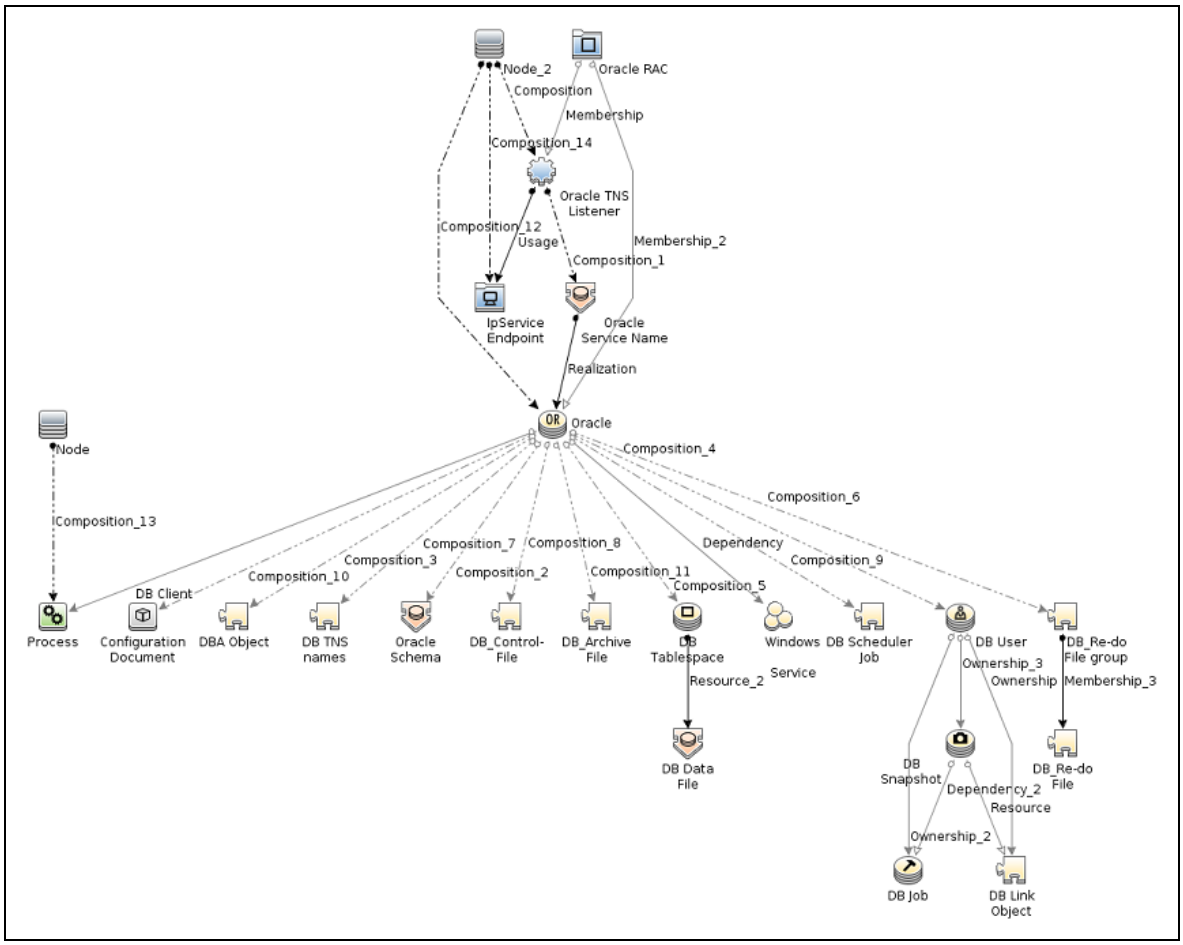
Supported Versions

Oracle Database Server discovery and Oracle TNS Names Topology discovery support Oracle 8, 9, 9i, 10, 10g, 11g, 12c, and 12c R1.

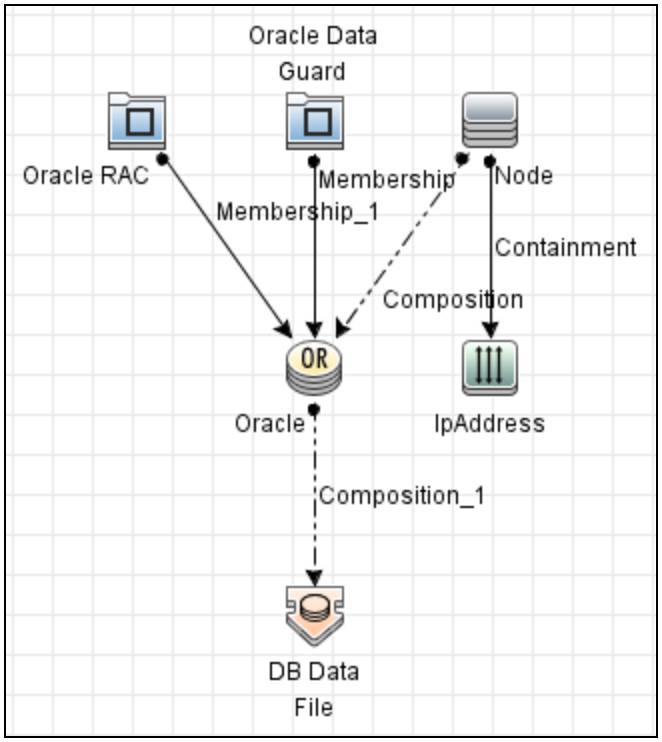
> **Note:** Oracle pluggable database (PDB) 12c is supported.

Topology

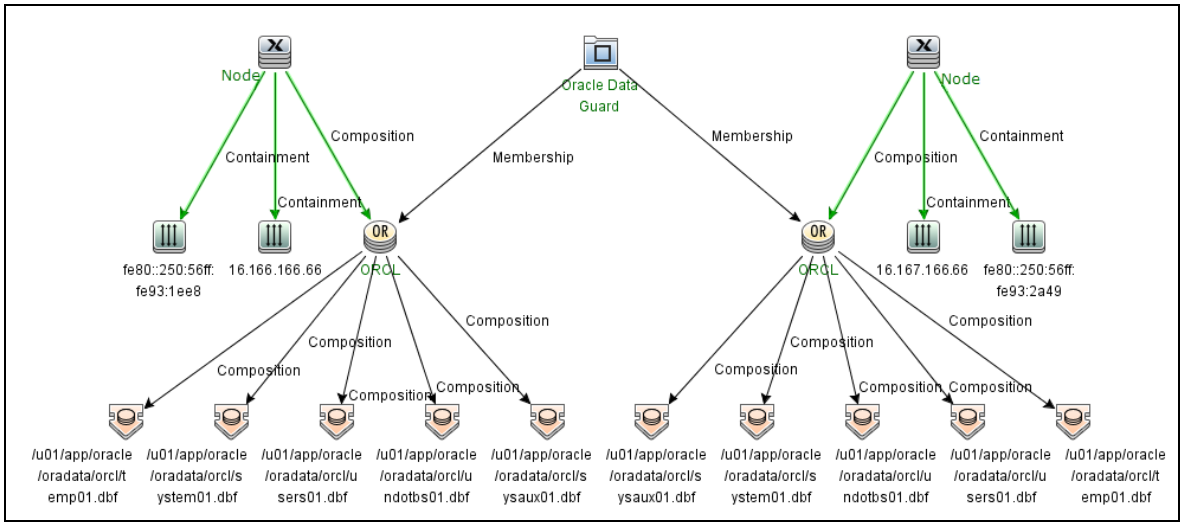
The following image displays the topology of the Oracle Database Server discovery:



The following image displays the topology of the Oracle Data Guard discovery.



The following image displays an example of the Oracle Data Guard discovery:



How to Discover Oracle Database Servers by SQL

This task describes how to discover Oracle database servers by SQL. This discovery adds a valid credentials ID to the CMDB. You can then use this CI to fully discover the database.

This task includes the following steps:

1. Prerequisite - Set up protocol credentials

   Oracle Database Connection by SQL discovery uses the Generic DB Protocol (SQL).

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Prerequisite - Verify user on Oracle database server

   Run the **Databases TCP Ports** job to verify the user name, password, and port used by the Oracle Database Server.

3. Run the discovery

   Activate the following jobs in the listed order:

   a. **Databases TCP Ports**

   b. **Oracle Database Connection by SQL**

   c. **Oracle Topology by SQL** or **Oracle Topology by SQL - Service Name**

   > **Note:** Due to the large amount of data reported by the Oracle Topology by SQL job, topology data is sent in chunks. Chunk size (the number of objects in a chunk) is regulated by the **discoverReportPageSize** job parameter. The default value is 1,000 objects in one chunk.

   For details on running jobs, see "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

How to Discover Oracle Data Guard

This section includes:

Discovery Mechanism

In general, Oracle Data Guard contains one primary database and more than one standby database.

In the **Oracle Connection by Shell** job, Data Flow Probe connects to both primary database and standby database with the Shell protocol, and then log in to Oracle with SQL*Plus.

Universal Discovery parses Oracle primary database SID and standby database service name from Shell command line, queries the Data Guard configuration information through SQL*Plus, and report back Oracle Data Guard CI and the connected databases.

Discovery Steps

This task includes the following steps:

1. Prerequisites - Set up protocol credentials

   The Oracle Data Guard discovery uses the Shell protocol to connect to the target server and run Shell commands. This discovery uses the Generic DB protocol (SQL) for the SQL*Plus connection.

   - If the Shell account is in the Oracle DBA group in OS, define a Shell protocol (SSH Protocol or NTCMD).
   - If the Shell account is NOT in the Oracle DBA group in OS, define a Shell protocol (SSH Protocol or NTCMD) and Generic DB Protocol (SQL). The SQL account should have the privilege to run SQL*Plus.

   > **Note:** When using the Generic DB Protocol (SQL), the Shell account should have the privilege to run SQL*Plus.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Run the discovery

   Activate the following jobs in the listed order:

   a. **Range IPs by ICMP**
   b. **Host Connection by Shell**
   c. **Host Applications by Shell**
   d. **Oracle Connection by Shell**

   For details on running jobs, see "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

How to Discover Oracle TNS Names Topology

This section describes how to discover Oracle TNS Names Topology from the Active Directory using the LDAP protocol.

Prerequisites

- Ensure that an Active Directory Server has been properly configured, on which Oracle TNS information is stored.
- Ensure that LDAP protocol credentials have been properly configured.

Run the discovery

1. Run the **Range IPs by ICMP** job to discover the target IPs.
2. Run the **TCP Ports** job to discover LDAP ports. Ensure that the LDAP port was discovered.
3. Run the **Active Directory Connection by LDAP** job to discover the Active Directory servers.
4. Run the **Oracle TNS Names by LDAP** job to discover the Oracle TNS Names topology.

How to Discover Oracle Database Servers-Lightweight

This task describes how to discover Oracle databases using a lightweight method of discovery. This discovery adds a valid credentials ID to the CMDB. You can then use this CI to fully discover the database.

This task includes the following steps:

1. Prerequisite - Set up protocol credentials

   Oracle Database Server discovery uses the Generic DB Protocol (SQL).

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Prerequisite - Verify user on Oracle database server

Run the **Databases TCP Ports** job to verify the user name, password, and port used by the Oracle Database Server.

3. Run the discovery

Activate the following jobs in the listed order:

a. **Databases TCP Ports**

b. **Oracle Database Connection by SQL- Lightweight**

c. **Oracle Topology by SQL**

> **Note:** Due to the large amount of data reported by the Oracle Topology by SQL job, topology data is sent in chunks. Chunk size (the number of objects in a chunk) is regulated by the **discoverReportPageSize** job parameter. The default value is 1,000 objects in one chunk.

For details on running jobs, see "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

Oracle Connection by Shell Job

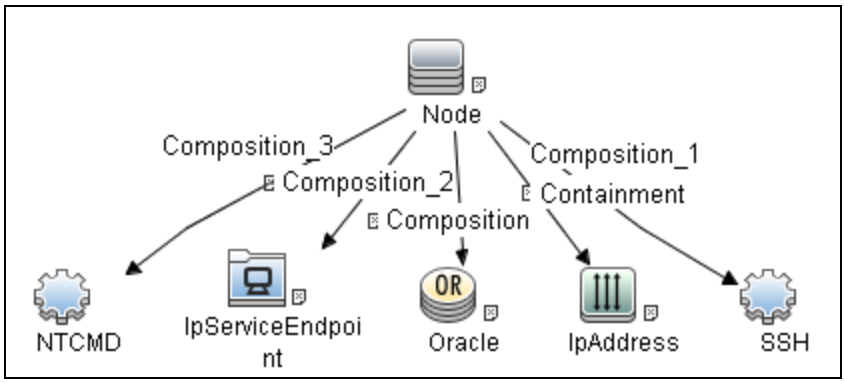
This job discovers all Oracle database servers using the Shell protocol. The job connects to the database via the SQL*Plus command to discover Oracle Data File, Oracle Data Guard, and Oracle RAC CIs.

Adapter

ID: `Shell_Dis_Oracle`

Trigger TQL

- Trigger query:



- CI attribute conditions:

CI	Attribute Value
IpAddress	NOT IP Probe Name Is null
IpServiceEndpoint	IpServiceName Equal ignore case oracle OR ServiceNames Contains oracle

Oracle Connection by Shell Adapter

This section includes details about the adapter.

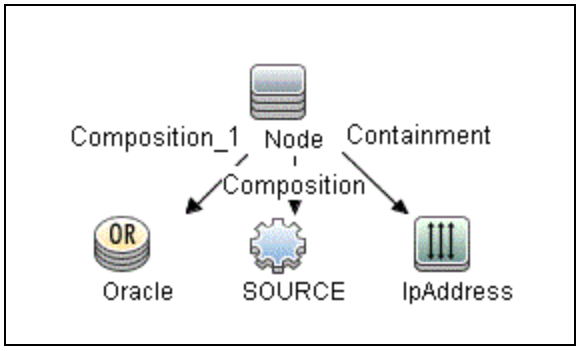
ID

Oracle Connection by Shell

Input CIT

Shell

Input TQL



Triggered CI Data

Name	Value
credentialsId	${SOURCE.credentials_id:}
db_credential_id	${Oracle.credentials_id:}
host_id	${Node.root_id}
ip_address	${SOURCE.application_ip:}
protocol	${SOURCE.root_class}

Used Scripts

- oracle_shell_topology.py
- oracle_shell_discoverer.py
- Shell_Dis_Oracle.py

Discovered CITs

- Composition
- Containment
- DB Data File
- IpAddress

- Membership
- Node
- Oracle
- Oracle Data Guard
- Oracle RAC

Oracle Database Connection by SQL- Lightweight Job

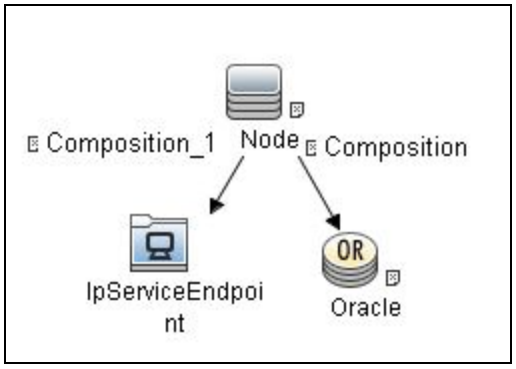
This section includes details about the job.

Adapter

ID: `SQL_NET_Dis_Connection_Oracle_Lightweight`

Trigger TQL

- Trigger query:



- CI attribute conditions:

CI	Attribute Value
IpServiceEndpoint	IpServiceName Equal ignore case oracle OR ServiceNames Contains oracle

Discovery Flow

This job performs the following actions:

1. Gets the Oracle credentials that are specified in the Discover Probe configuration.
2. Tries to connect using the specific credentials.
3. If connection is successful, reports the Oracle Database with the connected credentials.

Oracle Connection by SQL- Lightweight Adapter

This section includes details about the adapter.

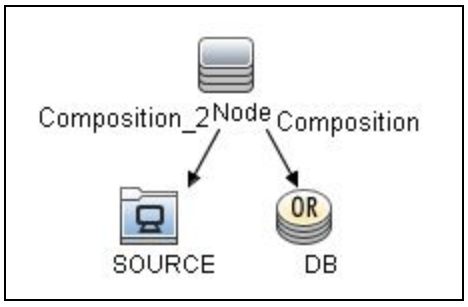
ID

Oracle Connection By SQL- Lightweight

Input CIT

IpServiceEndpoint

Input TQL



Triggered CI Data

Name	Value
application_ip	${DB.application_ip:NA}

Name	Value
application_port	${DB.application_port:NA}
sa_ip	${SOURCE.bound_to_ip_address:NA}
sa_port	${SOURCE.network_port_number:NA}
sid	${DB.name:NA}

Used Scripts

- file_ver_lib.py
- SQL_Connection.py

Discovered CITs

- Composition
- Containment
- IpAddress
- IpServiceEndpoint
- Node
- Oracle
- Oracle Service Name
- Usage

Parameters

- **protocolType.** Default value is **oracle**, should not be changed.

Oracle Database Connection by SQL Job

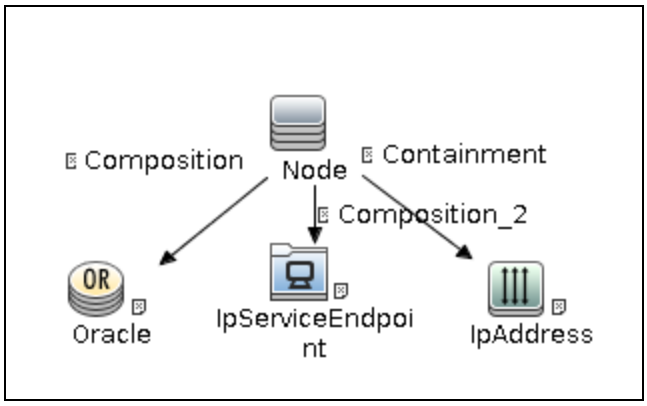
This section includes details about the job.

Adapter

ID: `Oracle Connection By SQL`

Trigger TQL

- Trigger query:



- CI attribute conditions:

CI	Attribute Value
IpAddress	NOT IP Probe Name Is null
IpServiceEndpoint	IpServiceName Equal ignore case oracle OR ServiceNames Contains oracle

Discovery Flow

This job performs the following actions:

1. Gets the Oracle credentials that are specified in the Discover Probe configuration.
2. Tries to connect using the specific credentials.
3. If connection is successful, reports the Oracle Database with the connected credentials.
4. If connection is successful, asks the database for it's primary IP and checks if this IP matches the one used for connection.

   If the primary IP does not match the one used for connection, the job checks if the database is in clustered mode.

5. If the IP reported by the database is reachable from the probe and it is possible to connect to it, that IP is populated to the UCMDB. Otherwise, the IP used for initial connection is populated to the UCMDB.

Oracle Connection by SQL Adapter

This section includes details about the adapter.

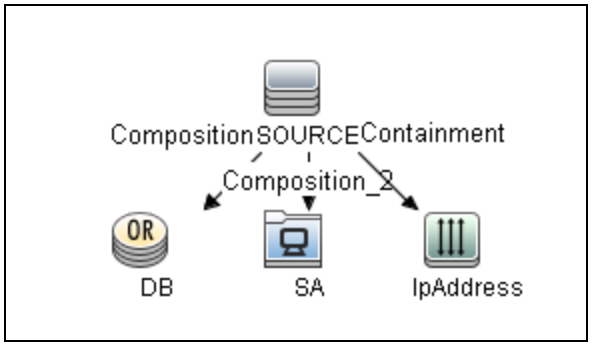
ID

Oracle Connection By SQL

Input CIT

Node

Input TQL



Triggered CI Data

Name	Value
application_ip	${DB.application_ip:NA}
application_port	${DB.application_port:NA}
ip_address	${IpAddress.name}
sa_ip	${SA.bound_to_ip_address:NA}

Name	Value
sa_port	${SA.network_port_number:NA}
sid	${DB.name:NA}

Used Scripts

- file_ver_lib.py
- SQL_Connection.py

Discovered CITs

- Composition
- Containment
- IpAddress
- IpServiceEndpoint
- Node
- Oracle
- Oracle Service Name
- Usage

Parameters

- **protocolType.** Default value is **oracle**, should not be changed.

Oracle TNS Names by LDAP Job

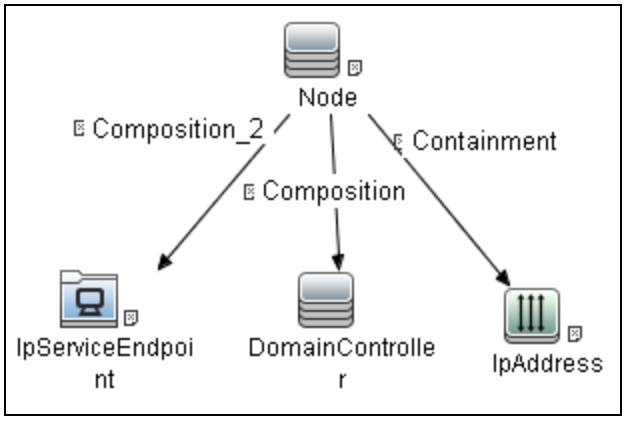
This section includes details about the job.

Adapter

ID: `oracle_tns_names_by_ldap`

Trigger TQL

- Trigger query:



- CI attribute conditions:

CI	Attribute Value
IpAddress	NOT IP Probe Name Is null
IpServiceEndpoint	IpServiceName Equal ignore case ldap OR ServiceNames Contains ldap
DomainController	NOT Reference to the credentials dictionary entry Is null AND NOT Application IP Is null

Parameters

By default, parameters are not overridden and use values from the adapter.

Discovery Flow

1. Get **DomainContext** from the root (if the **baseDN** parameter is not specified).
2. Get the **orclContext** object from the previous node.
3. Get the **orclNetService** object from the **orclContext** node.
4. Get the **orclNetDescString** attribute from the **orclNetService** object.

Oracle TNS Names by LDAP Adapter

This section includes details about the adapter.

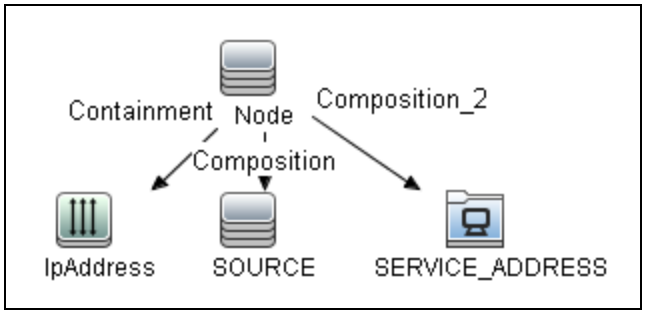
ID

oracle_tns_names_by_ldap

Input CIT

DomainController

Input TQL



Triggered CI Data

Name	Value
application_port	${SOURCE.application_port:NA}
credentials_id	${SOURCE.credentials_id}
ip_address	${SOURCE.application_ip}
port	${SERVICE_ADDRESS.network_port_number}

Used Scripts

- active_directory_utils.py
- db.py

- db_builder.py
- db_platform.py
- jdbc_url_parser.py
- oracle_by_ldap.py
- oracle_ldap_discoverer.py

Discovered CITs

- Composition
- Containment
- IpAddress
- IpServiceEndpoint
- Node
- Oracle
- Oracle Service Name
- Oracle TNS Listener
- Realization
- Usage

Parameters

- **baseDN.** Specifies the context in which to find the **orclContext** objects.

Oracle Topology by SQL Job

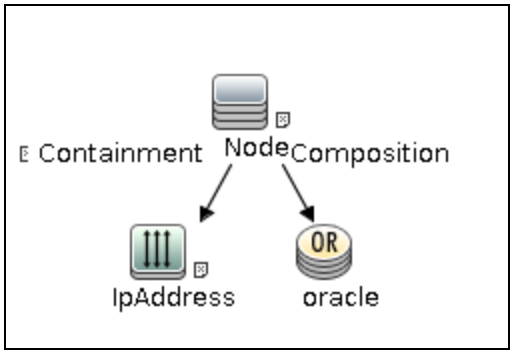
This section includes details about the job.

Adapter

ID: `Oracle database topology by SQL`

Trigger TQL

- Trigger query:



- CI attribute conditions:

CI	Attribute Value
IpAddress	NOT IP Probe Name Is null
oracle	NOT Reference to the credentials dictionary entry Is null

Discovery Flow

1. Connect to the Oracle Database using credentials ID that is specified in the Oracle CI.
2. Execute the specific SQL queries, according to the flags specified in the adapter parameters.
3. Push the discovered data to the UCMDB.

Oracle Database Topology by SQL Adapter

This section includes details about the adapter.

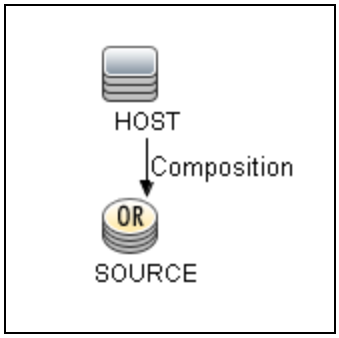
ID

```
Oracle database topology by SQL
```

Input CIT

Oracle

Input TQL



Triggered CI Data

Name	Value
credentialsId	${SOURCE.credentials_id}
ip_address	${SOURCE.application_ip}
port	${SOURCE.application_port:NA}
sid	${SOURCE.name:NA}

Used Scripts

- SQL_Dis_Oracle.py

Discovered CITs

- Composition
- Containment
- DB Client
- DB Data File
- DB Job
- DB Link Object
- DB Scheduler Job

- DB Snapshot
- DB Tablespace
- DB User
- DBA Object
- DB_Archive File
- DB_Control-File
- DB_Re-do File
- DB_Re-do File group
- Dependency
- IpAddress
- IpServiceEndpoint
- Membership
- Node
- Oracle
- Oracle CDB
- Oracle PDB
- Oracle RAC
- Oracle Schema
- Oracle Service Name
- Oracle TNS Listener
- Ownership
- Process
- Realization
- Resource
- Usage

Parameters

- **comprehensiveDiscovery.** If false, the DBA Object, DB Job and DB User are not retrieved. The

default value is false. If the parameter is set to false, changing other parameters has no effect on the discovery process (DBA Objects are not discovered).

- **discoverDbLinks.** If true, DB links are discovered. The default value is true.
- **discoverFunctions.** If false, functions are not retrieved. The default value is false.
- **discoverPackageBody.** If false, package bodies are not retrieved. The default value is false.
- **discoverPackages.** If false, packages are not retrieved. The default value is false.
- **discoverProcedures.** If false, procedures are not retrieved. The default value is false.
- **discoverReportPageSize.** The maximum amount of query result objects that can be sent in one bulk. The default value is 1,000.
- **discoverTables.** If false, tables are not retrieved. The default value is false.
- **discoveryDBClients.** If true, DB clients are retrieved. The default value is true.
- **discoveryUsers.** If true, database users are retrieved. If false, database user discovery is controlled by the **comprehensiveDiscovery** parameter.
- **excludeSysUser.**If false, system default users are included. The default value is false.

Oracle Topology by SQL- Service Name Job

This section includes details about the job.

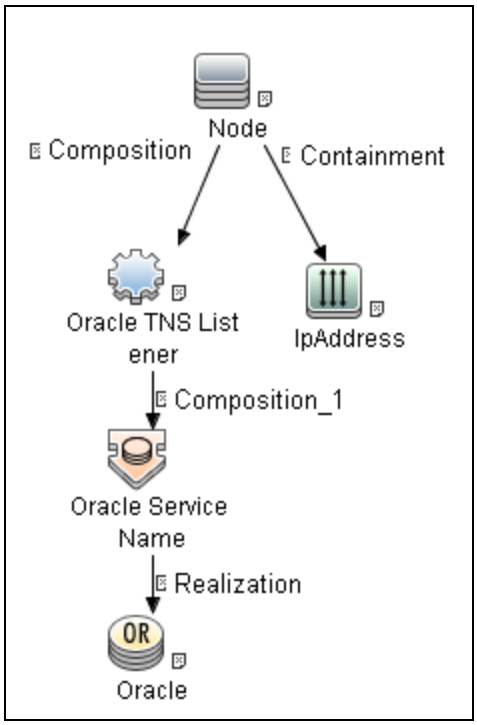
This job uses Oracle Service Name to connect Oracle and discovers Oracle topology by SQL.

Adapter

ID: `Oracle Topology by SQL - Service Name`

Trigger TQL

- Trigger query:



- CI attribute conditions:

CI	Attribute Value
IpAddress	NOT IP Probe Name Is null
Oracle Serive Name	NOT Reference to the credentials dictionary entry Is null

Discovery Flow

1. Connect to the Oracle Database using credentials ID that is specified in the Oracle Service Name CI.
2. Execute the specific SQL queries, according to the flags specified in the adapter parameters.
3. Push the discovered data to the UCMDB.

Oracle Database Topology by SQL - Service Name Adapter

This section includes details about the adapter.

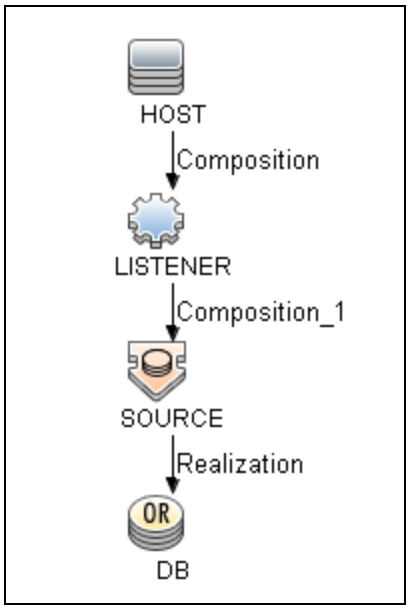
ID

```
Oracle Topology by SQL - Service Name
```

Input CIT

Oracle Service Name

Input TQL



Triggered CI Data

Name	Value
credentialsId	${SOURCE.credentials_id}
hostId	${HOST.root_id}
ip_address	${DB.application_ip}
oracleId	${DB.root_id}
serviceName	${SOURCE.name}

Used Scripts

- Oracle_SQL_Discoverer.py
- Oracle_Dis_SQL_Service_Name.py

Discovered CITs

- Composition
- Containment
- DB Client
- DB Data File
- DB Job
- DB Link Object
- DB Scheduler Job
- DB Snapshot
- DB Tablespace
- DB User
- DBA Object
- DB_Archive File
- DB_Control-File
- DB_Re-do File
- DB_Re-do File group
- Dependency
- IpAddress
- IpServiceEndpoint
- Membership
- Node
- Oracle
- Oracle CDB

- Oracle PDB
- Oracle RAC
- Oracle Schema
- Oracle Service Name
- Oracle TNS Listener
- Ownership
- Process
- Realization
- Resource
- Usage

Parameters

- **comprehensiveDiscovery.** If false, the DBA Object, DB Job and DB User are not retrieved. The default value is false. If the parameter is set to false, changing other parameters has no effect on the discovery process (DBA Objects are not discovered).
- **discoverDbLinks.** If true, DB links are discovered. The default value is true.
- **discoverFunctions.** If false, functions are not retrieved. The default value is false.
- **discoverPackageBody.** If false, package bodies are not retrieved. The default value is false.
- **discoverPackages.** If false, packages are not retrieved. The default value is false.
- **discoverProcedures.** If false, procedures are not retrieved. The default value is false.
- **discoverReportPageSize.** The maximum amount of query result objects that can be sent in one bulk. The default value is 1,000.
- **discoverTables.** If false, tables are not retrieved. The default value is false.
- **discoveryDBClients.** If true, DB clients are retrieved. The default value is true.
- **discoveryUsers.** If true, database users are retrieved. If false, database user discovery is controlled by the **comprehensiveDiscovery** parameter.
- **excludeSysUser.**If false, system default users are included. The default value is false.

Troubleshooting and Limitations – Oracle Database Server Discovery

This section describes troubleshooting and limitations for Oracle Database Server discovery.

- If you need to discover Oracle 8g, use the following values in **jdbcDrivers** and **jdbcPreUrls**:

  jdbcDrivers:

  ```
  <oracle>com.inet.ora.OraDriver</oracle>
  <oracleSSL>com.mercury.jdbc.oracle.OracleDriver</oracleSSL>
  ```

  jdbcPreUrls:

  ```
  <oracle>jdbc:inetora:%%ipaddress%%:%%protocol_port%%:%%sqlprotocol_
  dbsid%%?logging=false&amp;loginTimeout=%%protocol_timeout%%</oracle>
  <oracleSSL>jdbc:mercury:oracle://%%ipaddress%%:%%protocol_
  port%%;ServiceName=%%sqlprotocol_dbsid%%</oracleSSL>
  ```

- Oracle Data Guard Discovery cannot distinguish the logic standby instance or physical standby instance. SQL query cannot fetch such information if standby databases cannot be connected by SQL*Plus.
- Oracle account will be locked if Data Flow Probe tries to log in to Oracle with SQL*Plus many times but fails. This depends on the Oracle configuration.

Chapter 39: Oracle Real Application Cluster (RAC) Discovery

This chapter includes:

Overview 629
Supported Versions 629
Topology 629
How to Discover Oracle Real Application Cluster (RAC) 630
Oracle Listeners by Shell Job 631
Oracle RAC Topology by Shell Job 635
Configuration Items 638
Relationships 638
Troubleshooting and Limitations – Oracle RAC Discovery 639

Overview

DFM discovers information about Oracle RAC through the Shell protocols from the Oracle configuration files **listener.ora** and **tnsnames.ora**, and through the **lsnrct** utility.

Supported Versions

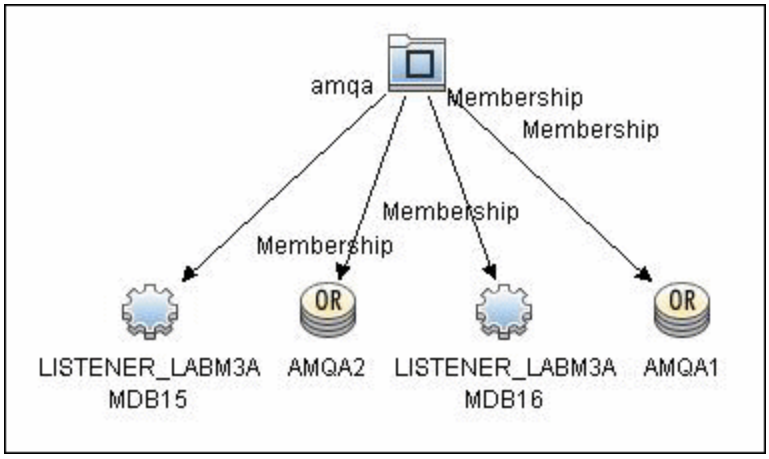
This discovery supports Oracle DB 10g, 11g, 12c, and 12c R1.

Topology

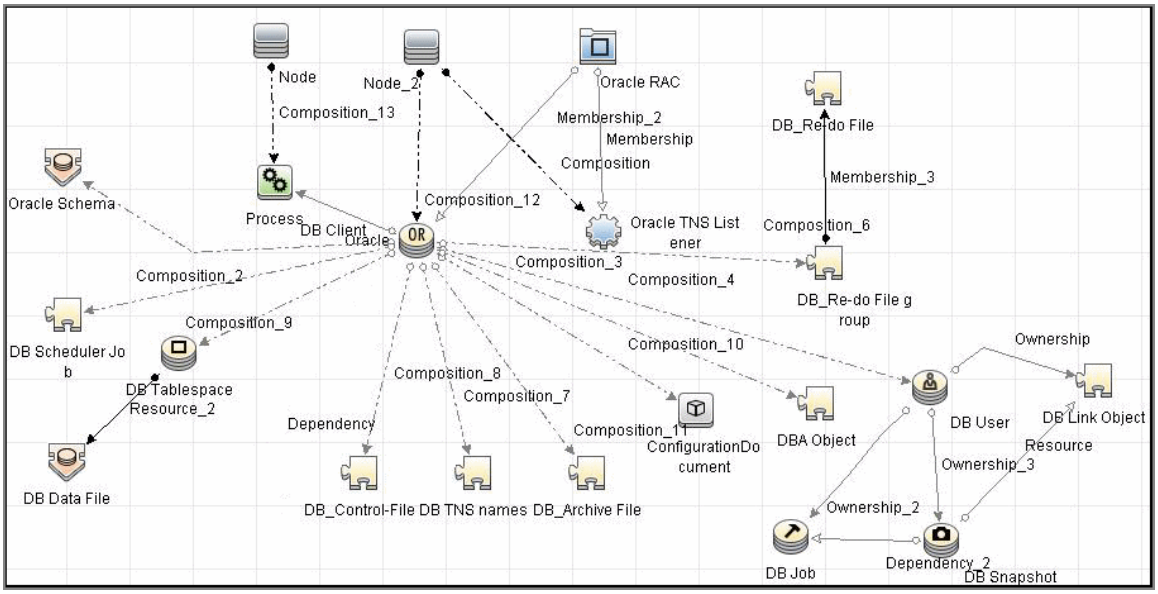
The following images display sample output of the Oracle RAC discovery topology.

> **Note:** For a list of discovered CITs, see "Oracle Listeners by Shell Job" on page 631 and "Oracle RAC Topology by Shell Job" on page 635.

- **Topology**



- **Oracle View**



How to Discover Oracle Real Application Cluster (RAC)

This section includes the following topics:

1. Prerequisite - Set up protocol credentials

   This discovery uses the NTCMD, SSH, or Telnet protocols.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Prerequisites - Other

   a. To retrieve all relevant information, verify that DFM has:

      - Read permissions for the **$ORACLE_HOME\network\admin** directory
      - The correct execute permissions for **$ORACLE_HOME\bin\lsnrctl** and for the corresponding library (lib) and message files.

   b. **Oracle Listeners by Shell job**. Verify that the RAC relative processes are running on the Oracle database. The file names begin with **ora_lms**, **ora_lmd**, **ora_lck**, and **oracm**.

c. **Oracle RAC Topology by Shell job**. The **Listened IPs** of the Listener CIT must be **not NULL**.

d. Run the **Host Connection by Shell** job, to activate Shell CITs.

3. Run the discovery

a. Run any of the host resources jobs that gather information about processes running on the host. For example, **Host Applications by Shell**.

If DFM discovers TNS Listener processes, the job creates Oracle TNS Listener CIs and an Oracle DB CI together with its connected processes.

b. To discover Oracle TNS Listener CIs with full data, run the **Oracle Listeners by Shell** job. This job connects to the host and retrieves the required data for the Oracle TNS Listener CI. For details, see "Oracle Listeners by Shell Job" below.

c. To discover Oracle RAC topology, run the **Oracle RAC Topology by Shell** job. This job connects to the hosts with full listeners and discovers RAC. For details, see "Oracle RAC Topology by Shell Job" on page 635. For details on undiscovered elements, see "Troubleshooting and Limitations – Oracle RAC Discovery" on page 639.

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

Oracle Listeners by Shell Job

This section includes details about the job.

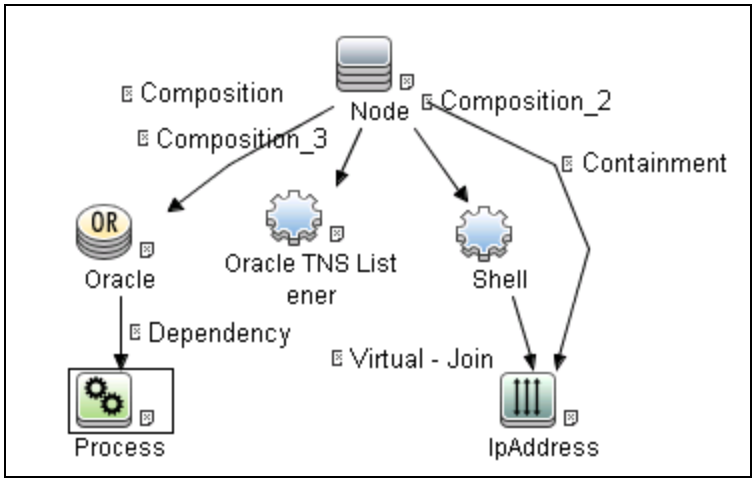
Discovery Mechanism

This job triggers on Oracle databases that have RAC related processes. The job:

1. Connects to the remote host by Shell.
2. Checks for the **ORACLE_HOME** environment variable.
3. If the variable is not defined, the job takes the **ORACLE_HOME** value from the job adapter (if defined).
4. Reads the **Oracle TNS listener** configuration file, stored in **$ORACLE_HOME/network/admin/listener.ora**, and performs further parsing.

5. Retrieves a full list of IP addresses to which this particular listener is listening.
6. Checks for listener status using the **$ORACLE_HOME/bin/lsnrctl** status.
7. Retrieves known services and listener status from the output.

Trigger Query

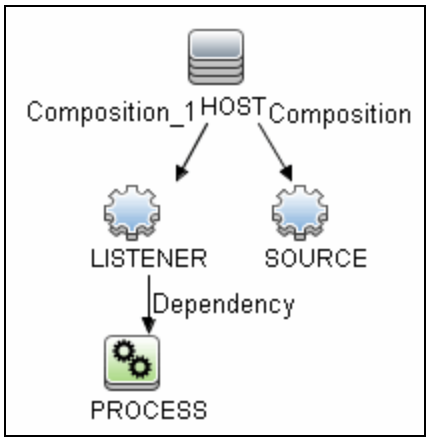


Node Name	Condition
Node	None
Oracle	None
Oracle TNS Listener	None
Shell	None
IpAddress	NOT IP Probe Name Is null
Process	Name Like ignore case ora_lms% OR Name Like ignore case ora_lmon% OR Name Like ignore case ora_lmd% OR Name Like ignore case ora_lck% OR Name Like ignore case oracm OR Name Like ignore case oracle%

Adapter

This job uses the **Oracle_Listeners_by_Shell** adapter.

- **Input Query**



- **Used Scripts**
  - oracle_shell_utils.py
  - oracle_listeners_by_shell.py
- **Triggered CI Data**

Name	Value
Protocol	${SOURCE.root_class}
connected_os_credentials_id	${SOURCE.connected_os_credentials_id:NA}
credentialsId	${SOURCE.credentials_id}
ip_address	${SOURCE.application_ip}
listener_names	${LISTENER.name}
listener_process_path	${PROCESS.process_path}

- **Adapter Parameters**

OracleHomes	Used when no **ORACLE_HOME** environment variable is defined. This value must be the same as the parameter in the **Oracle RAC Topology by Shell** job.

Discovered CITs

- Composition
- Containment
- IpAddress
- Node
- Oracle TNS Listener

> **Note:** To view the topology, see "Topology" on page 629.

Oracle RAC Topology by Shell Job

This section includes details about the job.

Discovery Mechanism

This job:

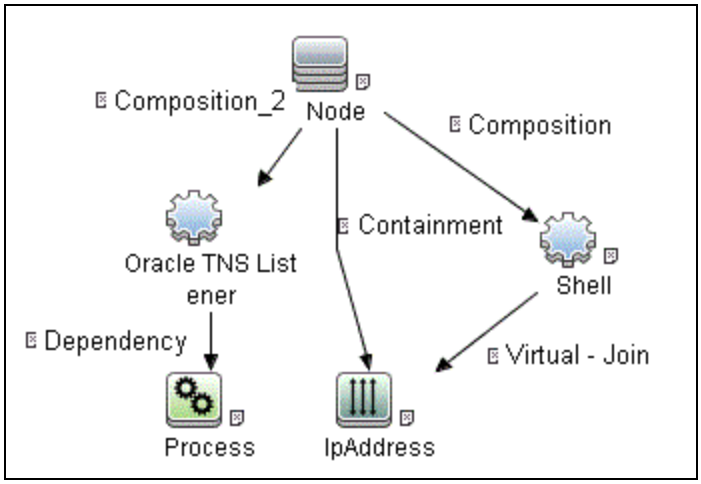
1. Connects to the remote host by Shell.
2. Checks for the **ORACLE_HOME** environment variable.
3. If it is not defined, the job uses the **OracleHome** value from the job adapter.
4. Enumerates configured database service names using the command **srvctl config database**.
5. Enumerates **sids** and hosts on which the service is available using the command **srvctl status database –d <service_name>**.
6. Retrieves RAC parameters such as Service Name and Nodes from the **$ORACLE_ HOME/network/admin/tnsnames.ora** file.
7. Checks if this RAC instance is running, by parsing the **lsnrctl status** output.

   > **Note:** Nodes are cited in the **tnsnames.ora** file by their internal IP or by their internal domain name. If the domain name appears, DFM resolves it.

8. Retrieves the full list of Listened IPs from the input query, for all listeners matching the query.
9. Parses this attribute's values from the list of listened IPs, to retrieve the Host Primary Domain name that corresponds to the MAC address. This is needed since the RAC CI's name key attribute must consist of a list of all the node domain names separated by the colon symbol (:).
10. Looks up the full node name in the build table sorted by IP address. The result is the Host Primary Domain name for each node.

    At this stage, the following information is available: the RAC Service Name, the fully qualified domain names of all the RAC nodes, and a RAC instances count.
11. Creates the RAC CI.

Trigger Query

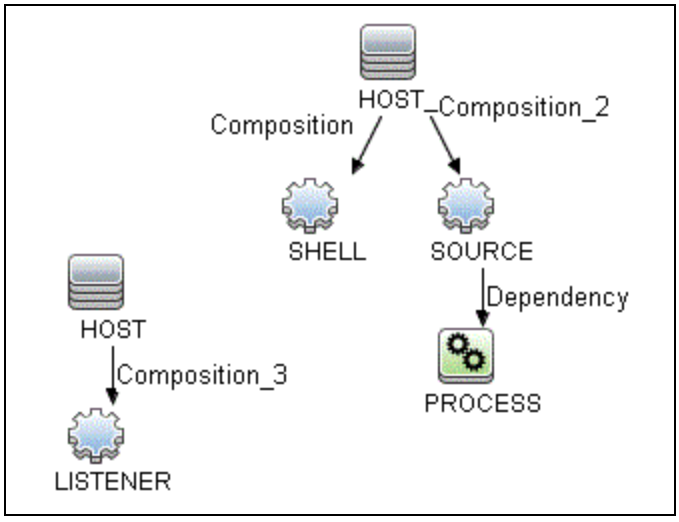


Node Name	Condition
Node	None
Oracle TNS Listener	NOT Listened IPs Is null
Process	None
IpAddress	NOT IP Probe Name Is null
Shell	NOT Reference to the credentials dictionary entry Is null

Adapter

This job uses the **Oracle_RAC_Topology_by_Shell** adapter.

- **Input Query**



- **Triggered CI Data**

Name	Value
Protocol	${SHELL.root_class}
credentialsId	${SHELL.credentials_id}
ip_address	${SHELL.application_ip}
listened_ips	${LISTENER.listened_ips:NA}
listenerName	${SOURCE.name}
listener_ip	${SOURCE.application_ip}
listener_process_path	${PROCESS.process_path}

- **Adapter Parameters**

OracleHomes	Used when no **ORACLE_HOME** environment variable is defined. This value must be the same as the parameter in the Oracle Listeners by Shell job.

Discovered CITs

- Composition
- Containment
- IpAddress
- Membership
- Node
- Oracle
- Oracle RAC
- Oracle TNS Listener
- Running Software

> **Note:** To view the topology, see "Topology" on page 629.

Configuration Items

CI	Description
Oracle TNS Listener	This CIT represents the Oracle TNS Listener.
CIT name	oracle_listener
Parent CIT name	application
Key attributes	• **name (displayed as Name)**. The `TNS Listener` constant. • **root_container (displayed as Container)**. The Container CI. • **listener_name (displayed as Name of the Listener)**. The real `TNS Listener` name.
Additional Attributes	**listened_ips (displayed as Listened IPs)**. Listened to IP addresses and machine domain name. Listened IPs are IP addresses that are listened to by the Oracle TNS Listener. Format: `<host_name>:<host_primary_ip>@<listened_ip>:<mac>;... <listened_ip>:<mac>` **Note:** MAC addresses are not currently discovered. The marker acts as a placeholder for future enhancements.

Relationships

CIT	Link Type	Cardinality
Node	Composition	1.*
RAC	Membership	1.*
Process	Dependency	1.*

Troubleshooting and Limitations – Oracle RAC Discovery

This section describes troubleshooting and limitations for Oracle RAC Discovery.

Error Message	Description
Failed to lookup host name. No RAC CI will be created.	For one or more nodes, the job failed to retrieve the FQDN (fully qualified domain name) from the listeners **listened_ips** attribute information. • Check the logs to retrieve the IP and destination. • Make sure that the FQDN for that IP can be obtained either from the DNS or from the host file.
No RAC CI are retrieved.	Not all nodes were discovered with the correct listener information.
Discovery cannot discover links to the remote machines (database clients)	This can occur in the following situation: The discovered database reports its clients by their host names and not by their IP addresses, and the host name cannot be resolved to an IP address. In this case, the remote client cannot be created.

Chapter 40: PostgreSQL Discovery

This chapter includes:

Overview 640
Supported Versions 640
Topology 641
How to Discover PostgreSQL 641
PostgreSQL Connection by SQL job 642

Overview

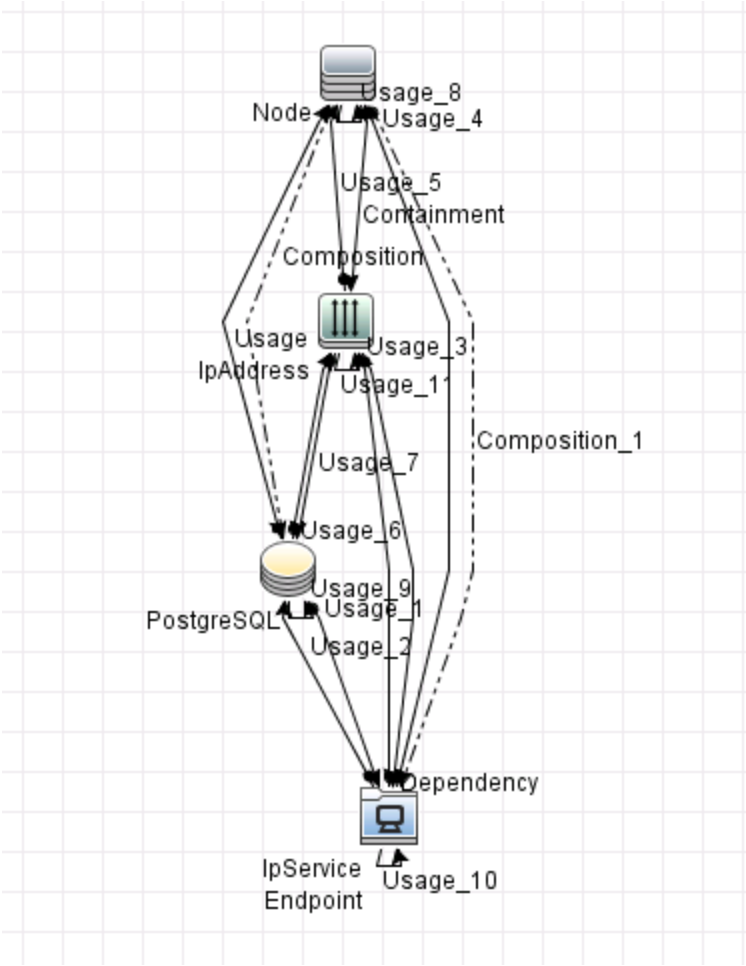
PostgreSQL is an open-source object-relational database management system with an emphasis on extensibility and standards-compliance. It runs on all major operating systems, including Linux, UNIX, and Windows.

Supported Versions

This discovery supports PostgreSQL versions: 7.x, 8.x, and 9.x.

Topology

The following image displays the topology of the PostgreSQL discovery.



How to Discover PostgreSQL

This section describes how to discover the topology managed by PostgreSQL.

Prerequisites

Set up the Generic DB Protocol (SQL) protocol. For more information on this, see the section explaining SQL protocol credentials in *HPE UCMDB Discovery and Integrations Content Guide - Supported Content*.

Run the discovery

Run the PostgreSQL discovery by executing the following jobs:

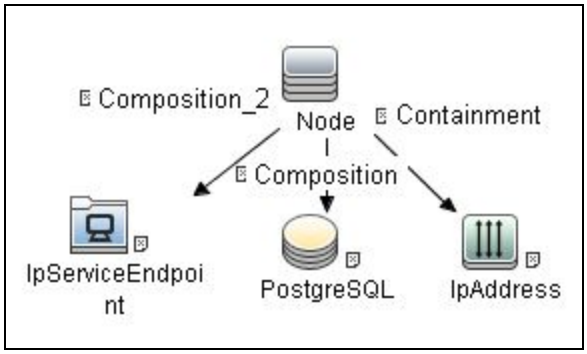
- **Databases TCP Ports**
- **PostgreSQL Connection by SQL**

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

PostgreSQL Connection by SQL job

This section includes details about the job.

Trigger TQL



Node Name	Condition
Node	None
PostgreSQL	None
IpAddress	NOT IP Probe Name Is null
IpServiceEndpoint	IpServiceName Equal ignore case postgresql OR ServiceNames Contains postgresql

Adapter

This job uses the **PostgreSQL Connection by SQL** adapter.

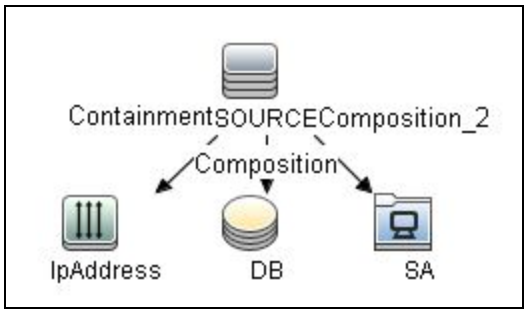
- **Adapter Type**

  Jython

- **Input CIT**

  Node

- **Input TQL**



- **Triggered CI Data**

Name	Value
application_ip	${DB.application_ip:NA}
application_port	${DB.application_port:NA}
ip_address	${IpAddress.name}
sa_ip	${SA.bound_to_ip_address:NA}
sa_port	${SA.network_port_number:NA}
sid	${DB.name:NA}

- **Used Scripts**
  - file_ver_lib.py
  - SQL_Connection.py
- **Required Permissions**

Permission	Operation	Usage Description	Objects and Parameters
SQL	select	Check PostgreSQL database version	version()

- **Discovered CITs**

- Composition
- Containment
- IpAddress
- IpServiceEndpoint
- Node
- PostgreSQL
- Usage

- **Adapter Parameters**

Parameter	Default Value	Description
protocolType	postgresql	The used protocol type.

Chapter 41: Sybase Discovery

This chapter includes:

Overview 646
Supported Versions 646
Topology 647
How to Discover Sybase 647
Sybase Database Connection by SQL job 648
Sybase Topology by SQL job 650

Overview

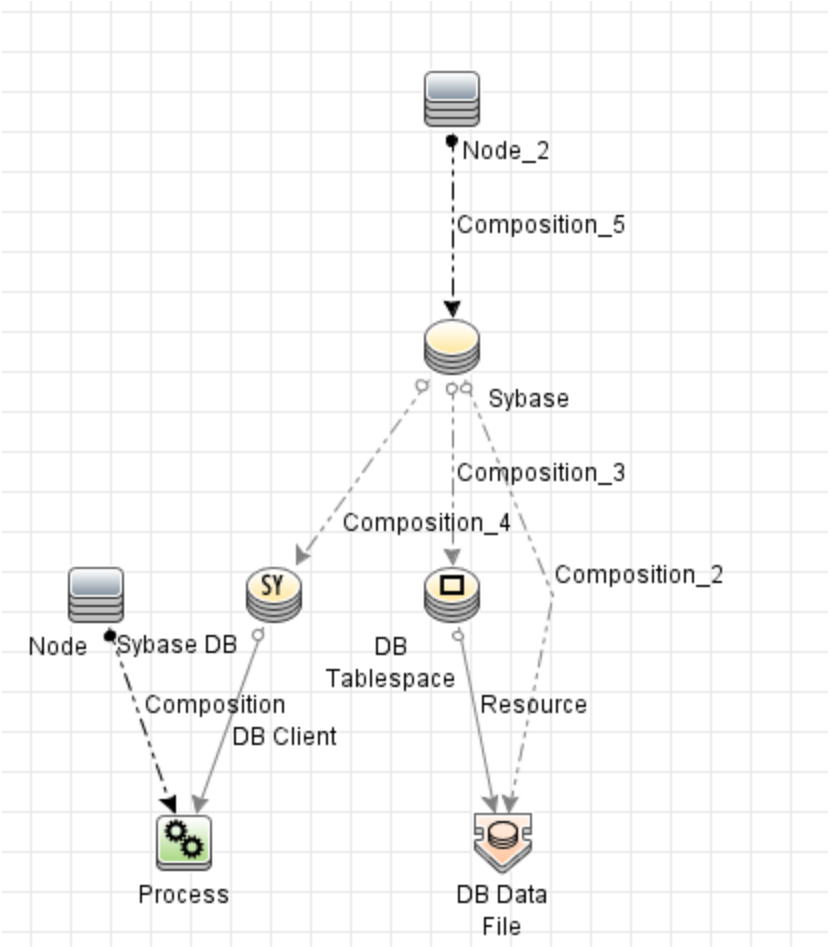
SAP Sybase ASE (Adaptive Server Enterprise), commonly known as ASE or just Sybase DB, is a relational model database server product for businesses developed by Sybase Corporation, now part of SAP AG. ASE is predominantly used on the UNIX platform, but is also available for Microsoft Windows.

Supported Versions

This discovery supports Sybase ASE versions: 10.x, 11.x, 12.x, 15.0, 15.5, and 16.

Topology

The following image displays the topology of the Sybase discovery.



How to Discover Sybase

This section describes how to discover the topology managed by Sybase.

Prerequisites

Set up the Generic DB Protocol (SQL) protocol. For more information on this, see the section explaining SQL protocol credentials in *HPE UCMDB Discovery and Integrations Content Guide - Supported Content*.

Run the discovery

Run the Sybase discovery by executing the following jobs:

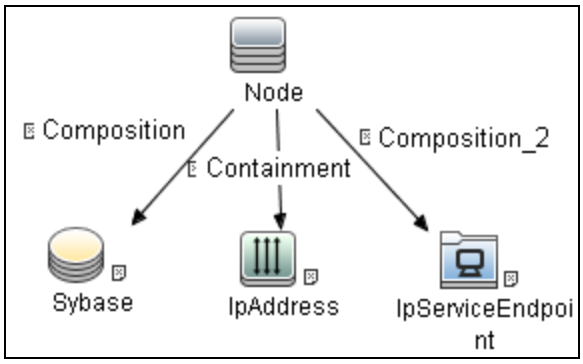
- **Databases TCP Ports**
- **Sybase Database Connection by SQL**
- **Sybase Topology by SQL**

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

Sybase Database Connection by SQL job

This section includes details about the job.

Trigger TQL



Node Name	Condition
Node	None
Sybase	None
IpAddress	NOT IP Probe Name Is null
IpServiceEndpoint	IpServiceName Equal ignore case sybase OR ServiceNames Contains sybase

Adapter

This job uses the **Sybase Connection By SQL** adapter.

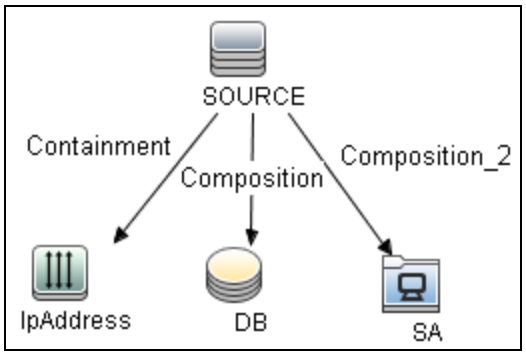
- **Adapter Type**

  Jython

- **Input CIT**

  Node

- **Input TQL**



- **Triggered CI Data**

Name	Value
application_ip	${DB.application_ip:NA}
application_port	${DB.application_port:NA}
ip_address	${IpAddress.name}
sa_ip	${SA.bound_to_ip_address:NA}
sa_port	${SA.network_port_number:NA}
sid	${DB.name:NA}

- **Used Scripts**
  - file_ver_lib.py
  - SQL_Connection.py
- **Required Permissions**

Permission	Operation	Usage Description	Objects and Parameters
SQL	select	Check Sybase database version	@@version
SQL	select	sid information	master..sysservers

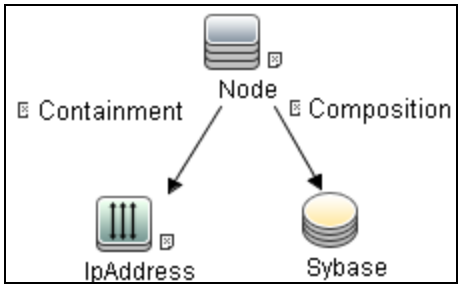
- **Discovered CITs**
  - Composition
  - Containment
  - IpAddress
  - IpServiceEndpoint
  - Node
  - SAP ASE Server
  - Usage
- **Adapter Parameters**

Parameter	Default	Description
protocolType	Sybase	The protocol type. Do not change the default value.

Sybase Topology by SQL job

This section includes details about the job.

Trigger TQL



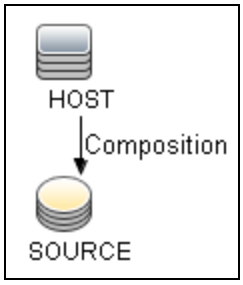
Node Name	Condition
Node	None
IpAddress	NOT IP Probe Name Is null
Sybase	NOT Application Username Is null AND NOT Reference to the credentials dictionary entry Is null

Adapter

This job uses the **Sybase Topology by SQL** adapter.

- **Adapter Type**
- Jython
- **Input CIT**

  Sybase ACE
- **Input TQL**



- **Triggered CI Data**

Name	Value
credentialsId	${SOURCE.credentials_id}
hostId	${HOST.root_id}
ip_address	${SOURCE.application_ip}
port	${SOURCE.application_port:NA}

- **Used Scripts**

  sybase_dis_physical.py
- **Required Permissions**

Permission	Operation	Usage Description	Objects and Parameters
SQL	select	Getting existing schema names	master..spt_values master..sysdatabases master.dbo.sysusages
SQL	select	Getting opened db sessions info	master..sysdatabases master..syslogins

Permission	Operation	Usage Description	Objects and Parameters
			master..sysprocesses
SQL	select	Getting tablespaces info	sybsystemprocs..sp_helpdevice
SQL	select	sid information	master..sysservers

- **Discovered CITs**
  - Composition
  - Containment
  - DB Client
  - DB Data File
  - DB Tablespace
  - DB User
  - IpAddress
  - Node
  - Process
  - Resource
  - SAP ASE Database
  - SAP ASE Server

Part 6: Enterprise Applications

Chapter 42: Active Directory Discovery

This chapter includes:

Overview 655

Supported Versions 655

Topology 656

How to Discover Active Directory Domain Controllers and Topology 658

Active Directory Connection by LDAP Job 659

Active Directory Topology by LDAP Job 662

Overview

Active Directory (AD) provides an extensible and scalable directory service that enables efficient managing of network resources.

Data Flow Management discovers Active Directory topology through the LDAP Directory Service Interface that communicates with the AD domain controllers. Data Flow Management uses JNDI to provide the API that interacts with the LDAP Directory Service Interface.

Supported Versions

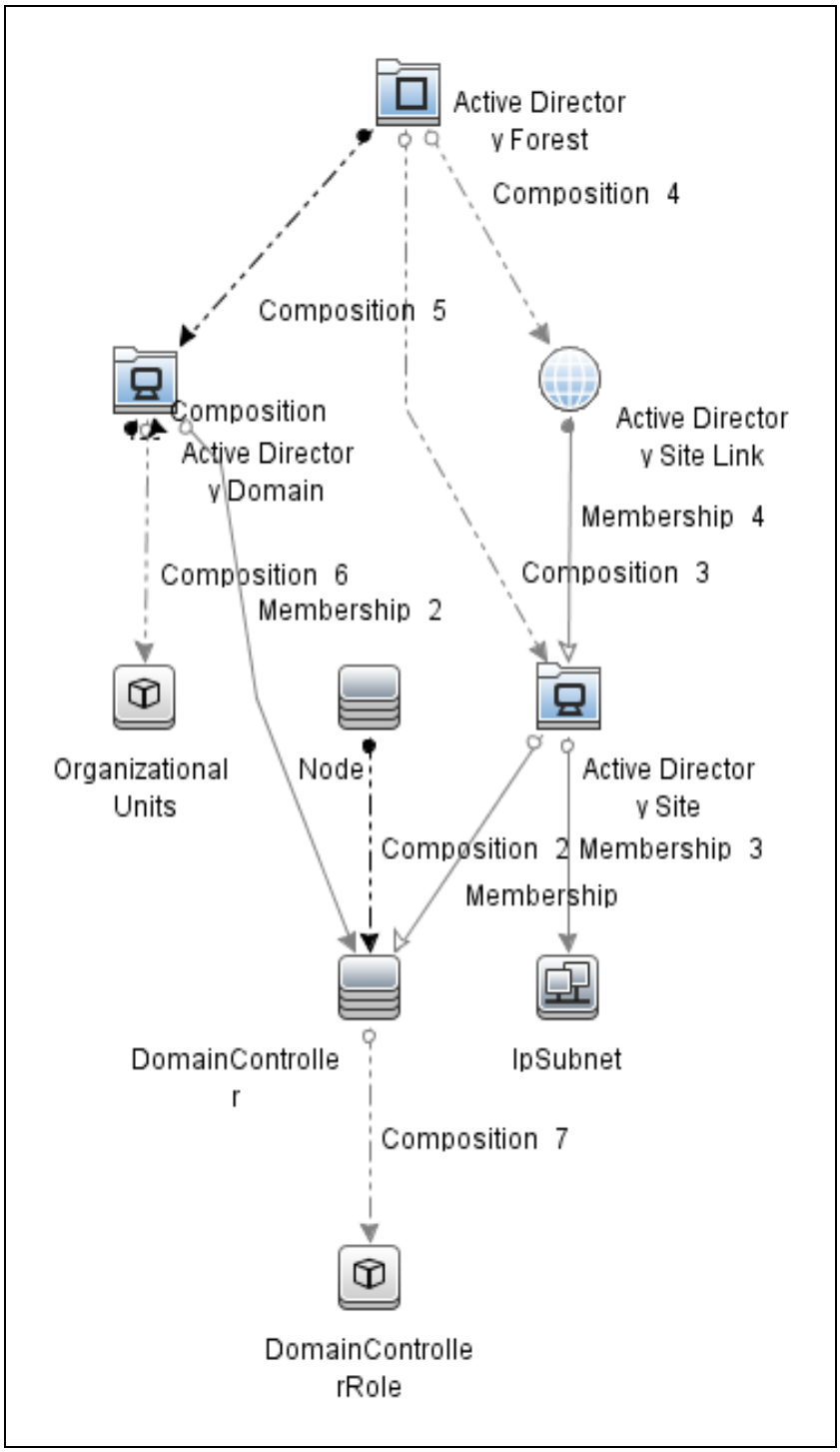
This discovery solution supports the following servers:

- Windows Server 2000
- Windows Server 2003
- Windows Server 2008
- Windows Server 2008 R2
- Windows Server 2012
- Windows Server 2012 R2
- Windows Server 2016

Topology

The following image displays the AD topology.

> **Note:** For a list of discovered CITs, see "Discovered CITs" on page 664.


Active Director
y Forest
Composition 4
Composition 5
Composition
Active Director
y Domain
Active Director
y Site Link
Membership 4
Composition 6
Membership 2
Composition 3
Organizational
Units
Node
Active Director
y Site
Composition 2
Membership 3
Membership
DomainControlle
r
IpSubnet
Composition 7
DomainControlle
rRole

How to Discover Active Directory Domain Controllers and Topology

This task explains how to discover Active Directory and includes the following steps:

1. Prerequisite - Set up protocol credentials

   a. To discover hosts, you must set up the SNMP, Shell (NTCMD, SSH, Telnet), and WMI protocols.

      - SNMP protocol

        Prepare the following information for the SNMP protocol: **community name** (for v2 protocol), **user name** (for v3 protocol), and **password** (for v3 protocol).

      - Shell Protocols: NTCMD, SSH, Telnet protocols

        Prepare the following information for the Shell protocol: **user name**, **password**, and **domain name** (optional for NTCMD).

      - WMI protocols

        Prepare the following information for the WMI protocol: **user name**, **password**, and **domain name** (optional).

   b. To run all AD jobs, you must set up the LDAP protocol. There are two versions of the protocol available: **2** and **3**. There is no formal standardization of version 2, therefore Data Flow Management uses the version 3 protocol.

      > **Note: User Name**: if a domain is present, use **username@domain**.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Prerequisite - Other

   a. Discover the host of each AD domain controller: activate one of the following jobs (depending on the protocol you are using):

      - **Host Connection by Shell**
      - **Host Connection by SNMP**
      - **Host Connection by WMI**

b. Verify that the **portNumberToPortName.xml** configuration file includes all possible AD ports. For example, if AD is running on LDAP port 389, locate the following row in the file:

```
<portInfo portProtocol="tcp" portNumber="389" portName="ldap" discover="0"
/>
```

Change the **discover="0"** attribute value to **discover="1"**.

For details, see the sections about the portNumberToPortName.xml file, and about a New Port, in the *HPE UCMDB Discovery and Integrations Content Guide - General Reference* document.

c. To discover all known LDAP ports, perform the following additional configuration to the TCP Ports job:

- set **ports** option to **ldap**

d. Open the LDAP port of the destination IP for each domain controller server by activating the following job in the **Tools and Samples > Discovery Tools** module:

- **TCP Ports.** This job includes the **TCP_NET_Dis_Port** adapter.

3. Run the discovery

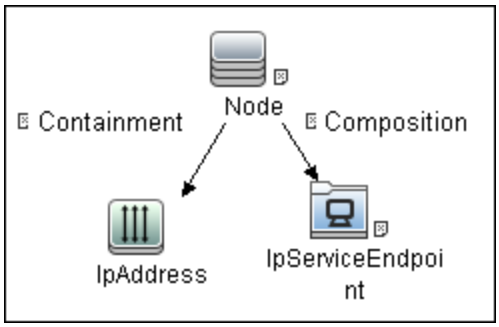
- Activate the **Active Directory Connection by LDAP** job. This job discovers the existence of AD domain controllers through LDAP. For query and parameter details, see "Active Directory Connection by LDAP Job" below.
- Activate the **Active Directory Topology by LDAP** job. This job connects to the AD domain controller servers and discovers their topology. For query and parameter details, see "Active Directory Topology by LDAP Job" on page 662.

Active Directory Connection by LDAP Job

This section contains details about the job.

Trigger Query

- Trigger CI: IpAddress
- Trigger query:



- CI attribute conditions:

CI	Attribute Value
Node	None
IpAddress	NOT IP Probe Name Is null
IpServiceEndpoint	IpServiceName Equal ignore case ldap OR ServiceNames Contains ldap

Adapter

This job uses the **LDAP_Active_Directory_Connection** adapter.

- Triggered CI Data

Name	Value	Description
hostId	${HOST.root_id}	The ID of the host on which the domain controller resides.
ip_address	${SOURCE.name}	The IP address, retrieved from the IpServiceEndpoint.
port_number	${Service_Address.network_port_number}	The LDAP port number, retrieved from the IpServiceEndpoint.

- Adapter Parameters

Parameter	Description
baseDn	This is the domain name where records about domain controllers are stored. **Default**: OU=Domain Controllers

Discovered CITs

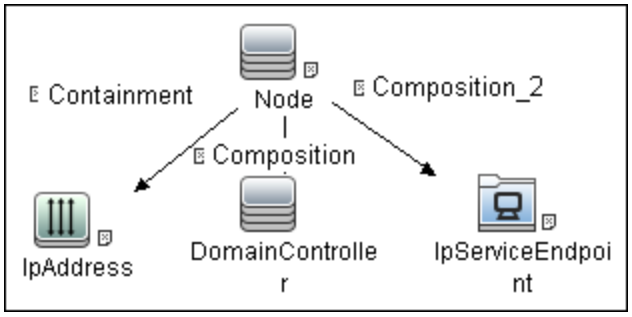
- Containment
- Composition
- DomainController
- Node
- IpAddress

Active Directory Topology by LDAP Job

This section contains details about the job.

Trigger Query

- Trigger CI: DomainController
- Trigger Query:



- CI attribute conditions:

CI	Attribute Value
Node	None
IpAddress	NOT IP Probe Name is null
DomainController	NOT Reference to the credentials dictionary entry Is null AND NOT Application IP Is null
IpServiceEndpoint	IpServiceName Equal ignore case ldap OR ServiceNames Contains ldap

Adapter

This job uses the **LDAP_Active_Directory_Topology** adapter.

- Triggered CI Data

Name	Value	Description
application_ port	${SOURCE.application _ port:NA}	The port retrieved from the IpServiceEndpoint.
credentials_id	${SOURCE.credentials _ id}	The credentials ID of the protocol saved in the domain controller's attribute.
hostId	${HOST.root_id}	The ID of the host on which the domain controller resides.
ip_address	${SOURCE.application_ip}	The IP address of the server.
port	${SERVICE_ ADDRESS.network_port_ number}	The LDAP port number.

- Adapter Parameters

Parameter	Description
baseDn	This is the domain name where records about domain controllers are stored. **Default**: OU=Domain Controllers
globalCatalogPort	The port number through which DFM accesses the domain controller designated as the global catalog. **Default: 3268** **Note**: This parameter is needed only when **tryToDiscoverGlobalCatalog** is set to true.
reportOUAsConfigurationDocument	If this parameter is set to **true**, this job reports the tree of Organizational Unit as configuration document. if **false**, this job reports the tree of Organizational Unit as the tree of CIs. **Default:** false
tryToDiscoverGlobalCatalog	If this parameter is set to **true**, DFM attempts to discover the entire topology by connecting to the domain controller designated as a global catalog server. The connection is made through the port defined in the **globalCatalogPort** parameter. **Default**: true - the global catalog is used for discovery

Discovered CITs

- ActiveDirectoryDomain. Domains in the AD Forest.
- Active Directory Forest. Information about functionality level and contiguous names.
- ActiveDirectorySite. Available site objects that are configured in the AD Forest.
- ActiveDirectorySiteLink
- ActiveDirectorySystem
- Composition
- Containment
- ConfigurationDocument
- DomainController
- DomainControllerRole
- Node
- Membership. Relationships between sites and subnets.
- IpSubnet. Available subnet objects.
- IpAddress

> **Note:** To view the topology, see "Topology" on page 656.

Chapter 43: Cisco Prime Infrastructure Discovery

This chapter includes:

Overview 666
Supported Versions 666
Topology 666
How to Discover Cisco Prime Infrastructure by Web Services 667
Cisco Prime by Web Services Job 668
Introduction 668
Adapter Information 668

Overview

Cisco Prime (Cisco Works prior to 2011, CiscoWorks before that) LAN Management is upgraded and replaced by Cisco Prime Infrastructure.

For details about CiscoWorks LAN Management Solution, see "CiscoWorks LAN Management Solution Integration" in the *HPE UCMDB Discovery and Integrations Content Guide - Third Party Integrations*.

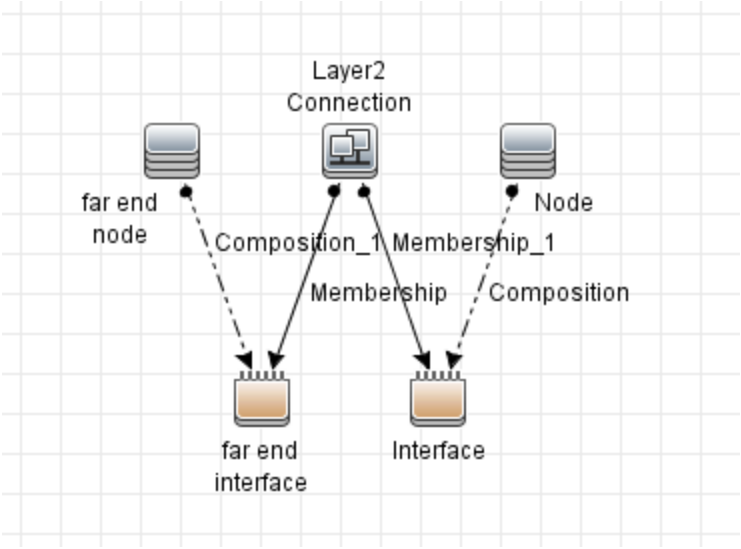
The **Cisco Prime by Web Services** job is used to discover Cisco Prime Infrastructure.

Supported Versions

Cisco Prime Infrastructure discovery supports Cisco Prime Infrastructure 3.x.

Topology

The following image displays the topology of the Cisco Prime Infrastructure discovery.



How to Discover Cisco Prime Infrastructure by Web Services

This task describes how to discover Cisco Prime Infrastructure by Web Services using the HTTP Protocol.

This task contains the following steps:

1. Prerequisites – Set up protocol credentials

   The Cisco Prime Infrastructure discovery solution is based on the HTTP Protocol.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Configure the URI endpoint

   a. Add the IP address of Cisco Prime server to Data Flow Probe IP Range.

      For Range information, see "New/Edit Range Dialog Box" in the *HPE Universal CMDB Data Flow Management Guide* document.

   b. Edit **UriEndpointConfiguration.xml**.

      i. Go to **Data Flow Management > Adapter Management > Resources** pane.

      ii. Click the **Find resource** button, enter **UriEndpointConfiguration.xml** in the **Name** field, and then click the **Find Next** button.

      iii. In **UriEndpointConfiguration.xml**, set the **url** to the Cisco Prime URL, and set the **type** to **cisco_prime** as follows:

```
<uri-endpoint>
    <url><Cisco Prime URL></url>
    <type>cisco_prime</type>
</uri-endpoint>
```

3. Run the discovery

   Run the following jobs in the following order:

   a. **Manual UriEndpoint Discovery**

   b. **Cisco Prime by Web Services**

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

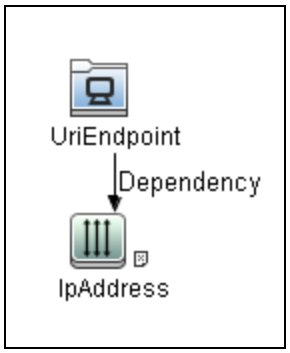
Cisco Prime by Web Services Job

This section includes details about the job.

Introduction

This job discovers nodes, interfaces, net devices, and Layer2 connections on Cisco Prime.

Trigger TQL



CI	Attribute Value
UriEndpoint	Type Equal cisco_prime
IpAddress	NOT IP Probe Name Is null

Adapter Information

This job uses the **Cisco Prime by WebServices** adapter.

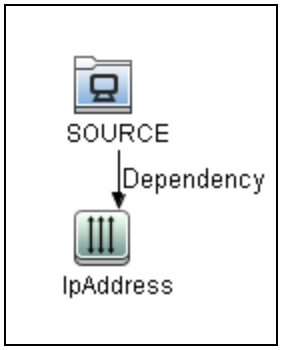
Adapter Type

Jython

Input CIT

UriEndpoint

Input TQL



CI	Attribute Value
IpAddress	NOT IP Probe Name Is null

Triggered CI Data

Name	Value
endpoint	${SOURCE.uri}
ip	${IpAddress.name}

Used Scripts

- cisco_prime_by_webservices.py

Discovered CITs

- Composition
- Containment
- Interface
- IpAddress

- Layer2Connection
- Memebership
- Node

Chapter 44: Cisco UCS

This chapter includes:

Overview 672

Cisco UCS Connection Job 672

Cisco UCS Manual Job 674

Cisco UCS Topology Job 676

Overview

Cisco UCS manages hardware and software in datacenters. This integration solution is based on its XML API to discover managed topologies. This solution contains three jobs.

Cisco UCS Connection Job

The Job is used to discover Cisco UCS as running software which will be trigger of the **Cisco UCS Topology** job.

Versions

The package supports Cisco UCS version 2.2(1b) and 3.x.

Prerequisites

The job needs UCS credential which include username and password.

Adapter Information

This job uses the **Cisco_UCS_Connection** adapter.

Input CIT

ip_address

Trigger TQL

Used Scripts

- ucs_connection_main.py
- ucs_connection_data_manager.py
- ucs_client.py
- ucs_base.py
- ucs_decorators.py

Discovered CITs

- RunningSoftware

Global Configuration File

- cisco_ucs/ucs_mapping.xml

Workflow

1. Get credentials for the trigger IP.
2. Iterate credentials, create UCS client to login. If successfully connected, report a UCS running software with the connected credential.

Cisco UCS Manual Job

The Job is used to discover Cisco UCS topology by a configuration file containing lines of URLs.

Versions

The package supports Cisco UCS version 2.2(1b) and 3.x.

Prerequisites

The job needs UCS credential which include username and password.

Adapter Information

This job uses the **Cisco_UCS_Manual** adapter.

Input CIT

discoveryprobegateway

Trigger TQL

Used Scripts

- ucs_manual_main.py

- ucs_pull_base.py
- ucs_connection_data_manager.py
- ucs_client.py
- ucs_base.py
- ucs_mapping_file_manager.py
- ucs_mapping_implementation.py
- ucs_mapping_interfaces.py
- ucs_validators.py
- ucs_decorators.py

Discovered CITs

- Backbone
- Chassis
- Composition
- Containment
- Fibre Channel HBA
- Fibre Channel Port
- Fibre Channel Switch
- HardwareBoard
- Membership
- Node
- PhysicalPort
- Rack

Global Configuration File

- cisco_ucs/ucs_mapping.xml

Workflow

1. Read ucs_url_list.conf and parse it to a list of URL.
2. Pick one URL and try all UCS credentials one by one until connected, then fetch data from UCS by its XML API
3. Parse the data from UCS and map them to UCMDB, then report CIs to UCMDB
4. Iterate steps 2-3 over the rest of URLs

Troubleshooting

Issue: You receive the following error message in the Communication log: `URLError: <urlopen error (-1, 'SSL handshake exception`

Solution 1: Https server does not own a valid SSL certificate (for example, self-signed certificate or expired), for this case, make sure enable the **Trust All SSL Certificates** options in current used UCS credential.

Solution 2: The server is not an Https server but you enabled the SSL in the credential. Disable the **Use HTTPS for connection** option for the credential.

Cisco UCS Topology Job

The Job is used to discover the Cisco UCS topology with UCS running as an input trigger.

Versions

The package supports Cisco UCS version 2.2(1b) and 3.x.

Prerequisites

The job needs UCS credential which include username and password.

Adapter Information

This job uses the **Cisco_UCS_Topology** adapter.

Input CIT

ip_address

Trigger TQL

Used Scripts

- ucs_topology_main.py
- ucs_pull_base.py
- ucs_connection_data_manager.py
- ucs_client.py
- ucs_base.py
- ucs_mapping_file_manager.py
- ucs_mapping_implementation.py
- ucs_mapping_interfaces.py
- ucs_validators.py
- ucs_decorators.py

Discovered CITs

- Backbone
- Chassis
- Composition

- Containment
- Fibre Channel HBA
- Fibre Channel Port
- Fibre Channel Switch
- HardwareBoard
- Membership
- Node
- PhysicalPort
- Rack

Global Configuration File

- cisco_ucs/ucs_mapping.xml

Workflow

1. Get credential from UCS running software.
2. Connect UCS system by the credential and fetch data from UCS by its XML API.
3. Parse the data from UCS and map them to UCMDB, then report CIs to UCMDB.

Chapter 45: Microsoft Exchange Server with Active Directory Discovery

This chapter includes:

Overview 680

Supported Versions 681

Topology 682

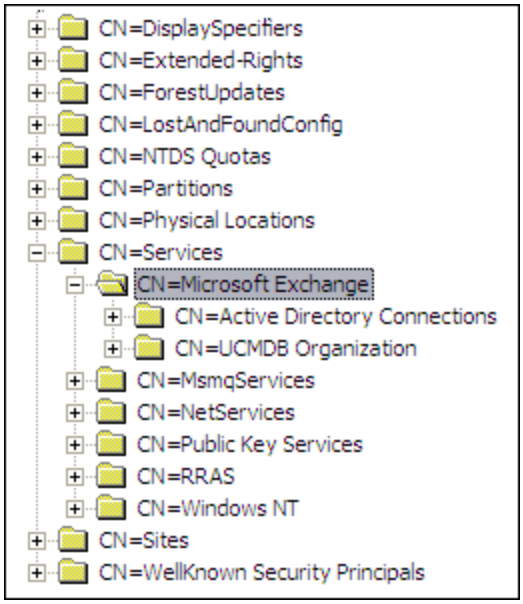
How to Discover Microsoft Exchange Server Topology with Active Directory 686

Microsoft Exchange Topology by LDAP Job 687

Troubleshooting and Limitations – Microsoft Exchange Server with Active Directory Discovery 690

Overview

With the addition of LDAP protocol support in Content Pack 5, DFM can discover the Exchange topology using Active Directory (AD). Because Exchange is tightly integrated with AD and stores most of its configuration there, DFM connects to the AD Domain Controller and extracts information from it. The Exchange configuration is stored in a specific node under Services:



The Base Distinguished Name of this node is:

"CN=Microsoft Exchange, CN=Services, CN=Configuration,DC=ucmdb-ex, DC=dot"

where **ucmdb-ex.dot** is the name of the domain in this example.

If this node exists, DFM drills down and discovers all remaining information that includes: Exchange organization, Exchange servers, administrative and routing groups, connectors, roles, and so on.

Multiple Domain Controllers can serve the same domain, in which case the information is replicated between them (multi-master replication). The controllers contain the same data, so DFM needs to run only against one of them.

> **Note:** The job for AD discovery triggers on, and runs against, all discovered domain controllers. However, as only updates are sent to the CMDB by the Data Flow Probe's result processing mechanism, the information is reported only once.

AD machines in the domain are registered in DNS as being configured for AD. DFM retrieves the FQDN (fully qualified domain name) from every Exchange discovery. This is the name of Exchange within AD. To report such an Exchange, DFM tries to resolve the FQDN to an IP address, as follows:

- DFM uses the default Data Flow Probe's DNS to resolve the Exchange FQDN.
- If this fails, DFM uses the target Domain Controller as the DNS. This is because in many cases the DNS server runs on the same machine as the Domain Controller. DFM runs the command **"nslookup <FQDN> <targetDC>"** in the Data Flow Probe's local Shell.
- If this fails, DFM skips this Exchange instance.

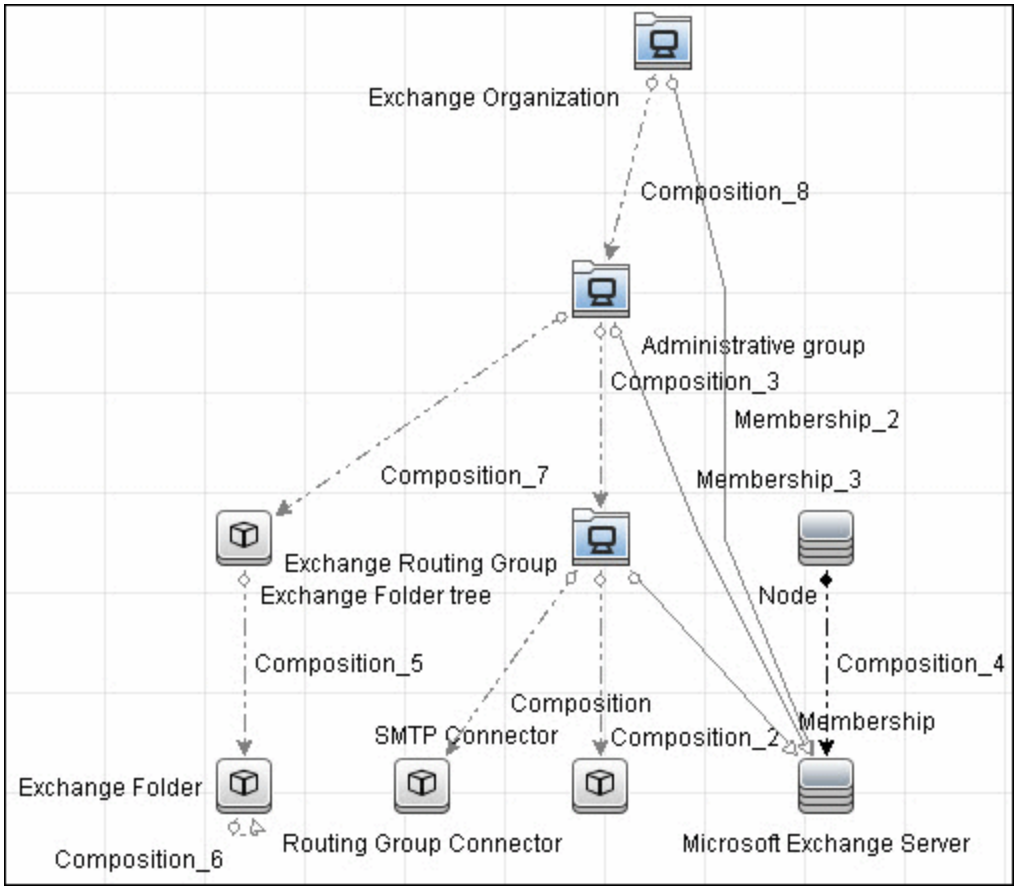
> **Note:** If the FQDN cannot be resolved either by a local DNS or by using the target Domain Controller as the DNS, the job displays the following message:
>
> `Cannot resolve IP address for host '<host>', Exchange Server won't be reported`

Supported Versions

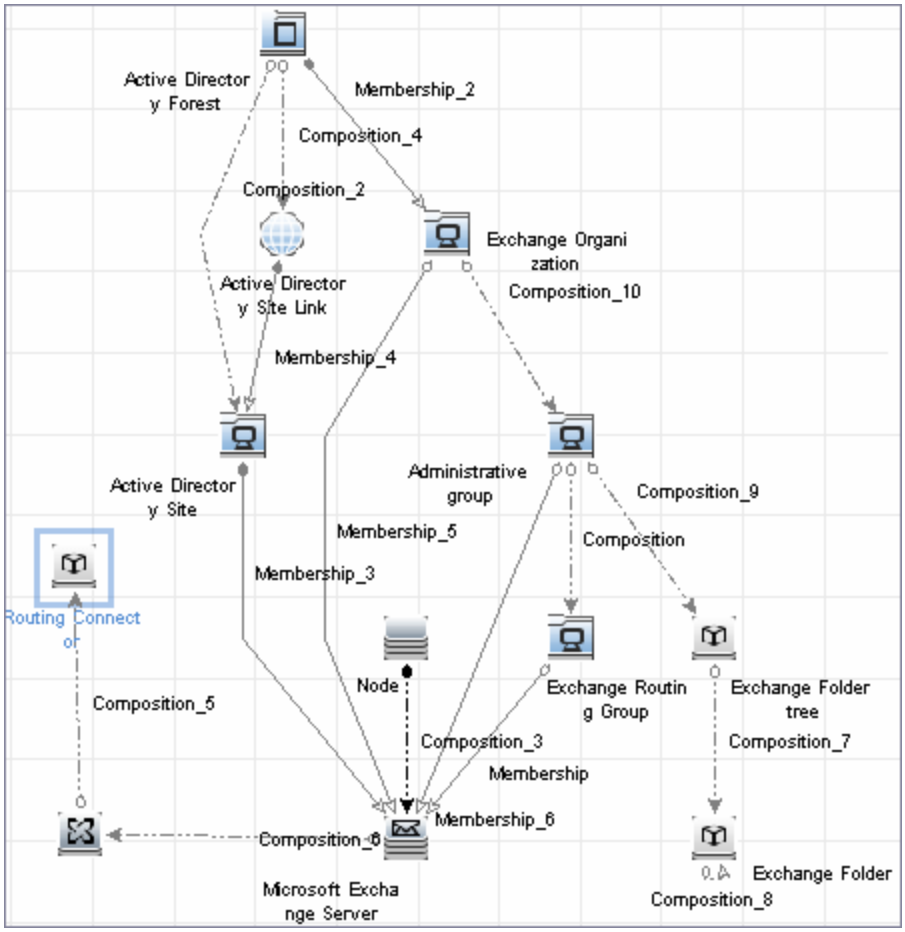
Microsoft Exchange discovery with Active Directory supports MS Exchange versions 2003, 2007, 2010, 2013, and 2016.

Topology

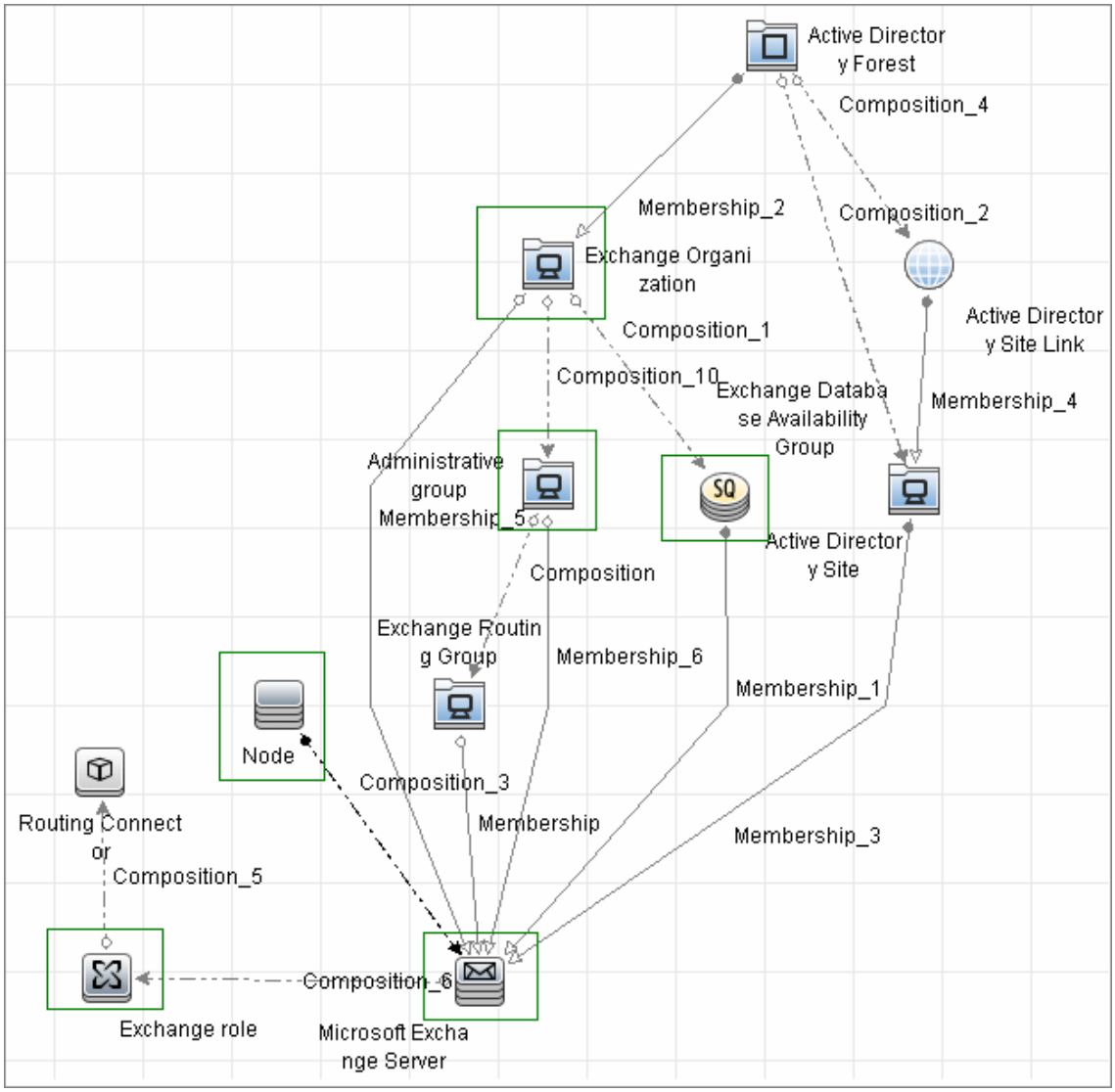
- **Microsoft Exchange Server 2003**



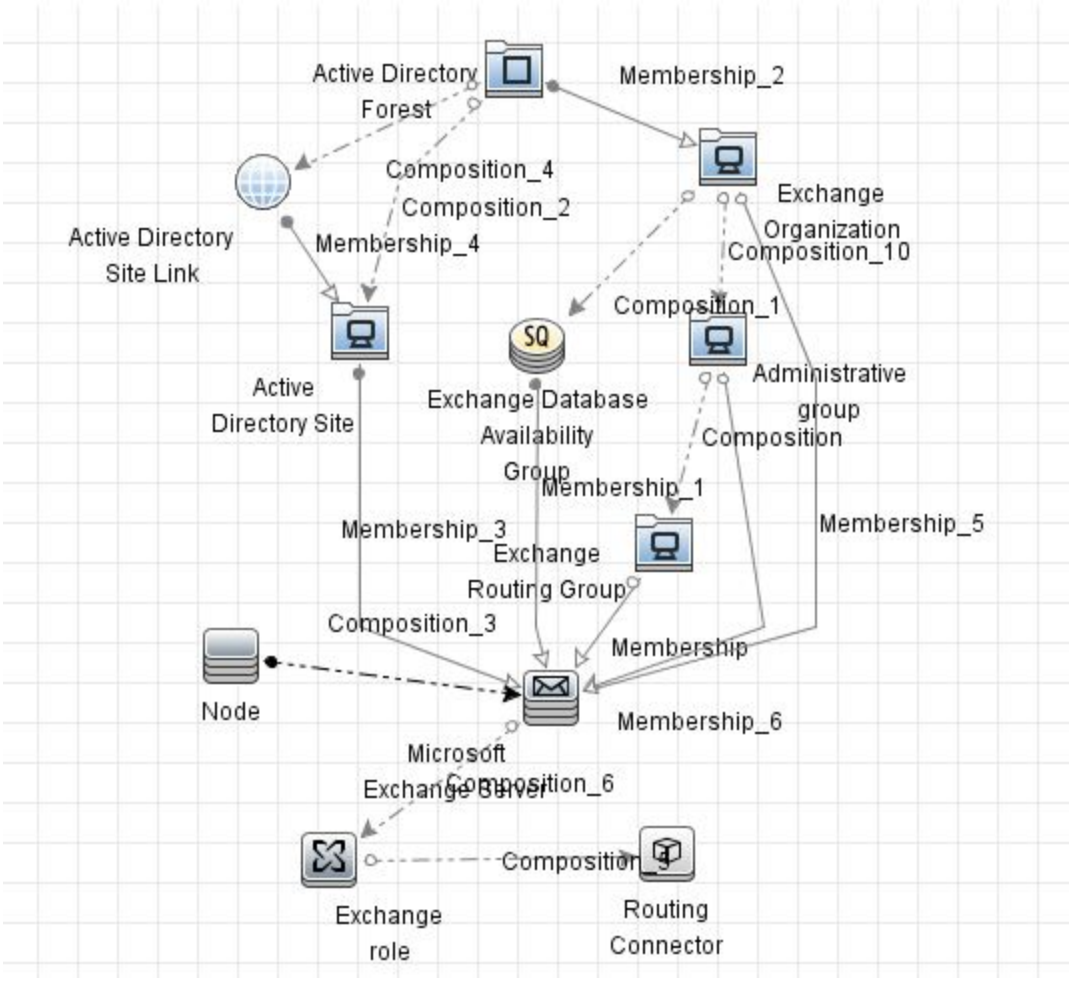
- **Microsoft Exchange Server 2007**



- **Microsoft Exchange Server 2010**



- **Microsoft Exchange Server 2013**



How to Discover Microsoft Exchange Server Topology with Active Directory

Note: This functionality is available as part of Content Pack 5.00 or later.

This section explains how DFM discovers Exchange by utilizing the tight integration between Exchange and AD. DFM runs jobs to discover Exchange elements in the topology that are available only through AD.

This task includes the following steps:

1. Prerequisite – Set up protocol credentials

   Define at least one set of LDAP protocol credentials. These credentials should enable connecting to a Domain Controller through the LDAP protocol and performing searches. DFM does not modify information in AD. The queried nodes reside in the Configuration partition under the following nodes:

   - **CN=Services,CN=Microsoft Exchange** node
   - **CN=Sites** node

   The LDAP protocol credentials should include:

   - **User name** and **password.** Use the user account from the target domain. For all nodes that are to be queried, give **List Contents** and **Read all properties** permissions.
   - **Authentication type**. **Simple**.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Prerequisite – Discover a Domain Controller

   To discover the Exchange topology with AD, DFM must first find a Domain Controller with an available LDAP connection.

   a. Activate the **Range IPs by ICMP** job, to ping the target host on which the Domain Controller runs.

   b. Activate the **TCP Ports** job against the target host, to discover open LDAP ports.

   c. Activate the **Active Directory Connection by LDAP** job, to discover the Domain Controller

on the target host.

d. To enable DFM to use the LDAP protocol, edit the following line in the **portNumberToPortName.xml** file (**Adapter Management > Resources pane > Packages > DDMInfra > Configuration Files**).

Change:

```
<portInfo portProtocol="tcp" portNumber="389" portName="ldap" discover="0"
/>
```

to

```
<portInfo portProtocol="tcp" portNumber="389" portName="ldap" discover="1"
/>
```

3. Run the discovery

Activate the **Microsoft Exchange Topology by LDAP** job.

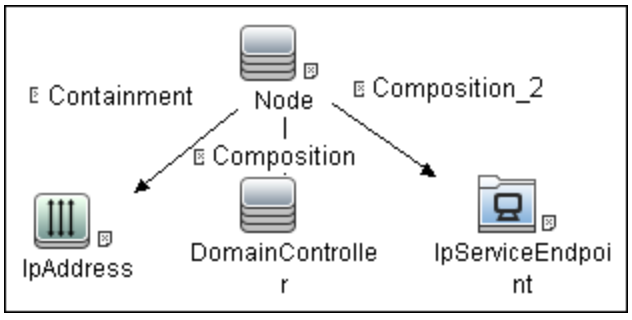
Microsoft Exchange Topology by LDAP Job

The components responsible for discovering Microsoft Exchange Server with Active Discovery are bundled in the Microsoft Exchange Server package, **Microsft_exchange_server.zip**.

Trigger Query

- Trigger CI: DomainController
- Trigger query:

  The Trigger query, **trigger_domainctl_ldap**, is part of the Active Directory package.



- CI attribute conditions:

CI	Attribute Value
Node	None
IpAddress	NOT IP Probe Name Is null
DomainController	NOT Reference to the credentials entry dictionary Is null AND NOT Application IP Is null
IpServiceEndpoint	IpServiceName Equal ignore case ldap OR ServiceNames Contains ldap

Adapter

This discovery uses the **ms_exchange_topology_by_ldap** adapter.

- Created/Changed CITs

Additional CITs	The following CITs have been added to the Microsoft Exchange Server Package ◦ Routing Group Connector ◦ SMTP Connector ◦ Exchange Routing Connector ◦ Send Connector ◦ Receive Connector ◦ Exchange Storage Group ◦ Exchange Mailbox Database ◦ Exchange Routing group
Deprecated CITs	The following CITs are deprecated; they remain in the package but are no longer reported: ◦ Directory Service Access DC ◦ Exchange Message queue ◦ Exchange link
Modified CITs	The following CITs were modified: ◦ **Exchange System** is now **Exchange Organization** ◦ **Microsoft Exchange Server** includes a new attribute: **is_master**

Discovered CITs

- Active Directory Forest
- ActiveDirectorySite
- ActiveDirectorySystem
- Administrative Group
- Composition
- Containment
- Exchange Database Availability Group

- Exchange Folder
- Exchange Folder Tree
- Exchange Mailbox Database
- Exchange Organization
- Exchange Role
- Exchange Routing Connector
- Exchange Routing Group
- ExecutionEnvironment
- IpAddress
- Membership
- MicrosoftExchangeServer
- Node
- Ownership
- Routing Group Connector
- SMTP Connector

Troubleshooting and Limitations – Microsoft Exchange Server with Active Directory Discovery

Currently Exchange Folders are not reported through the **Microsoft Exchange Topology by LDAP** job.

Chapter 46: Microsoft Exchange Server Discovery by NTCMD or UDA

This chapter includes:

Overview 692

Supported Versions 692

Topology 692

How to Discover Microsoft Exchange Server by NTCMD or UDA 696

Microsoft Exchange Connection by NTCMD or UDA Job 697

Microsoft Exchange Topology by NTCMD or UDA Job 698

Created/Changed CITs 700

Overview

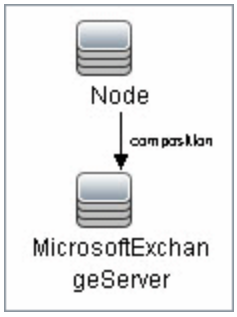
DFM discovers the following components of Microsoft Exchange Server (Exchange) software: Microsoft Exchange Server, Server Roles, Administrative and Routing groups, Organization, Clustered Mail Box, Database Availability group, Public folders, and Folder trees.

Supported Versions

Microsoft Exchange Server Discovery by NTCMD or UDA supports MS Exchange Server version 2007, 2010, 2013, and 2016.

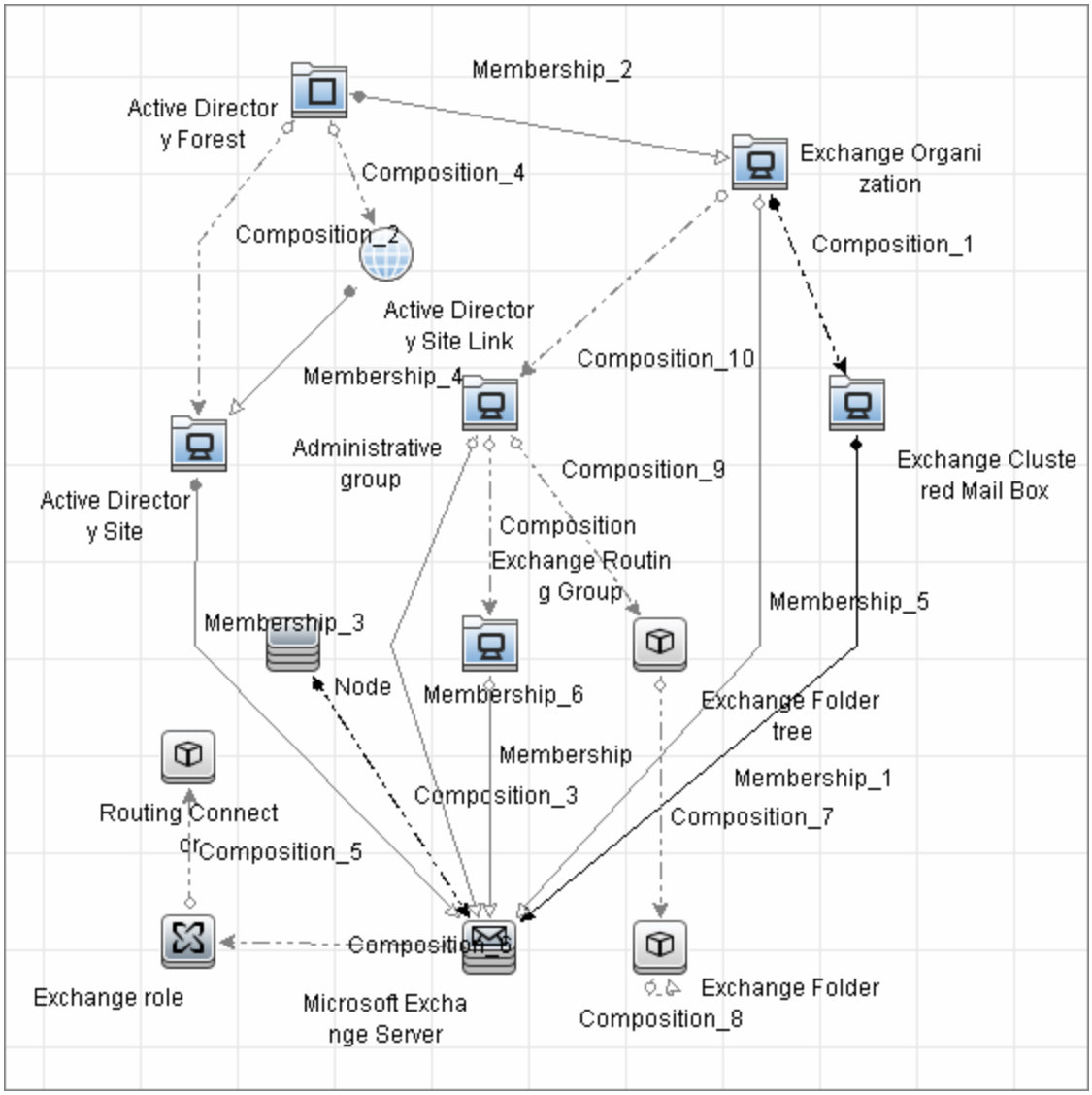
Topology

MS Exchange Connection by NTCMD or UDA:

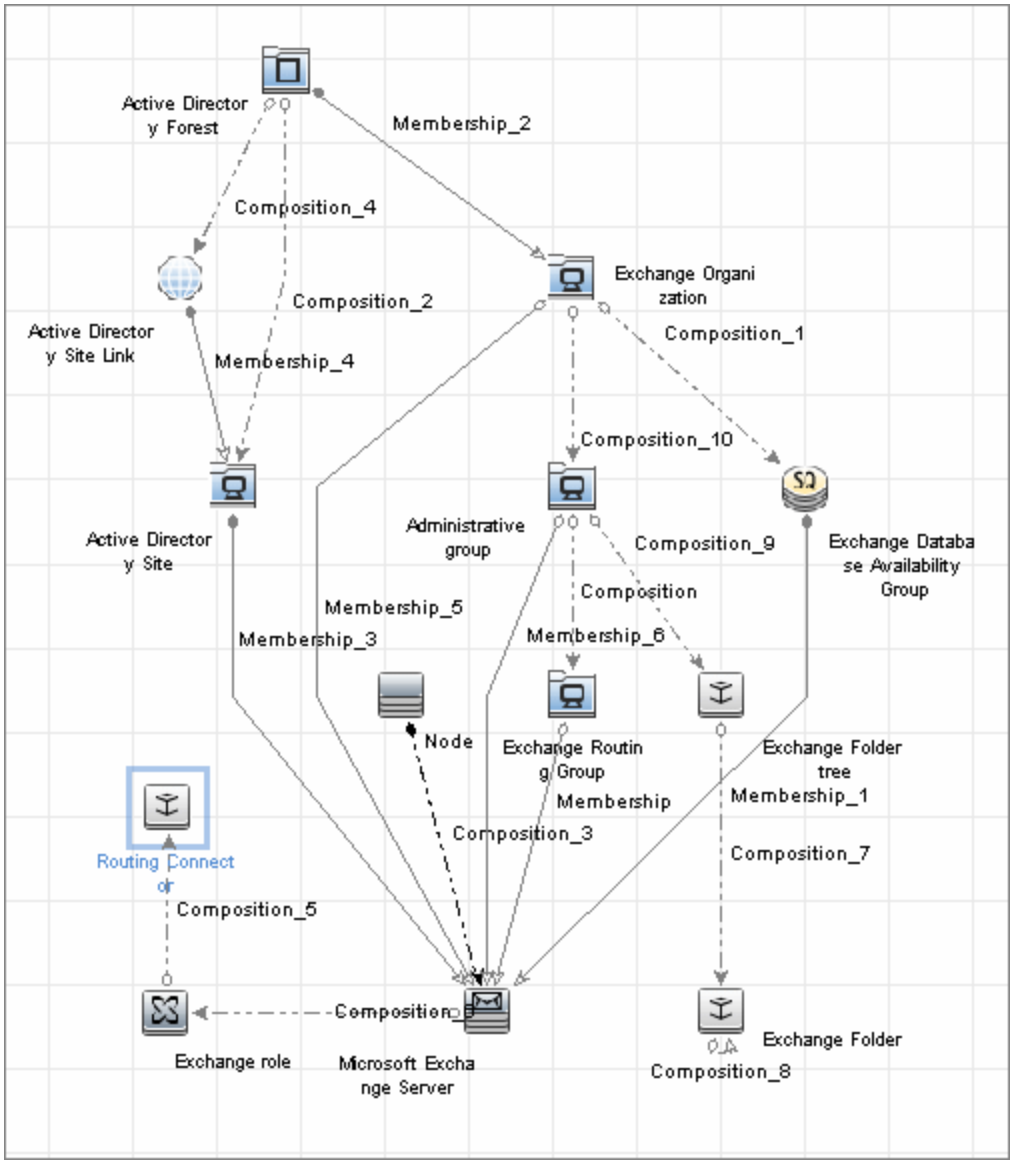


MS Exchange 2007 Topology:

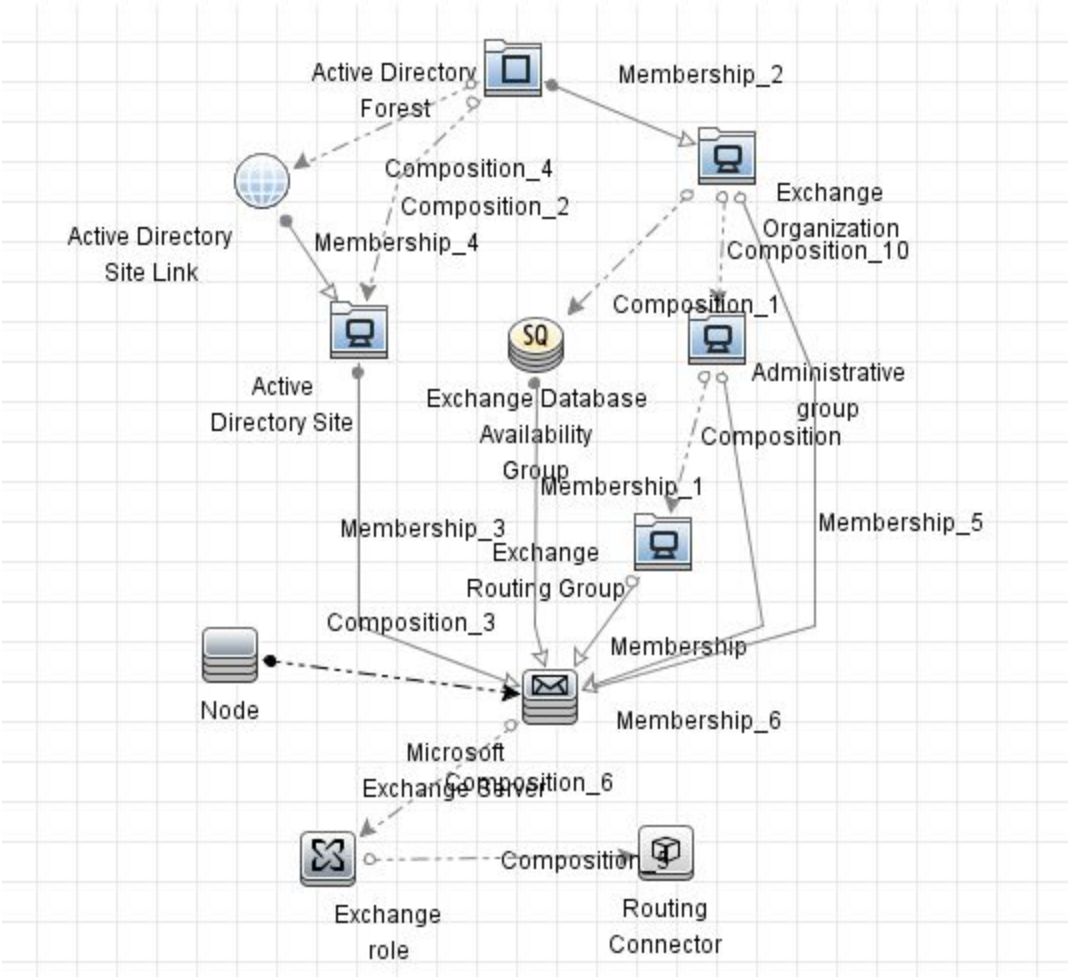
DFM runs the NTCMD protocol to retrieve the topology for MS Exchange 2007.



MS Exchange 2010 Topology:



Microsoft Exchange Server 2013



How to Discover Microsoft Exchange Server by NTCMD or UDA

DFM discovers Exchange by executing a PowerShell script on a remote machine with Exchange installed.

This task includes the following steps:

1. Prerequisite - Set up protocol credentials

   This discovery is based on the following protocol:

   - NTCMD protocol, or Universal Discovery protocol if UD Agent is installed on the Exchange server.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Prerequisite - Set up permissions

   - Set the script execution policy either to **Unrestricted** or **Remote Signed**.
   - Verify that the account used for discovery has the permissions of the **Exchange View-Only Administrator** role.

3. Run the discovery

   a. Run the **Host Connection by Shell** job.

   b. Run the **Host Applications by Shell** job to discover the Exchange process.

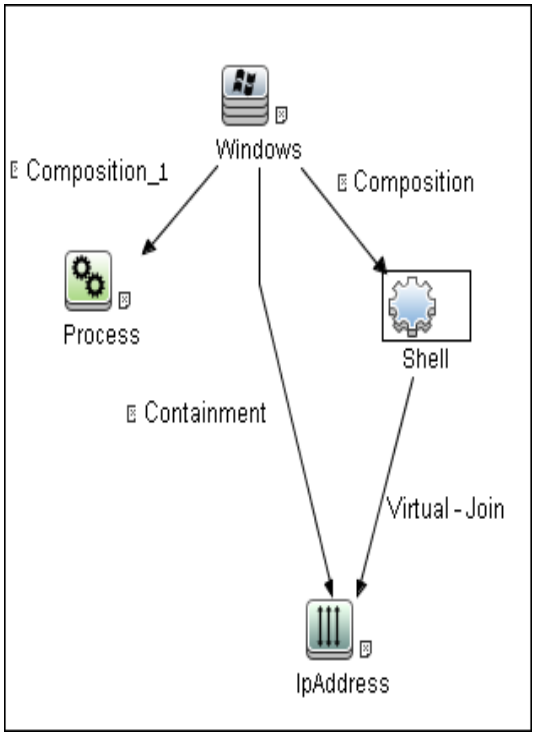
   c. Run the **Microsoft Exchange Connection by NTCMD or UDA** job to discover Exchange Server CIs.

   d. Run the **Microsoft Exchange Topology by NTCMD or UDA** job to discover the rest of the topology.

Microsoft Exchange Connection by NTCMD or UDA Job

This section contains details about the job.

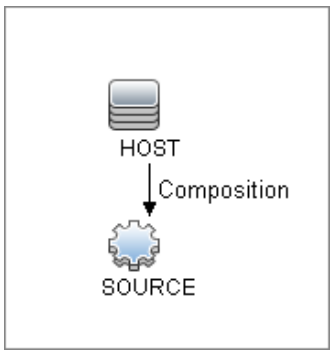
Trigger Query



Adapter

This job uses the **ms_exchange_connection_by_ntcmd** adapter.

- Input query:



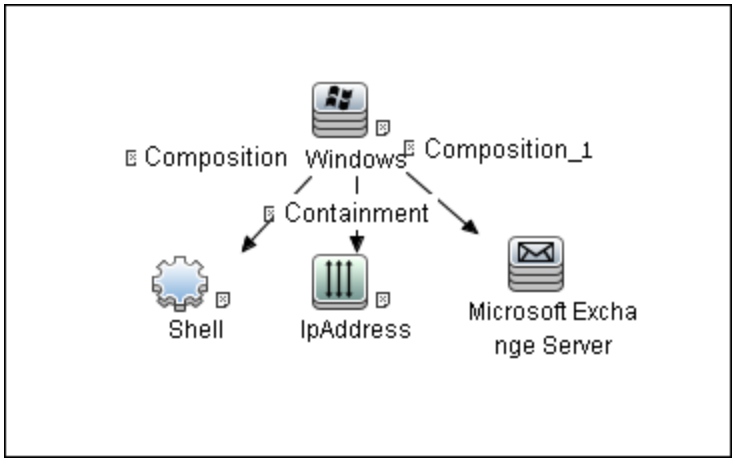
Discovered CITs

- Composition
- MicrosoftExchangeServer
- Node

Microsoft Exchange Topology by NTCMD or UDA Job

This section contains details about the job.

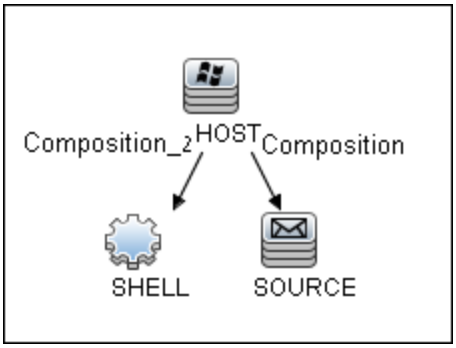
Trigger Query



Adapter

This job uses the **ms_exchange_topology_by_ntcmd** adapter.

- Input query:



Discovered CITs

- Administrative group
- Composition
- Exchange Client Access Server
- Exchange Clustered Mail Box
- Exchange Database Availability Group

- Exchange Edge Server
- Exchange Hub Server
- Exchange Mail Server
- Exchange Organization
- Exchange Unified Messaging Server
- Membership
- MicrosoftExchangeServer
- Node

Created/Changed CITs

The following CITs are used to create CIs for Exchange components:

Exchange Organization	This CIT represents the top-level Exchange system. For example, if an organization uses the Exchange solution, all the Exchange components are linked to a single Exchange Organization CI.
Microsoft Exchange Server	This CIT is inherited from the RunningSoftware CIT. The CIT represents Exchange software installed on a host.
Exchange Folder	This CIT represents Public folders available on the Exchange system. Public folder can be organized in a hierarchical structure, that is, one Public folder can contain another Public folder.
Exchange Role	This CIT is located in the **Application Resource > Microsoft Exchange Resource** folder. It is an abstract CIT that is the parent of the following CITs: • **Exchange Client Access Server**. Represents the Client Access Server role. • **Exchange Mail Server**. Represents the Mail Server role. • **Exchange Edge Server**. Represents Edge Server role. • **Exchange Hub Server**. Represents Hub Server role. • **Exchange Unified Messaging server**. Represents Unified Messaging server role.

Chapter 47: Microsoft Exchange Server by PowerShell Discovery

This chapter includes:

Overview 702

Supported Versions 702

Topology 702

How to Discover Microsoft Exchange by PowerShell 706

How to Configure PowerShell Remoting 707

How to Configure the Active Directory Side 708

Microsoft Exchange Topology by PowerShell Job 709

Troubleshooting and Limitations – Microsoft Exchange Server by PowerShell Discovery 715

Overview

Microsoft Exchange Server is the server side of a client–server, collaborative application product developed by Microsoft. It is part of the Microsoft Servers line of server products and is used by enterprises using Microsoft infrastructure products. Exchange's major features consist of electronic mail, calendaring, contacts and tasks; support for mobile and web-based access to information; and support for data storage.

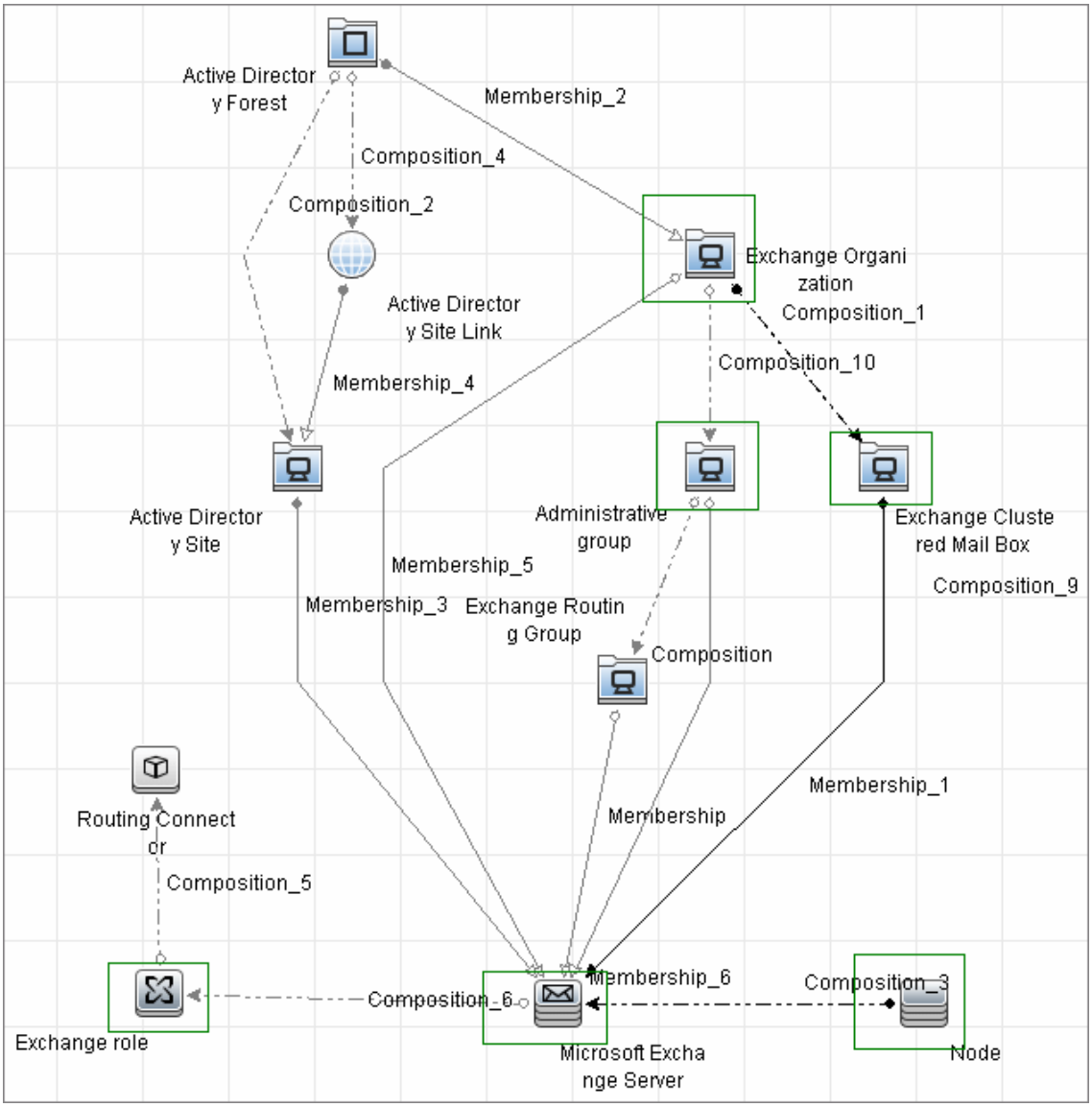
Supported Versions

Microsoft Exchange by PowerShell discovery supports MS Exchange Server versions 2007, 2010, 2013, and 2016.

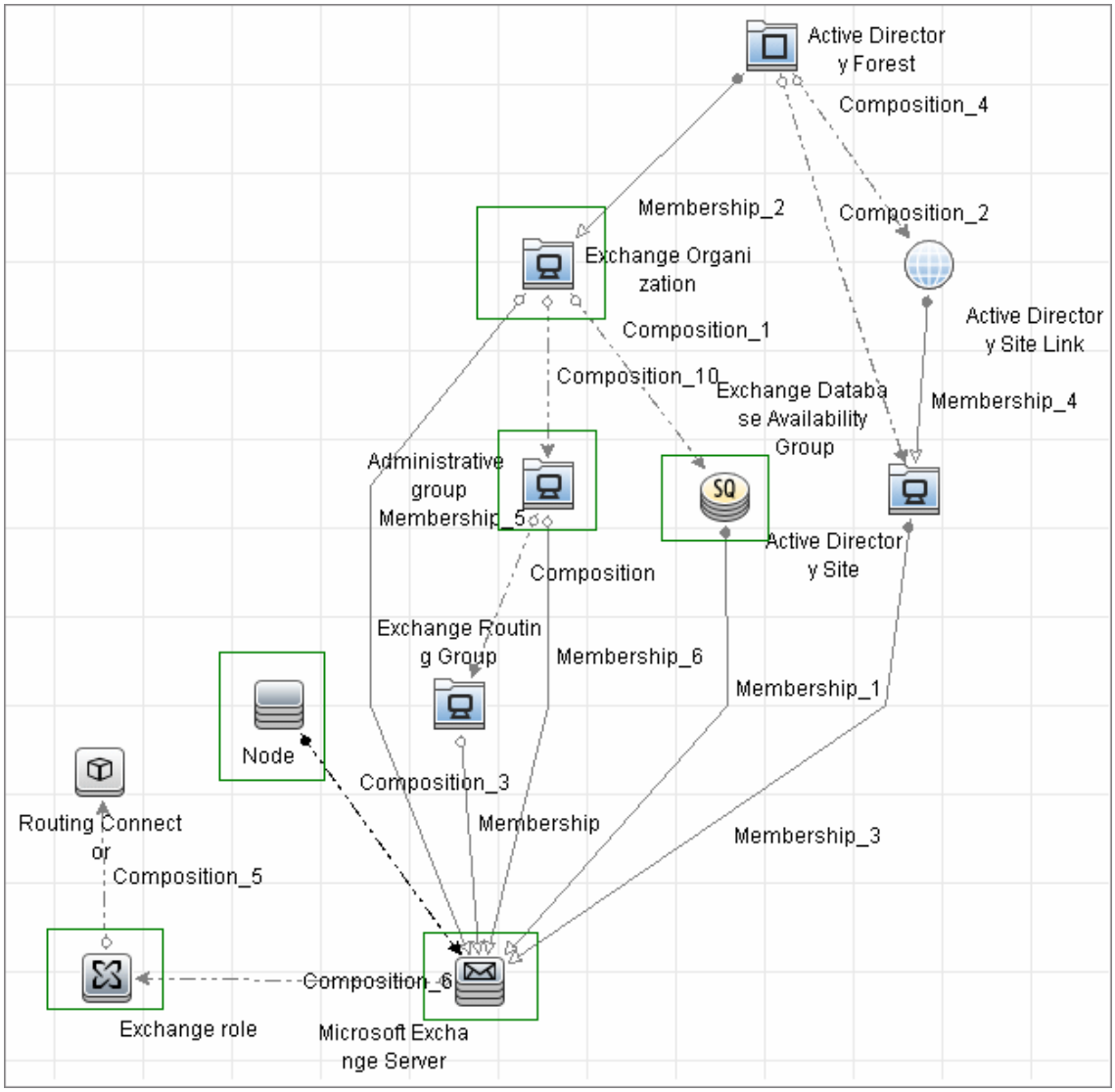
Topology

The following images illustrate the Microsoft Exchange by PowerShell topology. The CITs marked with borders can be discovered by the **Microsoft Exchange Topology by PowerShell** job.

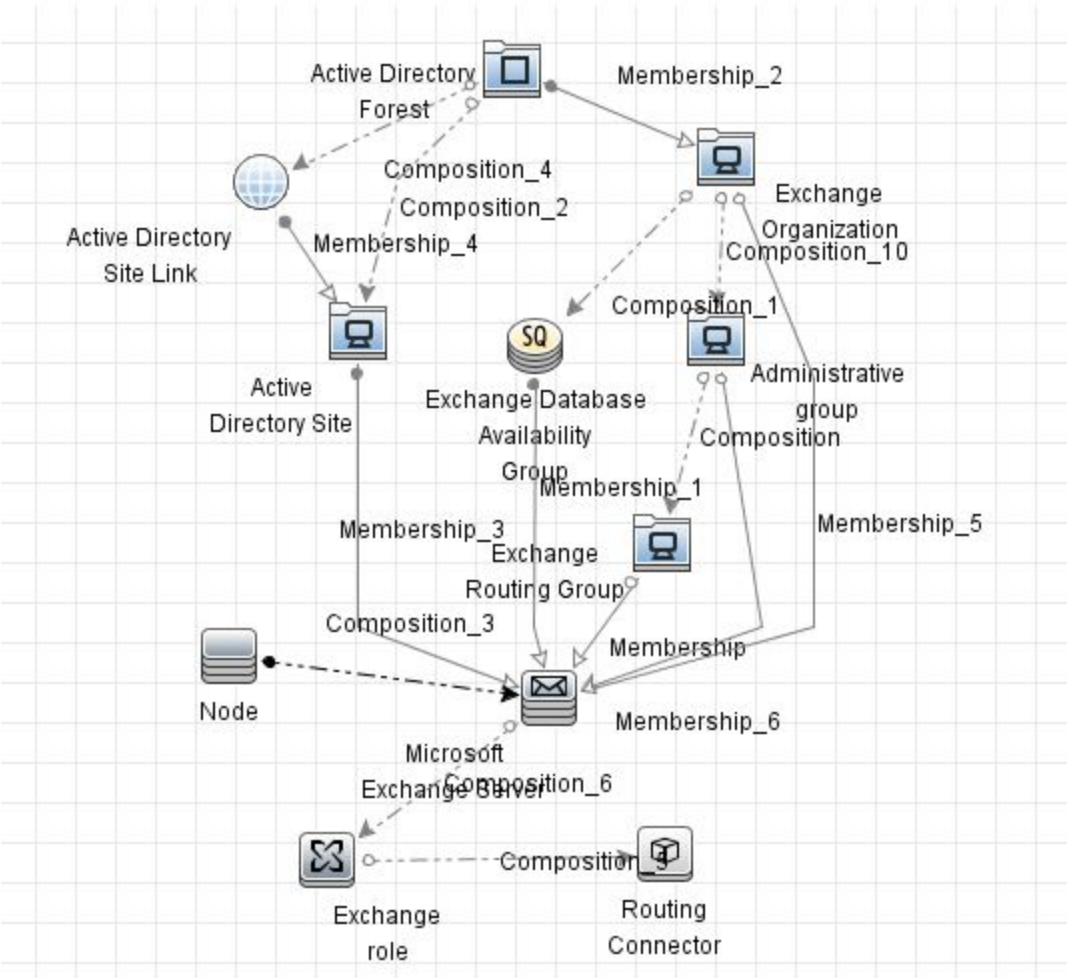
- **Microsoft Exchange Server 2007 by PowerShell**



- **Microsoft Exchange Server 2010 by PowerShell**



- **Microsoft Exchange Server 2013 by PowerShell**



How to Discover Microsoft Exchange by PowerShell

The following steps describe how to discover Microsoft Exchange by PowerShell.

1. Prerequisite - Set up protocol credentials

   This discovery solution is based on the PowerShell protocol.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

   Before starting the discovery ensure that PowerShell v2.0 or later is installed on the Data Flow Probe machine.

2. Prerequisite - Configure PowerShell remoting and AD

   a. Enable PowerShell remote access. For details, see "How to Configure PowerShell Remoting" on the next page.

   b. Configure the Active Directory side. For details, see "How to Configure the Active Directory Side" on page 708.

3. Prerequisite - Set up permissions

   Before starting the discovery, ensure that the discovery user has been granted all the required permissions to run the following commands:

   - **Snap-Ins:**
     - Microsoft.Exchange.Management.PowerShell.Admin (Exchange 2007)
     - Microsoft.Exchange.Management.PowerShell.E2010 (Exchange 2010)
   - **Get-ClusteredMailboxServerStatus**
   - **Get-ExchangeServer**
   - **Get-DatabaseAvailablityGroup**
   - **hostname**

4. Run the discovery

   a. Run the **Range IPs by ICMP** job to discover the Windows system IP addresses.

b. Run the **Host Connection by PowerShell** job to discover the Windows connection with the PowerShell agent and networking topology.

c. Run the **Host Applications by PowerShell** job to discover the host applications.

d. Run the **Microsoft Exchange Topology by PowerShell** job.

How to Configure PowerShell Remoting

This task describes how to enable PowerShell remote access.

This task includes the following steps:

1. Launch the PowerShell configuration

   In the PowerShell command prompt run the **winrm quickconfig**.

   > **Note:** From the moment that the PowerShell configuration is launched, you must differ between the server side configuration and client side configuration.

2. Configure the server-side machine

   On the server, depending on the authentication method that will be used, perform the following steps:

   a. Run **cd WSMan:\localhost\Service\Auth**.

   b. Run **dir** and verify that the required authentication type is enabled, that is, the **State** = **True**. If the required authentication type is disabled, run "**et-Item <AuthTypeName> True**. By default, **Kerberos** and **Negotiate** are enabled.

   c. Run **cd WSMan:\localhost\Service** and verify that **IPv4Filter** or **IPv6Filter** are set to either "*****" or to any other valid value for your environment.

   d. Run **cd WSMan:\localhost\Listener**, and then **dir**. Verify that the listener actually listens to the required IPs. By default, the listener listens to all IPs if the value "*****" is used.

   e. If you made any changes, restart the **winrm service** by running the **restart-service winrm** command.

3. Configure the client-side machine

   On the client machine, perform the following steps:

a. Run **cd WSMan:\localhost\Client\Auth**.

b. Run **dir** and verify that the required authentication type is enabled, that is, the **State** = **True**. If the required authentication type is disabled, run **Set-Item <AuthTypeName> True**.

> **Note:** The allowed protocols must coincide with the ones configured on the server side.

c. Run **cd WSMan:\localhost\Client**.

d. Run **dir** and check value of **TrustedHosts**. By default, the value is empty so that no connection outside is possible. **TrustedHosts** is an ACL field where the allowed values are a domain name or a list of domain names and an IP address or a list of IP addresses. The value may have a special symbol **""**, meaning that any destination or any symbol can appear in any part of the specified destinations list. If the only value is **""**, then the client is allowed to connect to any host. This is the recommended value.

   To change the value for **TrustedHosts**, use **Set-Item TrustedHosts <Value>**.

> **Note:** No translation from FQDN to IP is done while validating the ACL. This means that if the connection is performed by IP and only an FQDN is listed in the **TrustedHosts** field (or vice versa), the connection will not be allowed.

e. If you made any changes, restart the **winrm service** by running the **restart-service winrm** command.

How to Configure the Active Directory Side

Some Exchange PowerShell command-lets need to perform AD LookUps. AD servers (starting from Win 2003) do not allow **Anonymous** lookups while the impersonalization is still applied. This results in various errors while trying to run the Exchange/AD-related command-lets remotely.

This task includes the following steps:

1. Configure delegation on the Active Directory side

   To enable remote calls of such command-lets, you must configure the **Delegation** on the Active Directory side.

   a. Log on to the domain controller using an administrator account.

   b. Select **Start > Programs > Administrative Tools > Active Directory Users and Computers**.

c. Select you domain's, **Users** folder.

d. Right-click the user account that is to be delegated, and click **Properties**.

e. In the **Account** tab, under the **Account options**, make sure that the **Account is sensitive and cannot be delegated** option is NOT selected.

f. Click **OK**.

2. Allow required servers to perform the delegated requests

Confirm that the server process account is trusted for delegation if the server process runs under a Windows user account:

a. In the **Active Directory Users and Computers > Users** folder, right-click the user account that is used to run the server process that will impersonate the client, and click **Properties**.

b. In the Account tab, under the **Account options**, select the **Account is trusted for delegation** option.

3. Confirm that the server process account is trusted for delegation for the server process

a. In **Active Directory Users and Computers,** right-click **Computers**, and click **Properties**.

b. Right-click the server computer (where the process that impersonates the client will be running), and click **Properties**.

c. On the General page, select **Trust computer for delegation**.

d. Select **Use any authentication protocol**.

e. Click **Add** and select the required processes.

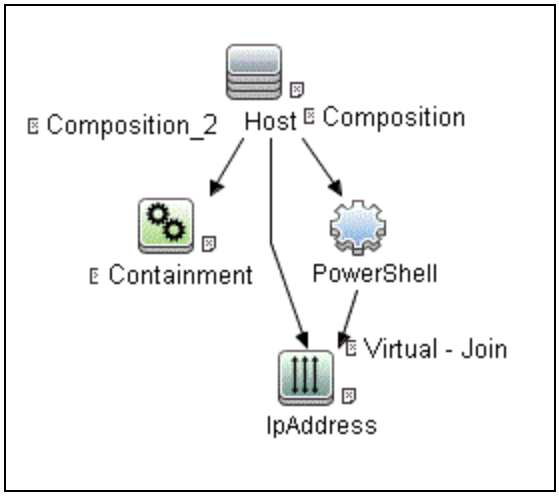
f. If only the Kerberos protocol is used, select the **Trust this computer for delegation to any service** or **Use Kerberos only**.

> **Note:** If the **Kerberos** authentication is used and the connection is performed from outside of the destination domain, **Trust Domain** must be configured on the target AD.

Microsoft Exchange Topology by PowerShell Job

The components responsible for discovering Microsoft Exchange Server by PowerShell are bundled in the Microsoft Exchange Server package, **Microsft_exchange_server.zip**.

Trigger Query

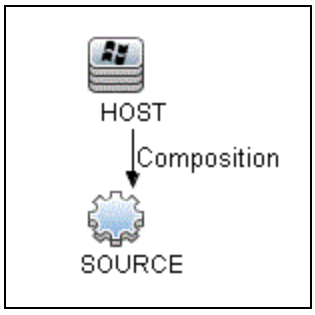


Node Name	Condition
Host	None
Containment	Name Like Microsoft.Exchange.%.exe
IpAddress	NOT IP Probe Name Is null
PowerShell	NOT Reference to the credentials dictionary entry Is null

Adapter

This job uses the **MS_Exchange_Topology_by_Powershell** adapter.

- Input Query



- Triggered CI Data

Name	Value
credentialsId	${SOURCE.credentials_id}
ip_address	${SOURCE.application_ip}

- Used Scripts

  The following scripts are used by Microsoft Exchange by PowerShell discovery.

  - host_win.py
  - host_win_shell.py
  - msexchange.py
  - msexchange_win_shell.py
  - ms_exchange_topology_by_powershell.py
  - networking.py
  - networking_win_shell.py

Created/Changed Entities

Entity Name	Entity Type	Entity Description
Microsoft Exchange Topology by PowerShell.xml	Job	Main Job
MS_Exchange_Topology_by_PowerShell.xml	Adapter	Discovery adapter
ms_exchange_topology_by_powershell.py	Script	Discovery script
ms_exchange_process_and_powershell.xml	TQL	Trigger Query
ms_exchange_clustered_mailbox.xml	Class	CI Type
ms_exchange_dag.xml	Class	CI Type
ms_exchange_win_shell.py	Script	Discovery script
ms_exchange.py	Script	Discovery script

Commands

The following commands are used by Microsoft Exchange by PowerShell discovery.

- **Get-ExchangeServer Command**

  ```
  Get-ExchangeServer | Where-Object {$_.Fqdn.ToLower().StartsWith
  ((hostname).ToLower())} | Format-List Name, Guid, Fqdn, ServerRole, DataPath,
  WhenCreated, ExchangeVersion, AdminDisplayVersion, OrganizationalUnit, Site,
  ExchangeLegacyDN
  ```

  - Output

    ```
    Name : SAM-RND-DC01
    Guid : e8f5c340-6cf1-4fc6-aa34-226ab99282dd
    Fqdn : SAM-RND-DC01.ddm-rnd.ua
    ServerRole : Mailbox, ClientAccess, UnifiedMessaging, HubTransport
    DataPath : C:\Program Files\Microsoft\Exchange Server\V14\Mailbox
    WhenCreated : 8/6/2010 5:24:05 PM
    ExchangeVersion : 0.1 (8.0.535.0)
    AdminDisplayVersion : Version 14.0 (Build 639.21)
    OrganizationalUnit : ddm-rnd.ua/SAM-RND-DC01
    Site : ddm-rnd.ua/Configuration/Sites/Default-First-Site-Name
    ExchangeLegacyDN : /o=SiteScope Rnd Lab/ou=Exchange Administrative Group
    (FYDIBOHF23SPDLT)/cn=Configuration/cn=Servers/cn=SAM-RND-DC01
    ```

  - Mapping

    The output of this command is used to fill in the attributes of the CIs:

Command Output Attribute	CI Type	CI Attribute
Name	Exchange Server	Name
Guid	Exchange Server	Guid
Fqdn	Exchange Server	Fqdn
ServerRole	Corresponding Server Role CIs are created	Corresponding Server Role CIs are created
WhenCreated	Exchange Server	Creation Date
ExchangeLegacyDN	Exchange Server	Organization
AdminDisplayVersion	Exchange Server	Version
AdminDisplayVersion	Exchange Server	Application Version
AdminDisplayVersion	Exchange Server	Application Version Description

- **Get-ClusteredMailboxServerStatus Command**

  ```
  Get-ClusteredMailboxServerStatus
  ```

- Output

```
Identity : ddm-ex2k7ccr
ClusteredMailboxServerName : DDM-EX2K7CCR.ddm01.local
State : Online
OperationalMachines : {DDM-EX2K7CCR-N1 <Active, Quorum Owner>,
DDM-EX2K7CCR-N2}
FailedResources : {}
OperationalReplicationHostNames : {ddm-ex2k7ccr-n1, ddm-ex2k7ccr-n2}
FailedReplicationHostNames : {}
InUseReplicationHostNames : {ddm-ex2k7ccr-n1, ddm-ex2k7ccr-n2}
IsValid : True
ObjectState : Unchanged
```

- Mapping

  The output of this command is used to fill in the attributes of the CIs:

Command Output Attribute	CI Type	CI Attribute
Identity	Exchange Clustered Mailbox	Name
ClusteredMailboxServerName	Used to determine the name of the cluster	Used to determine the name of the cluster

- **Get-DatabaseAvailabilityGroupCommand**

```
Get-DatabaseAvailabilityGroup | format-list
```

- Output

```
Name : DDMDAG
Servers : {DDM-EXCLN2, DDM-EXCLN1}
WitnessServer : DDM-EXCLDC.DDM.LOCAL
WitnessDirectory : c:\EXCLFSW
AlternateWitnessDirectory :
NetworkCompression : InterSubnetOnly
NetworkEncryption : InterSubnetOnly
DatacenterActivationMode : Off
StoppedMailboxServers : {}
StartedMailboxServers : {}
DatabaseAvailabilityGroupIpv4Addresses : {172.24.10.129}
OperationalServers :
PrimaryActiveManager :
ThirdPartyReplication : Disabled
ReplicationPort : 0
NetworkNames : {}
AdminDisplayName :
ExchangeVersion : 0.10 (14.0.100.0)
DistinguishedName : CN=DDMDAG,CN=Database Availability
```

```
Groups,CN=Exchange Administrative Group
(FYDIBOHF23SPDLT),CN=Administrative Groups,CN=Discovery,CN=Microsoft
Exchange,CN=Services,CN=Configuration,DC=ddm, DC=local
Identity : DDMDAG
Guid : 51799b4d-9c0d-4842-990a-f9862be3e7a4
ObjectCategory : ddm.local/Configuration/Schema/ms-Exch-MDBAvailability-
Group
ObjectClass : {top, msExchMDBAvailabilityGroup}
WhenChanged : 1/31/2011 4:24:34 PM
WhenCreated : 1/31/2011 3:45:06 PM
WhenChangedUTC : 1/31/2011 2:24:34 PM
WhenCreatedUTC : 1/31/2011 1:45:06 PM
OrganizationId :
OriginatingServer : ddm-excldc.ddm.local
IsValid : True
```

- Mapping

  The output of this command is used to fill in the attributes of the CIs:

Command Output Attribute	CI Type	CI Attribute
Name	Exchange Database Availability Group	Name
Distinguished name	Used to relate to an Exchange organization	Used to relate to an Exchange organization

Discovered CITs

- Administrative group
- Composition
- Containment
- Exchange Client Access Server
- Exchange Clustered Mail Box
- Exchange Database Availability Group
- Exchange Edge Server
- Exchange Hub Server

- Exchange Mail Server
- Exchange Mailbox Database
- Exchange Mail Server
- Exchange Organization
- Exchange Unified Messaging Server
- ExecutionEnvironment
- IpAddress
- Membership
- MicrosoftExchangeServer
- Node
- Ownership

Troubleshooting and Limitations – Microsoft Exchange Server by PowerShell Discovery

This section describes troubleshooting and limitations for Microsoft Exchange Server by PowerShell discovery.

- **Problem:** No results brought, cmdlet calls end with errors like:

  Active Directory error 0x80072020 occurred while searching for domain controllers in domain <Domain Name>: An operations error occurred.

  +CategoryInfo :

  +FullyQualifiedErrorId : 7D2B0C9D

  Reason: The "Delegation" is not configured properly.

  Solution: Configure Active Directory "Delegation" as described in "How to Configure the Active Directory Side" on page 708.

- **Problem:** No results brought, cmdlet calls end with errors like:

  Value cannot be null..

Parameter name: parameters

+ CategoryInfo :

+ FullyQualifiedErrorId : System.ArgumentNullException,Microsoft.Exchange.Management.SystemConfigurationTasks.GetExchangeServer

Reason: The "Delegation" is not configured properly or connection is performed from an untrusted domain or not all required patches are installed on the server (for more details, see the official Microsoft site).

Solution: Configure Active Directory "Delegation" as described in "How to Configure the Active Directory Side" on page 708, and check the patch-level. For more information, check the official Microsoft site.

- **Problem:** Calls to the Exchange command-lets fail with timeouts and/or session gets broken.

An application cannot impersonate a user and then run Windows PowerShell commands in an Exchange Server 2007 environment.

Reason: This is a known Exchange 2007 bug.

Solution: To fix this problem, run Microsoft Patch KB943937, which is a part of MS Exchange 2007 SP1. For more information, see the Microsoft Patch description (http://support.microsoft.com/kb/943937).

Chapter 48: Microsoft Exchange Server by WMI Discovery

This chapter includes:

Overview 718

Supported Versions 718

Topology 719

How to Discover Microsoft Exchange Server 2003 by WMI 720

Microsoft Exchange Connection by WMI Job 721

Microsoft Exchange Topology by WMI Job 723

Created/Changed CITs 724

Troubleshooting and Limitations – Microsoft Exchange Server by WMI Discovery 725

Overview

DFM discovers the following components of Microsoft Exchange Server (Exchange) software, versions 2003: Microsoft Exchange Server, Administrative and Routing groups, Organization, Public folders, and Folder trees.

All information about Exchange is retrieved by the WMI protocol from the **root\MicrosoftExchangeV2** namespace.

There are two jobs responsible for Exchange discovery:

- Microsoft Exchange Connection by WMI
- Microsoft Exchange Topology by WMI

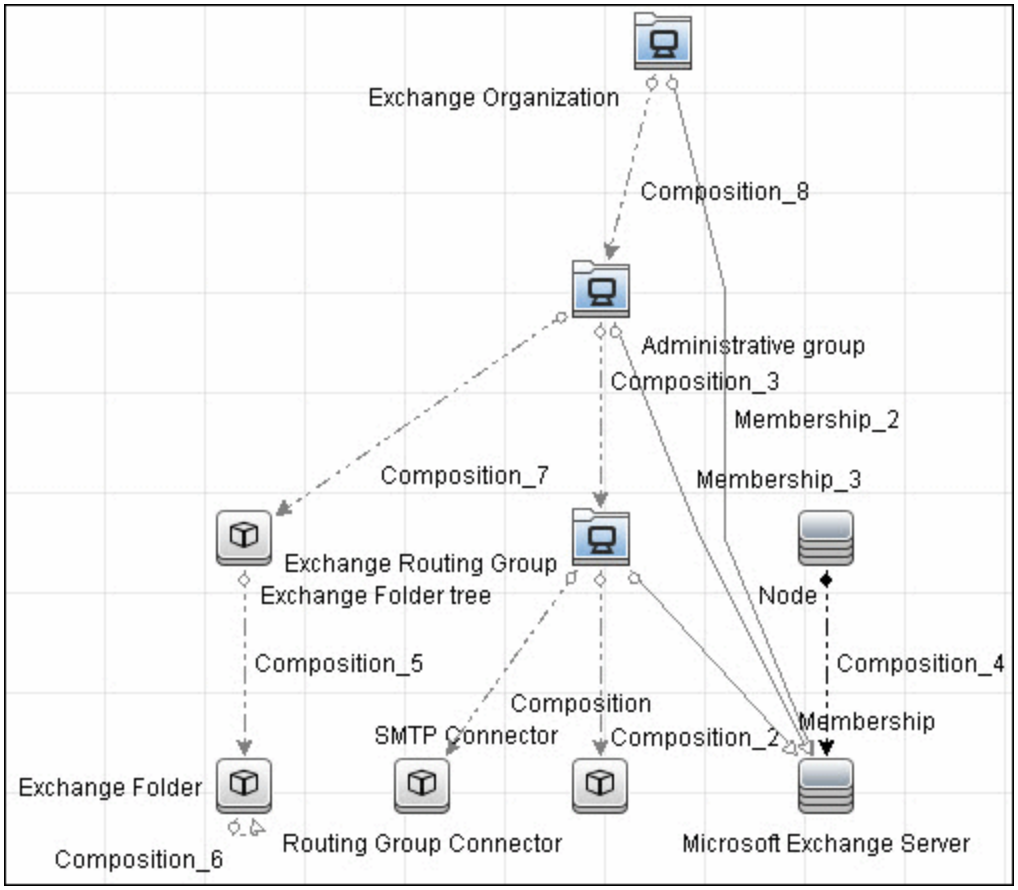
Supported Versions

Microsoft Exchange Server by WMI discovery supports Microsoft Exchange Server 2003.

Topology

Microsoft Exchange Topology by WMI job

DFM connects to the remote host and retrieves the topology for MS Exchange 2003:



How to Discover Microsoft Exchange Server 2003 by WMI

This task explains how to discover MS Exchange Server 2003 using the WMI protocol.

1. Prerequisite - Set up protocol credentials

   This discovery is based on the WMI protocol.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

   Information about Exchange is taken from the **root\MicrosoftExchangeV2** namespace.

2. Prerequisite - Set up permissions

   You must enable read-only permissions for the **root\MicrosoftExchangeV2 WMI** namespace. In some cases the **root\cimv2** namespace is also needed (with read-only permissions). For details, see "Troubleshooting and Limitations – Microsoft Exchange Server by WMI Discovery" on page 725.

3. Run the discovery

   Activate the following jobs:

   - **Network Infrastructure Discovery:**
     i. Run **Host Connection** > **Host Connection by WMI** to discover WMI CITs.
     ii. Run any of the **Host Resources** jobs and **Host Applications** jobs that gather information about processes running on a host. If a process named **emsmta.exe** or **exmgmt.exe** is discovered on a host, the **Microsoft Exchange Connection by WMI** job is triggered.
   - **Enterprise Applications > Microsoft Exchange**
     i. Run **Microsoft Exchange Connection by WMI**. This job reports the server that is actually running on this host. To discover other Exchange servers, you must run this job on each host where Exchange is running. The job creates Exchange CITs.

     This job connects to the remote host by WMI to the **root\MicrosoftExchangeV2** namespace.

     The following WMI queries are executed:

```
SELECT AdministrativeNote, CreationTime, ExchangeVersion, FQDN, GUID,
MTADataPath, MessageTrackingEnabled, MessageTrackingLogFileLifetime,
MessageTrackingLogFilePath, MonitoringEnabled, Type FROM Exchange_Server
```

This query returns all Exchange servers present in the Exchange organization.

ii. The Exchange CI created by **Microsoft Exchange Connection by WMI** job acts as a trigger for the **Microsoft Exchange Topology by WMI** job. The Trigger CI connects to the host where Exchange is running and retrieves the complete topology. (For details on troubleshooting error messages, see "Troubleshooting and Limitations – Microsoft Exchange Server by WMI Discovery" on page 725.)

This job connects to the remote host by WMI to the **root\MicrosoftExchangeV2** namespace. The following WMI queries are executed (order is preserved):

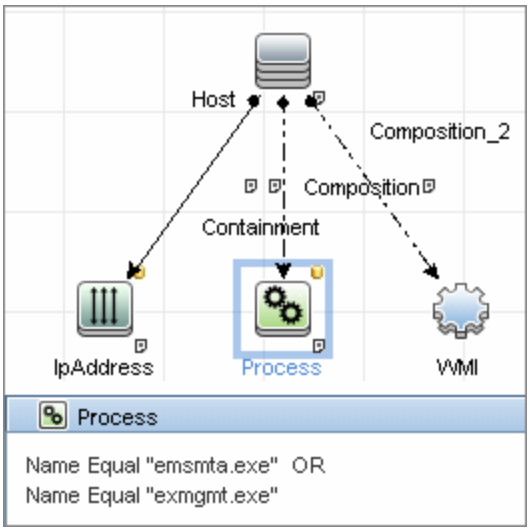
```
SELECT AdministrativeGroup, DN, FQDN, Name, RoutingGroup FROM Exchange_
Server
SELECT AdministrativeGroup, AdministrativeNote, CreationTime,
Description, GUID, Name, RootFolderURL FROM Exchange_FolderTree
SELECT AddressBookName, AdministrativeNote, Comment, ContactCount,
FolderTree, FriendlyUrl, IsMailEnabled, Path, Url FROM Exchange_
PublicFolder
```

Microsoft Exchange Connection by WMI Job

This section contains details about the job.

Trigger Query

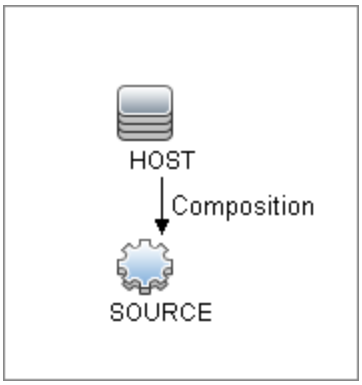
- Trigger CI: ms_exchange_process_and_wmi
- Trigger query:



Adapter

This job uses the **MS_Exchange_Connection_by_WMI** adapter.

- Input query:



Discovered CITs

- Composition
- Computer

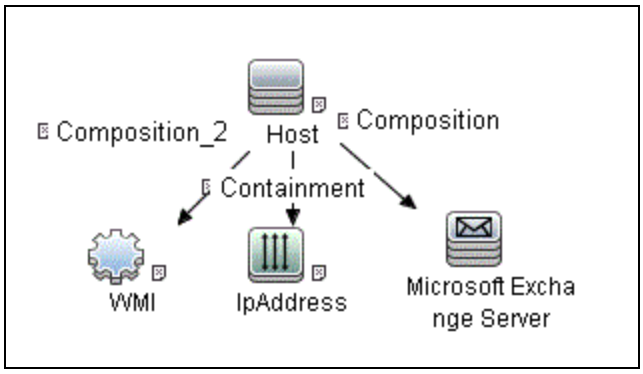
- MicrosoftExchangeServer

Microsoft Exchange Topology by WMI Job

This section contains details about the job.

Trigger Query

- Trigger CI: **ms_exchange_server_and_host_and_wmi**
- View: Microsoft Exchange Topology
- Trigger query:

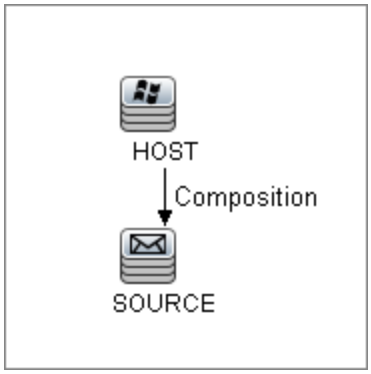


Node Name	Condition
Host	None
WMI	None
IpAddress	NOT IP Probe Name Is null
Microsoft Exchange Server	NOT Reference to the credentials dictionary entry Is null AND Version Like %2003%

Adapter

This job uses the **MS_Exchange_Topology_by_WMI** adapter.

- Input query:



Discovered CITs

- Administrative group
- Composition
- Containment
- Exchange Folder
- Exchange Folder tree
- Exchange Organization
- Exchange Routing Group
- IpAddress
- Membership
- MicrosoftExchangeServer
- Node

Created/Changed CITs

The following CITs are created for Exchange components:

CIT	Description
Exchange	This CIT is located in the Application System folder. It is an abstract CIT that is the parent of the following CITs: • **Administrative group**. This CIT represents the administrative group in the Exchange organization. • **Exchange Organization**. This CIT represents the top-level of the Exchange organization. For example, if an organization uses the Exchange solution, then all the Exchange components are linked to a single Exchange Organization CI. • **Exchange Routing Group.** This CIT represents a Routing Group that exists in the Exchange organization. Routing groups supply varying network connectivity across servers, and restrict access of users in specific areas. Routing groups are deprecated in Exchange 2007. Instead Exchange 2007 relies on the Active Directory Sites configuration to connect between different Exchange Servers.
Microsoft Exchange Server	This CIT is inherited from the RunningSoftware CIT. The CIT represents Exchange software installed on a host.
Microsoft Exchange Resource	This CIT is located in the Application Resource folder. It is an abstract CIT that is the parent of the following CITs: • **Exchange folder.** This CIT represents the public folders available in the Exchange organization. A public folder may be organized in an hierarchical structure, that is, one public folder may contain another public folder. • **Exchange folder tree.** This CIT provides information about public and private folder trees on Exchange servers.

Troubleshooting and Limitations – Microsoft Exchange Server by WMI Discovery

This section describes troubleshooting and limitations for Microsoft Exchange by WMI discovery.

- **Administrative Group Limitation**.

  If an Administrative group does not contain any Exchange servers or folder trees, the Administrative group is not discovered.

- **Error Messages**

Error message	Reason	Solution
Failed to	To model Exchange topology correctly, the	◦ Run any job that will retrieve

Error message	Reason	Solution
obtain host name	**Microsoft Exchange Connection by WMI** job should know the name of the host to which it is connected. DFM tries to retrieve the **host_hostname** attribute of the host, matched by the input query. If the attribute is not set, DFM runs the following WMI query to obtain the domain name of the host: `SELECT Name FROM Win32_ComputerSystem` If this query fails for any reason, the job also fails with this error message.	the correct host name. ◦ Set the host name manually. ◦ Refer to the log files for more information as to why the WMI query for host name failed.
Failed to discover folder trees and public folders		Check if the credentials you use for connection match those described in "Prerequisite - Set up protocol credentials" on page 720.

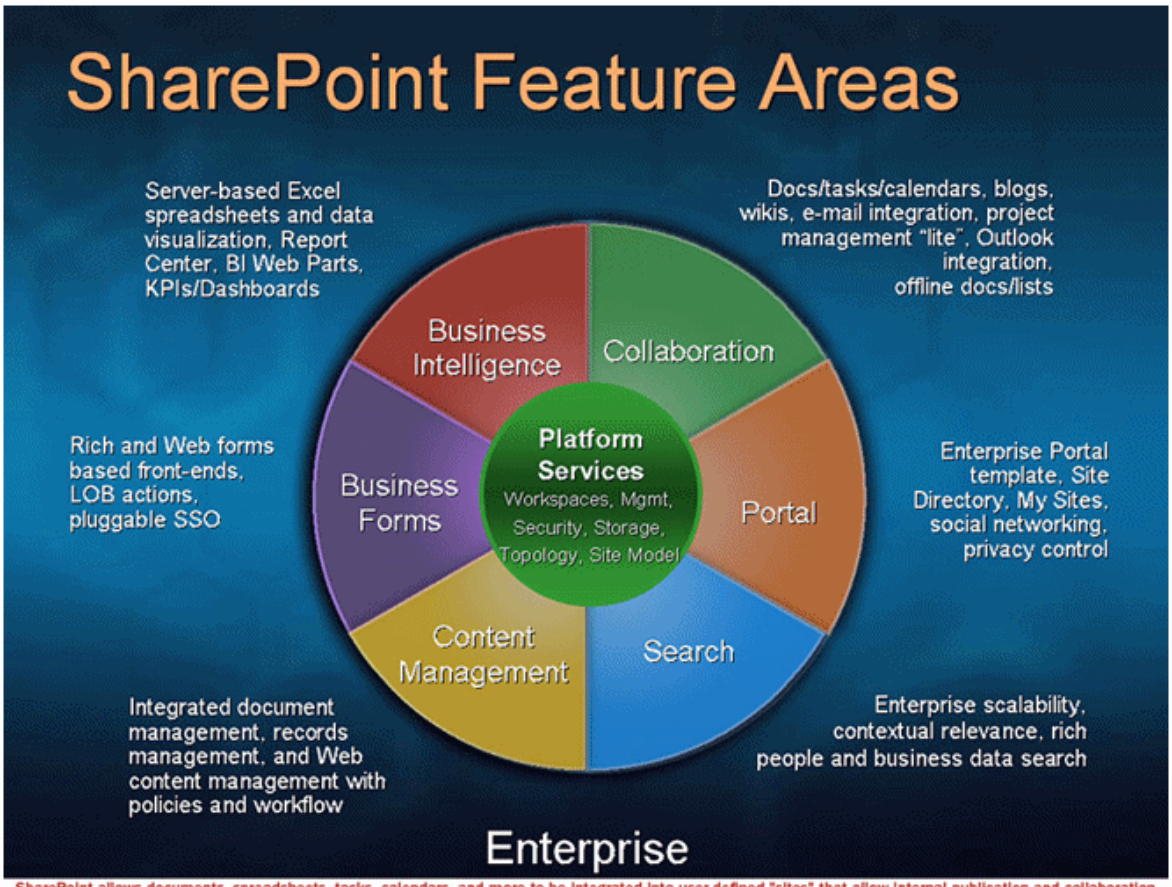
Chapter 49: Microsoft SharePoint Discovery

This chapter includes:

- Overview 728
- Supported Versions 728
- Topology 729
  - Host Connection by Shell Job 729
  - Host Applications by Shell Job 729
  - Microsoft SharePoint Topology Job 731
- How to Discover Microsoft SharePoint 731
- Microsoft SharePoint Topology Job 732
- Miscrosoft SharePoint Discovery Commands 736
- Troubleshooting and Limitations – Microsoft SharePoint Discovery 740

Overview

Microsoft SharePoint is a family of software products developed by Microsoft for collaboration, file sharing, and Web publishing. This family of products include: Microsoft SharePoint Server, Microsoft SharePoint Foundation, Microsoft Search Server, Microsoft SharePoint Designer, and Microsoft SharePoint Workspace.



In terms of the CMDB class model, it can be described as a set of services (application server, search server, indexing server, and so on) with its Web tier based on IIS, and its storage tier based on the MS SQL Server.

Supported Versions

Microsoft SharePoint discovery supports:

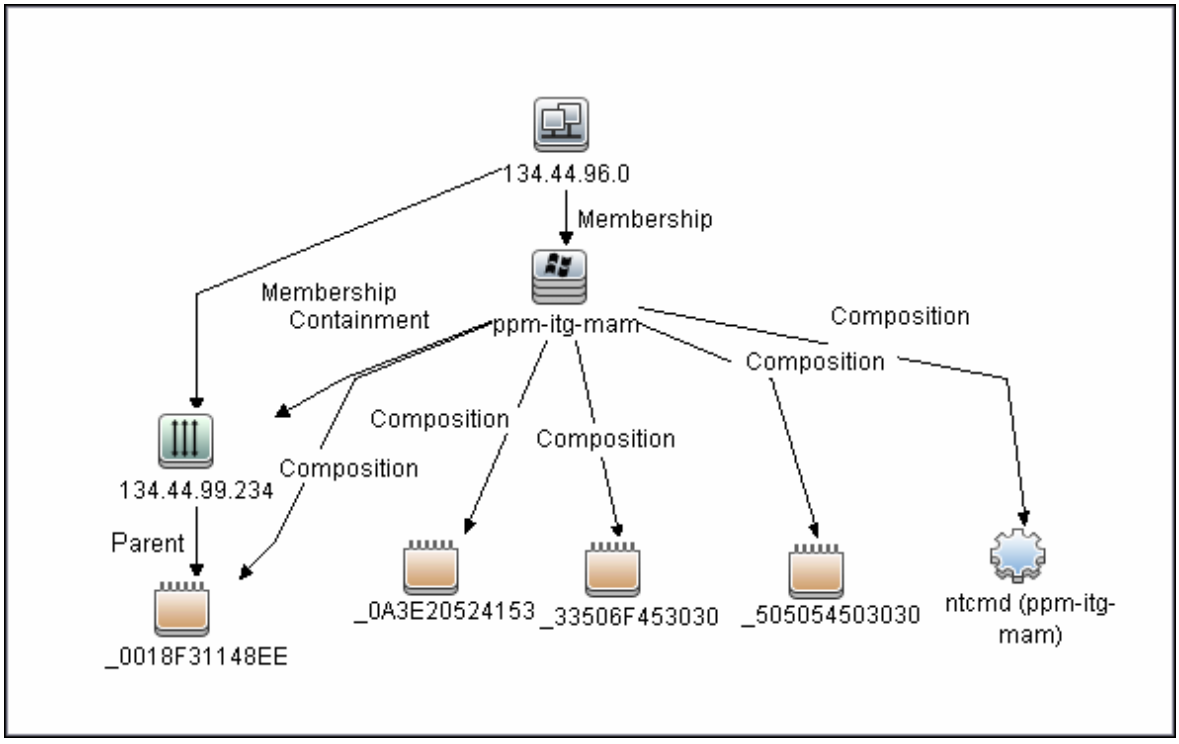
- Microsoft SharePoint 2007
- Microsoft SharePoint Server 2010
- Microsoft SharePoint Server 2013
- Microsoft SharePoint Server 2016

> **Note:** This discovery is expected to work on all available versions of Microsoft SharePoint.

Topology

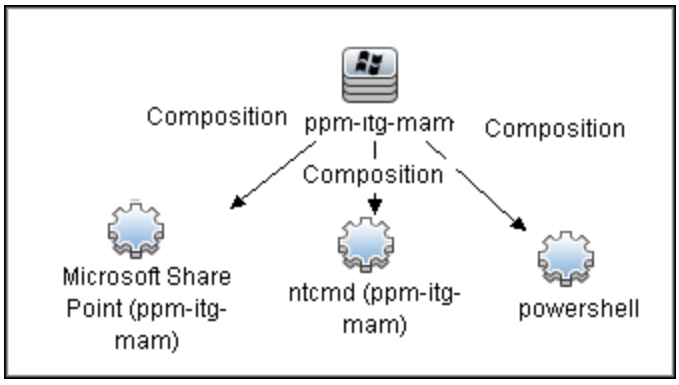
The following images display sample output for the Sharepoint discovery jobs.

Host Connection by Shell Job



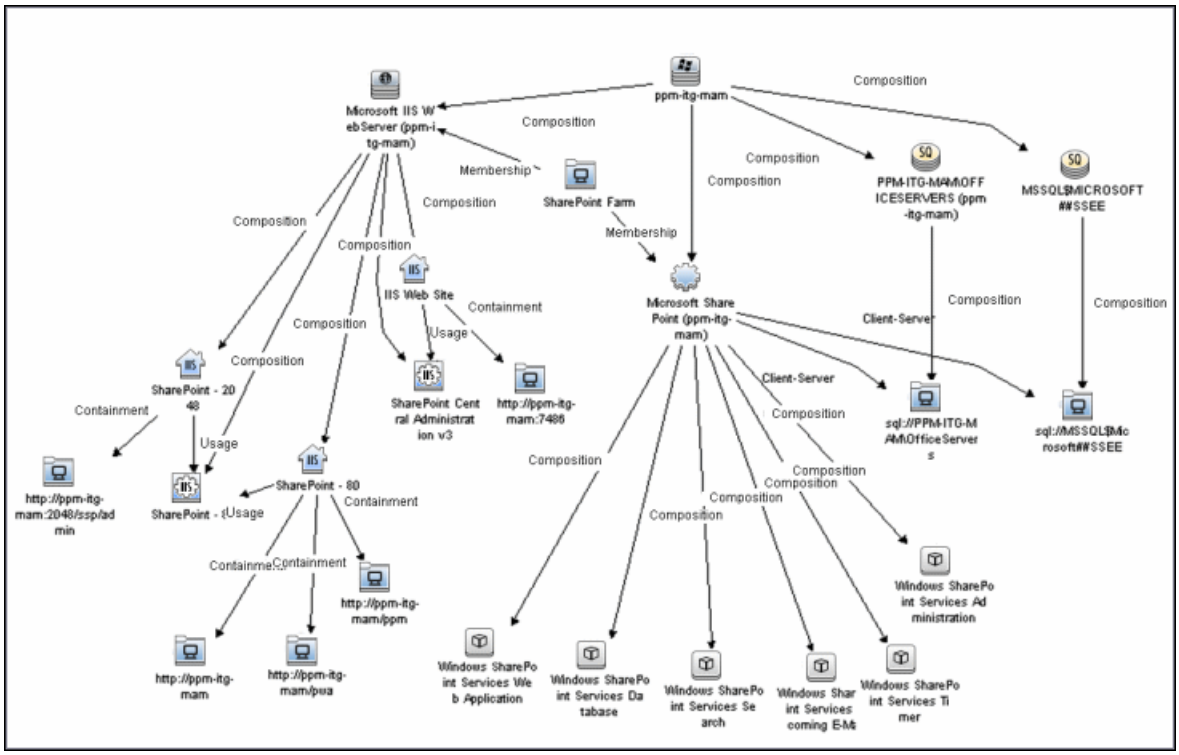
Host Applications by Shell Job

> **Note:** Only the data necessary for the continued flow is shown.


Composition
ppm-itg-mam
Composition
Composition
Microsoft Share Point (ppm-itg-mam)
ntcmd (ppm-itg-mam)
powershell

Microsoft SharePoint Topology Job

Note: For a list of discovered CITs, see "Discovered CITs" on page 736.



How to Discover Microsoft SharePoint

The following steps describe how to discover Microsoft SharePoint.

1. Prerequisite - Set up protocol credentials

   This discovery solution is based on the PowerShell protocol which can also be accessible over NTCMD, SSH, and Telnet protocols at script execution level. Ensure that the corresponding credentials are provided.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Prerequisite - Set up user permissions

The logged in user must have Read permissions on the SharePoint Configuration Database.

3. Run the discovery

   a. Run the **Range IPs by ICMP** or **Range IPs by nmap** job to discover the SharePoint system IP addresses.

   b. Run the **Host Connection by Shell** or **Host Connection by Powershell** job to discover the connection between SharePoint and the Shell or PowerShell agent, and the networking topology.

   c. Run the **Host Applications by Shell** or **Host Applications by PowerShell** job to discover the connection between the SharePoint system and the SharePoint software element, and the detailed host topology.

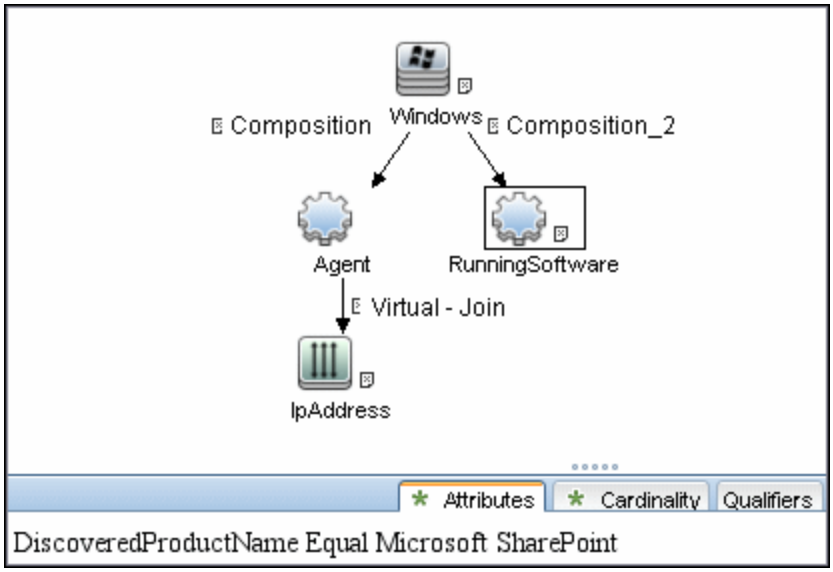
   d. Run the **Microsoft SharePoint Topology** job to discover the Microsoft SharePoint Server topology.

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

Microsoft SharePoint Topology Job

This section includes details about the job.

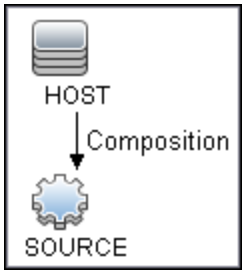
Trigger Query



> **Note:** On IPAddress, the **IP Probe name is not null** attribute is set.

Adapter

- Input CIT: Agent
- Input Query



- Used Scripts

- sharepoint_win_shell.py
- sharepoint.py
- SharePointMain.py

> **Note:** This job may also use library scripts supplied with the **AutoDiscoveryContent** package.

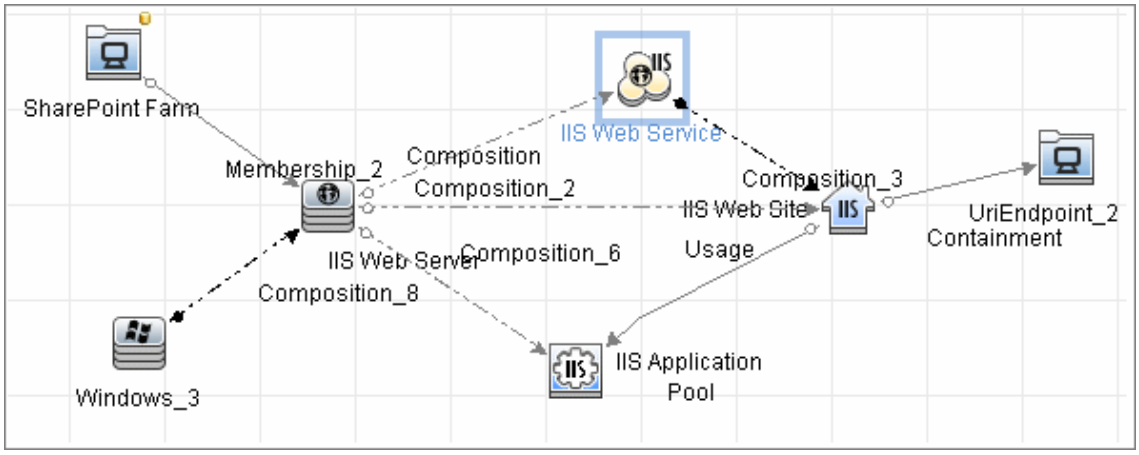
Job Parameters

Parameter	Description
discoverSharePointUrls	Indicates whether to discover URLs of SharePoint sites.
relativeCommandTimeoutMultiplier	The amount of time to wait for the result against the default command execution time.
reportIntermediateWebService	Indicates whether the IIS WebService between IIS Web Server and IIS Web Site should be reported. This parameter should be set in accordance with the **report_legacy_topology** parameter of the IIS Applications by NTCMD or UDA job.

Depending on the setting of the **reportIntermediateWebService** parameter, this job reports one of the following IIS topologies:

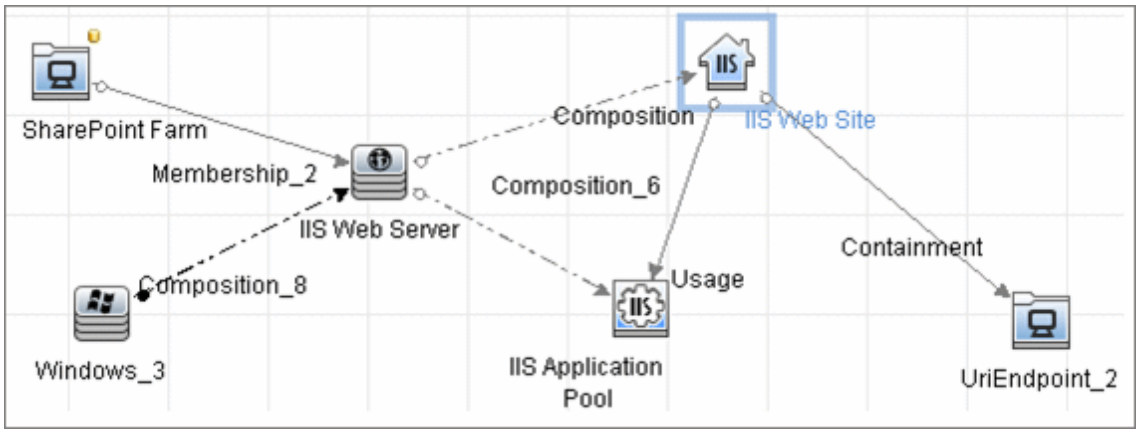
- **reportIntermediateWebService = true**:

  IIS Web Server -> IIS Web Service -> IIS Web Site



- **reportIntermediateWebService = false**:

  IIS Web Server -> IIS Web Service -> IIS Web Site



Created/Changed Entities

Entity Name	Entity Type	Entity Description
Sharepoint Farm	CIT	New CIT information regarding the SharePoint farm.
Sharepoint Service	CIT	New CIT - a textual file which holds data regarding the SharePoint service configuration
Microsoft SharePoint Topology	Job	New topology job
Enterprise Applications - Microsoft SharePoint	Module	Discovery module
ms_sharepoint_by_shell	Adapter	Discovery adapter
sharepoint_application_agents.xml	TQL query	Trigger TQL query
sharepoint.py	Script	SharePoint topology script
sharepoint_win_shell.py	Script	Script contains mechanism of the SharePoint discovery by Shell and PowerShell
SharePointMain.py	Script	Main script, the job entry point
Sharepoint_xml.ps1	Resource	PowerShell script which represents the SharePoint configuration in XML format

Discovered CITs

- ClientServer
- Composition
- Containment
- IIS Application Pool
- IIS Web Server
- IIS Web Service
- IIS Web Site
- IpAddress
- Membership
- RunningSoftware
- SharePoint Farm
- SharePoint Service
- SQL Server
- UriEndPoint
- Usage
- Windows

> **Note:** To view the topology, see "Topology" on page 729.

Miscrosoft SharePoint Discovery Commands

The SharePoint topology is discovered by running the **Sharepoint_xml.ps1** script. It contains following functions which provide the relevant information in XML format:

This section includes:

- "ShowSharePointConfig" on the next page
- "ShowSharePointHostConfig" on the next page

- "ShowSharePointWebConfig" on the next page
- "SharePoint Library Command Flow" on page 740

ShowSharePointConfig

- **Sample Output**

```
<farm id="4ddfb9c7-754a-4a66-8ee6-7d86613b873c" version="12.0.0.6421">
<hosts> As described for ShowSharePointHostConfig section </hosts>
<webServices> As described for ShowSharePointWebConfig section </webServices>
</farm>
```

- **Modeled CITs: SharePoint Farm**

Attribute	Value
ID	4ddfb9c7-754a-4a66-8ee6-7d86613b873c

ShowSharePointHostConfig

- **Sample Output**

```
<hosts>
  <host name="ucmdb-11">
    <db type="SharedDatabase">Server=ucmdb-11;Database=SharedServices1_DB;Trusted_
Connection=yes;App=Windows SharePoint Services;Timeout=15</db>
    <db type="SPConfigurationDatabase">Server=ucmdb-11;Database=SharePoint_
Config;Trusted_Connection=yes;App=Windows SharePoint Services;Timeout=15</db>
    <service name="Windows SharePoint Services Database">
Databases                   :
NormalizedDataSource        : ucmdb-11
...
    </service>
  </host>
</hosts>
```

- **Modeled CITs: IpAddress**

Attribute	Value
IP Address	Resolved IP of ucmdb-11

- **Modeled CITs: Windows**

Attribute	Value
Host key	'Resolved IP of ucmdb-11' 'IP domain'

- **Modeled CITs: Software Element**

Attribute	Value	Comments
Container	Previously described Windows	
Name	Microsoft SharePoint	
Vendor	microsoft_corp	
Application version	12.0.0.6421	Taken from the SharePoint Farm version attribute

- **Modeled CITs: SQL Server**

Attribute	Value
Container	Previously described Windows
Database Name	ucmdb-11
Vendor	microsoft_corp

- **Modeled CITs: SharePoint Service**

Attribute	Value
Container	Previously described Software Element
Name	Windows SharePoint Services Database
Document Data	Databases : NormalizedDataSource : ucmdb-11 ...

ShowSharePointWebConfig

- **Sample Output**

```
<webServices>
  <webService id="c8e64134-0daa-4614-9ed8-257aa653fe9c">
      <applicationPool name="SharePoint - 80">
```

```
    <webApplication name="SharePoint - 80">
      <url>http://ddvm-shrpnt/</url>
      <site>http://ddvm-shrpnt</site>
      <site>http://ddvm-shrpnt/personal/administrator</site>
      <site>http://ddvm-shrpnt/ssp/admin</site>
    </webApplication>
  </webService>
</webServices>
```

- **Modeled CITs: Windows**

Attribute	Value
Host key	'Resolved IP of ddvm-shrpnt' 'IP domain'

- **Modeled CITs: IIS**

Attribute	Value	Comments
Container	Previously described Windows	
Name	Microsoft IIS WebServer	
Vendor	microsoft_corp	

- **Modeled CITs: IIS Application Pool**

Attribute	Value
Container	Previously described IIS
Name	SharePoint - 80
Vendor	microsoft_corp

- **Modeled CITs: IIS Web Site**

Attribute	Value
Container	Previously described IIS
Name	SharePoint - 80

- **Modeled CITs: URL**

Attribute	Value
Container	IIS Host (Windows)
Name	http://ddvm-shrpnt

SharePoint Library Command Flow

The SharePoint library is loaded using the following command flow:

- **[System.Reflection.Assembly]::LoadWithPartialName("Microsoft.SharePoint");**
- **$spFarm = [Microsoft.SharePoint.Administration.SPFarm]::Local;**
- **if(!$spFarm){echo("---CANNOT EXECUTE DISCOVERY---"); exit(1)}**

After the last command is executed, the local SharePoint farm is initialized or the message **---CANNOT EXECUTE DISCOVERY---** is displayed.

When SharePoint is discovered by PowerShell, the **ShowSharePointHostConfig** and **ShowSharePointWebConfig** commands are called (described in "Miscrosoft SharePoint Discovery Commands" on page 736 above). The SharePoint Farm CI is built from executing the following commands:

- **Echo($spFarm.Id.Guid)** – discovers the farm ID
- **Echo($spFarm.BuildVersion.ToString())** – discovers the farm version

Troubleshooting and Limitations – Microsoft SharePoint Discovery

This section provides troubleshooting and limitations for Microsoft SharePoint discovery.

1. The credential on which the job connects to the SharePoint host must provide a trusted connection to the SharePoint configuration database. If the database host is the third host (discovered host) and the trusted connection is used for the SharePoint configuration database, such configurations will not be discovered. To avoid this problem SQL credentials must be used in the SharePoint configuration.

   The discovery mechanism works in the following cases:

   - The SharePoint configuration database is connected via named pipes (a farm on a single host)
   - An SQL connection is used for the configuration database
   - A trusted connection is used for the configuration database, and this database is hosted with some other SharePoint components

2. For each SharePoint service, all the configuration details are merged into one string in the **service**

configuration attribute of the SharePoint Service CIT.

3. **Problem:** The error message **No SharePoint library found** is displayed.

   Solution A: It is recommended to check the Event Viewer on the SharePoint database machine, to see if there are unsuccessful connection attempts from the SharePoint instance which is being discovered. If there are unsuccessful connection attempts, add a new login to MS SQL Server manager (the one which could not access the database) and grant **db_owner** permissions for the **SharePoint_Config** database to this new login.

   Solution B: Select the **Run remote commands impersonated** check box in the NTCMD Protocol Parameters dialog box.

Chapter 50: SAP Discovery

This chapter includes:

Introduction to SAP Discovery 742

SAP ABAP Discovery 744

SAP Java Discovery 766

SAP Solution Manager Discovery 783

Introduction to SAP Discovery

SAP Discovery focuses primarily on the SAP architecture layer according to different SAP system configurations. The SAP system configurations supported are:

- ABAP
- JAVA
- DS (Double Stack)

Each SAP system is comprised of:

- NetWeaver Application server, including the following types:
  - Central Instance
  - SCS (Central Services)
  - Dialog Instance
- Message/Enqueue server
- Database
- Components, including:
  - Software Components
  - Development Components

> **Note:** In SAP Discovery, in the case of JAVA and ABAP configurations, one application server is considered as one instance of the configuration, but in the case of DS configuration two application servers with the same instance name on the same host are considered as one instance of the DS

configuration.

Discovery Mechanism

SAP Discovery uses two types of mechanisms to perform discovery:

- **Shallow.** SAP Discovery uses application signature and plugins.
- **Deep.** SAP Discovery uses dedicated jobs.

  Most dedicated jobs are separated by the ABAP or JAVA application server type. If a server is identified as part of a DS configuration, then the entire system is marked as DS.

Note: You can discover the entire SAP system by discovering a connection to the SAP Solution Manager. By doing this you create a single set of credentials. There is no need to create a set of credentials for each SAP system.

Application Signatures and Plugins

The following application signatures exist for JAVA and ABAP configurations with the various application servers:

- SAP ABAP SCS
- SAP ABAP Application Server (Dialog)
- SAP ABAP Application Server (Central)
- SAP JAVA SCS
- SAP JAVA Application Server (Dialog)
- SAP Message Server with plugin **plugins_sap_message_server** (relevant for all SAP configurations including ABAP, JAVA, and DS)
- SAP Enqueue Server with plugin **plugins_sap_enqueue_server** (relevant for all SAP configurations including ABAP, JAVA, and DS)

All ABAP-related signatures are processed with the following plugins:

- **plugins_sap_abap_instance_to_system_linkage**
- **sap_cs_and_ap_version_by_shell**
- **sap_cs_and_ap_version_by_wmi**

All JAVA-related signatures are processed with the following plugins:

- **plugins_sap_java_instance_to_system_linkage**
- **sap_cs_and_ap_version_by_shell**
- **sap_cs_and_ap_version_by_wmi**

> **Note:** The following plugins are common to both ABAP-related and JAVA-related signatures:
>
> - **sap_cs_and_ap_version_by_shell**
> - **sap_cs_and_ap_version_by_wmi**

SAP ABAP Discovery

This section includes:

Overview 745
Supported Versions 745
Topology 746
How to Discover SAP ABAP 746
SAP Solution Manager Topology by SAP JCO Job 751
SAP Solution Manager by SAP JCO Job 752
SAP Applications by SAP JCO Job 754
SAP ABAP Topology by SAP JCO Job 756
SAP ABAP Connection by SAP JCO Job 759
SAP ITS by NTCMD or UDA Job 760
SAP System by Shell Job 762
SAP TCP Ports Job 762
Troubleshooting and Limitations – SAP ABAP Discovery 766

Overview

UCMDB discovers the SAP Application Server ABAP, which provides the complete technology and infrastructure to run ABAP applications.

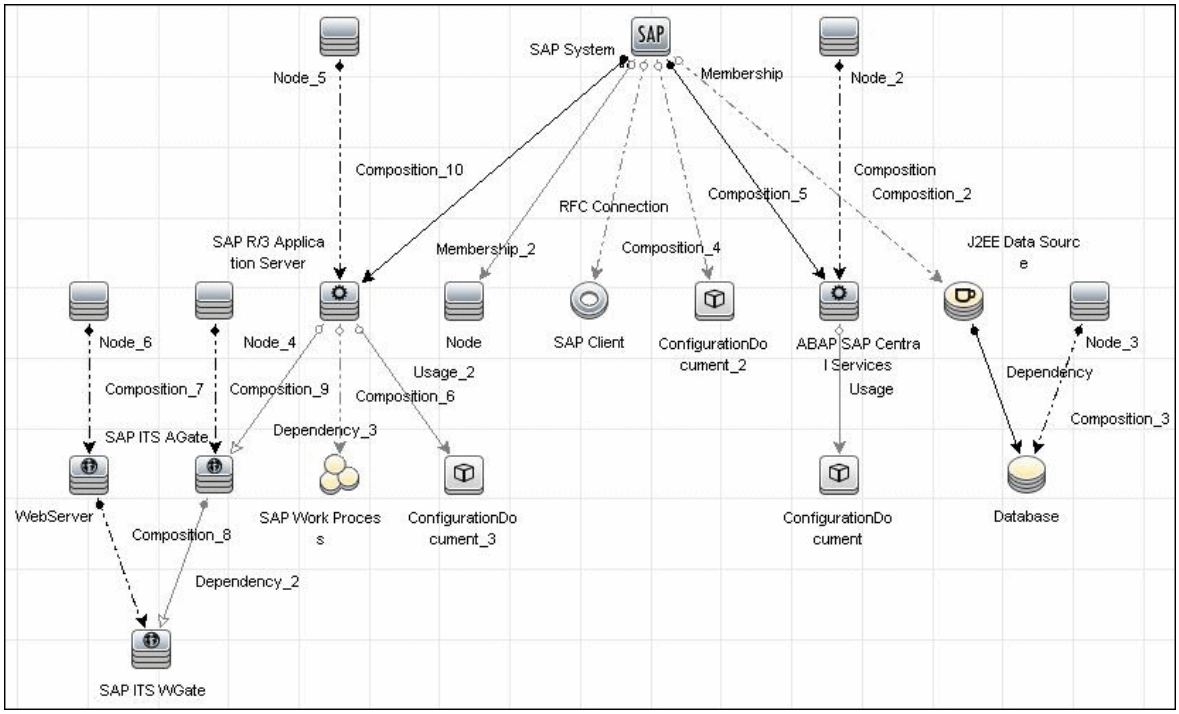
> **Note:** You can discover the whole SAP system by discovering a connection to the SAP Solution Manager. In this way, you create a single set of credentials; there is no need to create a set of credentials for each SAP system. DFM discovers all systems (and their topology) with this one set. For details, see "SAP Solution Manager Discovery" on page 783.

Supported Versions

SAP BASIS and SAP AS (Architecture layer)	Versions 3.x to 6.x
SAP JCo.	2.x and 3.x (starting from 3.0.7) Version 3.0.7 and newer is recommended
SAP Solution Manager	Versions 6.x, 7.x

Topology

The following image displays the topology of the SAP ABAP discovery:



How to Discover SAP ABAP

This task discovers SAP ABAP architecture, SAP application components, SAP transactions, and SAP Solution Manager business process definitions. It includes the following steps:

1. ## Prerequisite - Set up protocol credentials

   The following protocols enable connection to a machine to verify whether an SAP system is installed on it:

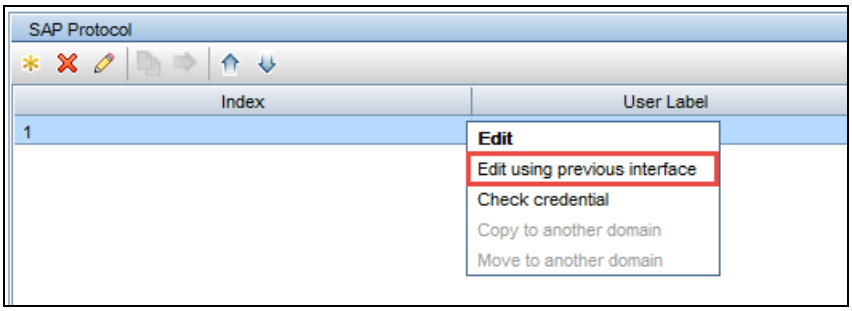
   - NTCMD protocol
   - SSH protocol
   - Telnet protocol
   - SAP protocol

For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

To choose correct JCo version:

a. Create a credential for the SAP protocol, or choose an existing one.

b. Right-click the credential, and then select **Edit using previous interface**, as shown below.



c. In the dialog box that opens, either confirm that the JCO version is correct, or change it to the correct version. The default version is 2.x.

2. Prerequisite – Install Java Connectors

> **Note:** All actions in this part should be performed on the machine where the Data Flow Probe is installed.

JCo version 3.x (from 3.0.7)

a. Download the SAP JCo package. This is accessible from the **SAP Service Marketplace > SAP JCo >Tools & Services** window: http://service.sap.com/connectors.

b. Extract the JCo installation ZIP content to a temporary directory (for example: C:\temp).

c. Copy **sapjco3.jar** from the temporary directory to the **<DataFlowProbe_root>\content\lib** directory.

As an alternative to 2c, you may instead copy **sapjco3.jar** to the **<DataFlowProbe_root>\content\lib\sap** directory. If you do this, you must change the **<DataFlowProbe_root>\bin\WrapperEnv.conf** file by finding the following string:

```
set.SAP_CLASSES=%sap%/sapjco.jar;%sap%/com_sap_pj_jmx.jar;
%sap%/exception.jar;%sap%/logging.jar;%sap%/sapj2eeclient.jar;
%sap%/sapxmltoolkit.jar
```

and adding **;%sap%/sapjco3.jar** to the end like this:

```
set.SAP_CLASSES=%sap%/sapjco.jar;%sap%/com_sap_pj_jmx.jar;
%sap%/exception.jar;%sap%/logging.jar;%sap%/sapj2eeclient.jar;
%sap%/sapxmltoolkit.jar;%sap%/sapjco3.jar
```

d. Copy **sapjco3.dll** from the temporary directory to the DataFlowProbe directory containing the file sapjco3.jar.

e. In the **WrapperEnv.conf** file on the probe, change the Environment Discovery Path for the SAP CLASSES by replacing **%sap%/sapjco.jar** with **%sap%/sapjco3.jar**.

JCo version 2.x

a. Download the SAP JCo package. This is accessible from the **SAP Service Marketplace > SAP JCo >Tools & Services** window: http://service.sap.com/connectors.

b. Extract the JCo installation ZIP content to a temporary directory (for example: C:\temp).

c. Copy **sapjco.jar** from the temporary directory to the **<DataFlowProbe_root>\content\lib** directory.

As an alternative to 2c, you may instead copy **sapjco.jar** to the **<DataFlowProbe_root>\content\lib\sap** directory. If you do this, you must ensure that **sapjco.jar** is defined in the SAP_CLASSES parameter of the **<DataFlowProbe_root>\bin\WrapperEnv.conf** file as shown in the following string:

```
set.SAP_CLASSES=%sap%/sapjco.jar;%sap%/com_sap_pj_jmx.jar;
%sap%/exception.jar;%sap%/logging.jar;%sap%/sapj2eeclient.jar;
%sap%/sapxmltoolkit.jar
```

d. Copy **sapjcorfc.dll** from the temporary directory to the DataFlowProbe directory containing the file sapjco.jar.

e. Copy **librfc32.dll** from the temporary directory to the directory for the shared libraries where it can be loaded by linker. This is usually the **%winnt%** or **%winnt%\System32** directory. See the JCo README for details.

3. Configure adapter parameters

To specify exactly which CIs to discover, or to omit unnecessary CIs, you can configure the adapter parameters, as follows:

Discovery	Configuration
To discover all SAP transactions	Set **getAllTransactions** to **true**
To discover active SAP	Set **getActiveTransactions** to **true**

Discovery	Configuration
transactions	
To discover SAP transactions that were changed by discovered transports	◦ Set **getTransChanges** to **true** ◦ Set the **from** date (**transChangesFromDate**) and the **to** date (**transChangesToDate**). The date format is **MM/DD/YYYY** or **YYYYMMDD**. ◦ Set the **from** time (**transChangesFromTime**) and the **to** time (**transChangesToTime**). The time format is **HH:MM:SS** or **HHMMSS**.

For details on configuring adapter parameters, see the section describing Adapter Management in the *HPE Universal CMDB Data Flow Management Guide*.

4. Run the discovery
   a. In the Universal Discovery window, activate the jobs in the following order:

      For details on running jobs, see the section describing the Module/Job-Based Discovery in the *HPE Universal CMDB Data Flow Management Guide*.

      - **Range IPs by ICMP** or **Range IPs by nmap**.
      - **Host Connection by Shell** and **Host Resources/Applications by Shell.** Discovers SAP running software and processes (or **SAP TCP Ports.** Discovers IP service endpoints).
      - **SAP ABAP Connection by SAP JCO.** Connects to the SAP system and creates a SAP System CI with a credentials ID. Subsequently, the other ABAP jobs use these credentials to connect to SAP.
      - **SAP ABAP Topology by SAP JCO.** Discovers infrastructure entities in the SAP system: hosts, application servers, work processes, databases, SAP clients, configuration files, software components (discovered as configuration files), and support packages (discovered as configuration files).
      - **SAP Applications by SAP JCO.** Discover the application components of this system. The result of this job may be many CIs. To omit unnecessary CIs, you can configure the adapter parameters. For details, see "Configure adapter parameters" on the previous page.
      - **SAP ITS by NTCMD or UDA.** Discovers Internet Transaction Server (ITS) entities (Application Gateway and Web Gateway).
      - **SAP Solution Manager by SAP JCO.** Discovers SAP Solution Manager components. SAP Solution Manager discovery enables you to discover the business process hierarchy. For details, see "SAP Solution Manager Discovery" on page 783.

b. For details on the CIs that are discovered, see the section describing the Discovery Job Details Pane in the *HPE Universal CMDB Data Flow Management Guide*.

c. Verify that DFM discovered the appropriate components. Access the **SAP_ABAP_Topology** view in the Modeling Studio and verify that the map displays all components.

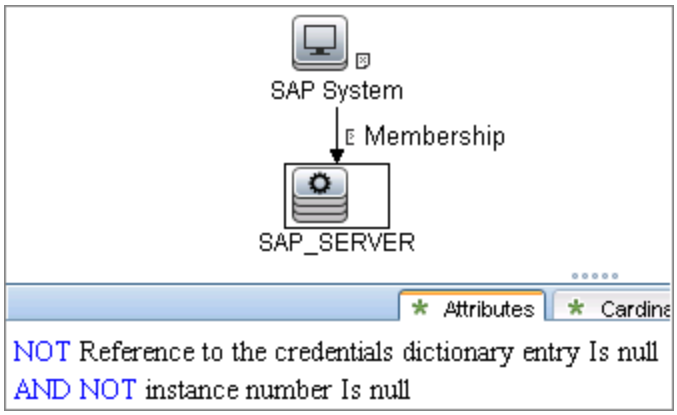
d. To view the CIs discovered by the SAP APAB discovery, see the section describing the Discovered CIs Window in the *HPE Universal CMDB Data Flow Management Guide*.

SAP Solution Manager Topology by SAP JCO Job

This section includes details about the job.

Trigger Query

- Trigger CI: SapAbapApplicationServer
- Trigger query:



Used Scripts

- db.py
- db_builder.py
- db_platform.py
- iteratortools.py
- jdbc.py
- jmx.py
- jdbc_url_parser.py
- jee.py
- sap.py
- sap_abap.py
- sap_abap_discoverer.py
- sap_discoverer.py

- sap_jee.py
- sap_solman_discoverer.py
- sap_solman_topology.py
- saputils.py

Discovered CITs

- Composition
- ConfigurationDocument
- Containment
- Database
- Dependency
- IpAddress
- J2eeCluster
- Membership
- Node
- SapAbapApplicationServer
- SapClient
- SapJ2eeApplicationServer
- SapJ2eeCentralServices
- SapSystem
- Usage

Adapter Parameters

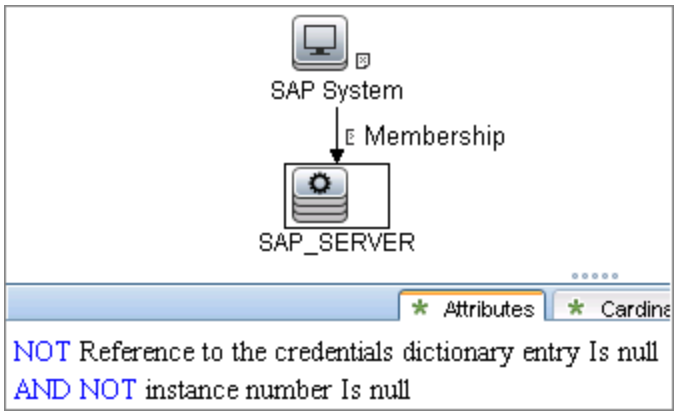
- **remoteJVMArgs.** The JVM parameters that should be passed to the remote process.
- **runInSeparateProcess.** If true, the pattern runs in a separate thread.

SAP Solution Manager by SAP JCO Job

This section includes details about the job.

Trigger Query

- Trigger CI: SapAbapApplicationServer
- Trigger query:



Used Scripts

- cmdlineutils.py
- command.py
- iteratortools.py
- sap.py
- sap_abap.py
- sap_abap_discoverer.py
- sap_discoverer.py
- sap_solman_discoverer.py
- sap_solution_manager.py
- saputils.py

Discovered CITs

- Composition
- Containment

- IpAddress
- Membership
- Node
- SapAbapApplicationServer
- SapBusinessProcess
- SapBusinessScenario
- SapProcessStep
- SapProject
- SapSystem
- SapTransaction

Adapter Parameters

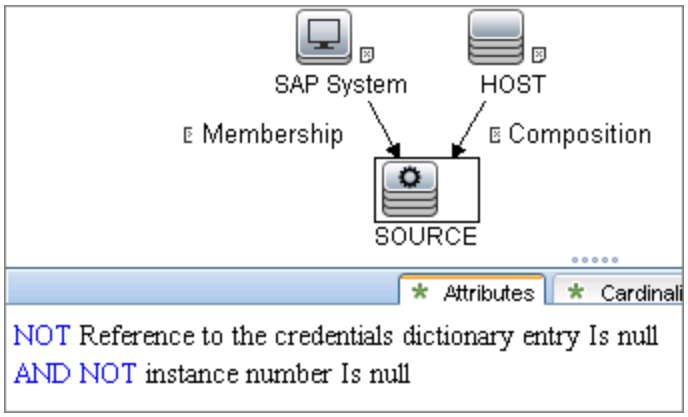
Name	Default Value	Description
discoverScenarioProcesses	false	Indicates whether to discover the scenario processes.
getProcessSteps	true	Indicates whether to get the process steps.
remoteJVMArgs	-Xms256m -Xmx1024m -XX:PermSize=256m -XX:MaxPermSize=256m	JVM parameters that should be passed to the remote process.
reportCIsInChunks	false	Indicates whether to report CIs in chunks.
runInSeparateProcess	true	Indicates whether the pattern runs in a separate thread.

SAP Applications by SAP JCO Job

This section includes details about the job.

Trigger Query

- Trigger CI: SapAbapApplicationServer
- Trigger query:



Used Scripts

- sapapputils.py
- saputils.py
- sap_applications.py

Discovered CITs

- Composition
- Containment
- SapApplicationComponent
- SapSystem
- SapTransaction
- SapTransport
- SapTransportChange
- Usage

Adapter Parameters

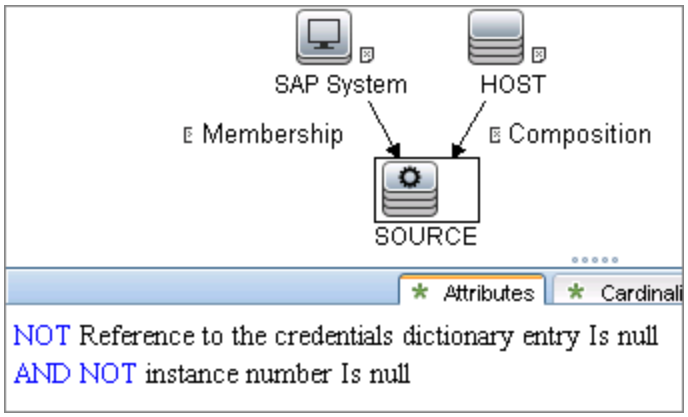
Name	Default Value	Description
getActiveTransactions.	false	Indicates whether to retrieve active transactions and aggregated statistics.
getAllTransactions	false	Indicates whether to retrieve all transactions.
getAppComponents	true	Indicates whether to retrieve the SAP application components.
getTransChanges	false	Indicates whether to retrieve transaction changes using Change and Transport System.
remoteJVMArgs	-Xms256m -Xmx1024m -XX:PermSize=256m -XX:MaxPermSize=256m	JVM parameters that should be passed to the remote process.
runInSeparateProcess	true	Indicates whether the pattern runs in a separate thread.
transChangesDaysInterval	0	Retrieves transaction changes by a given number of days back from today.
transChangesFromDate	01/25/2010	Retrieves transaction changes from this date.
transChangesFromTime	00:00:00	Retrieves transaction changes from this time.
transChangesToDate	01/25/2010	Retrieves transaction changes till this date.
transChangesToTime	23:00:00	Retrieves transaction changes till this time.

SAP ABAP Topology by SAP JCO Job

This section includes details about the job.

Trigger Query

- Trigger CI: SapAbapApplicationServer
- Trigger query:



Used Scripts

- iteratortools.py
- cmdlineutils.py
- entity.py
- db_platform.py
- db.py
- db_builder.py
- sap_db.py
- jdbc_url_parser.py
- jdbc.py
- saputils.py
- command.py
- sap.py
- flow.py
- sap_flow.py

- sap_abap.py
- sap_discoverer.py
- sap_abap_discoverer.py
- sap_site_by_jco.py

Discovered CITs

- Composition
- ConfigurationDocument
- Containment
- Database
- Dependency
- IpAddress
- JdbcDataSource
- Membership
- Node
- RfcConnection
- RunningSoftware
- SapAbapApplicationServer
- SapClient
- SapGateway
- SapSystem
- SapWorkProcess
- Usage

Adapter Parameters

- **discoverRFCConnections.** If **true**, this job gets the RFC Connections of the SAP system.
- **discoverSAPProfiles.** If **true**, this job discovers SAP profiles by querying SAP database.

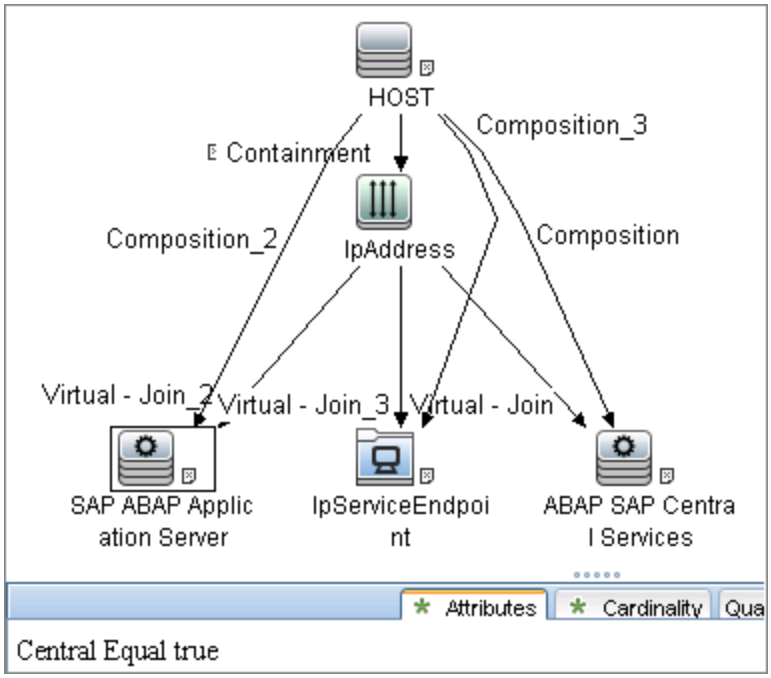
- **remoteJVMArgs.** The JVM parameters that should be passed to the remote process.
- **reportComponentsAsConfigFile.** If **true**, this job reports software components as a registry (configuration file). If **false**, this job reports separate CIs per component. The default value is **true**.
- **runInSeparateProcess.** If true, the pattern runs in a separate thread.

SAP ABAP Connection by SAP JCO Job

This section includes details about the job.

Trigger Query

- Trigger CI: IpAddress
- Trigger query:



Used Scripts

- iteratortools.py
- flow.py

- sap_flow.py
- entity.py
- cmdlineutils.py
- saputils.py
- command.py
- sap.py
- sap_abap.py
- sap_discoverer.py
- sap_abap_discoverer.py
- sap_system_dis.py

Discovered CITs

- Composition
- Containment
- IpAddress
- Membership
- Node
- SapAbapApplicationServer
- SapSystem

Adapter Parameters

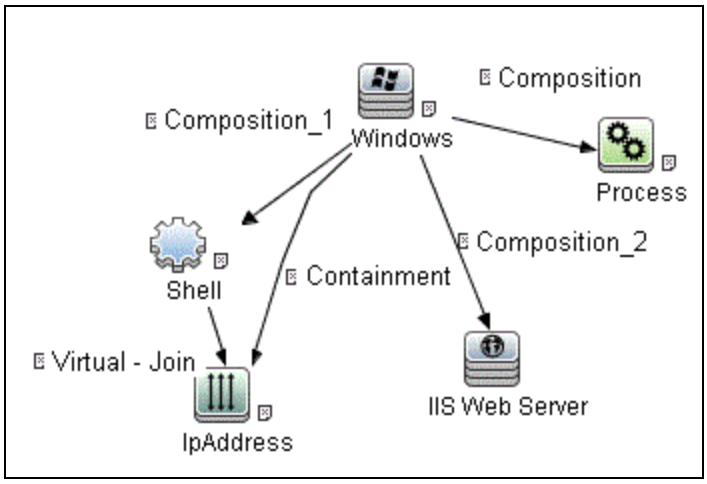
- **remoteJVMArgs.** The JVM parameters that should be passed to the remote process.
- **runInSeparateProcess.** If true, the pattern runs in a separate thread.

SAP ITS by NTCMD or UDA Job

This section includes details about the job.

Trigger Query

- Trigger CI: IIS Web Server
- Trigger query:



Node Name	Condition
Process	Name Like %mmanager% AND NOT Process Path Is null
Shell	NOT Reference to the credentials dictionary entry Is null AND (CI Type Equal ntcmd OR CI Type Equal uda)
IpAddress	NOT IP Probe Name Is null

Used Script

- cmdlineutils.py
- command.py
- entity.py
- iteratortools.py
- sap.py
- sap_abap.py

- sap_its.py
- saputils.py

Discovered CITs

- Composition
- Containment
- Dependency
- IpAddress
- Node
- SapAbapApplicationServer
- SapItsAGate
- SapItsWGate
- WebServer

SAP System by Shell Job

This job is not recommended to use and is moved to **Discovery Modules > Tools and Samples > Deprecated Jobs**.

SAP TCP Ports Job

This section includes details about the job.

Adapter

This job uses the **TCP Ports Discovery** adapter.

Trigger Query

Node Conditions

Node Name	Condition
IpAddress	`NOT IP Probe Name Is null`

Job Parameters

Name	Default Value	Description
checkIfIpIsReachable	true	This flag indicates whether the job should check if the discovered IP is reachable before the job starts to check availability of the host's ports.
checkOnlyKnownPorts	true	This flag indicates whether the job should discover only known ports. This flag does not cancel the **ports** or **UDPports** parameters. Setting this flag to **false** is applicable only with a real port range in the **ports** or **UDPports** parameter.
connectTimeOut	5000	The timeout (in milliseconds) when connecting to an IP and port.
nmapPath		The full path to the nmap executable file (for example: **C:\Program Files (x86)\Nmap\nmap.exe**).
pingTimeOut	2000	The ICMP ping timeout (in milliseconds).
ports	**For JEE TCP Ports job:** • weblogic, weblogicSSL, websphere_jmx, rmi	This parameter contains a list of TCP ports on which discovery is performed. This list can include ranges, separate port numbers, and known protocol names (such as http, ftp, etc.) and must be comma separated. If this list is empty or contains the value *****, discovery is performed only on all known TCP ports. If a port range is entered (such as 1000-1100),

Name	Default Value	Description
	For Databases TCP Ports job: • oracle, db2, sybase, sql, mysql **For SAP TCP Ports job:** • sap, sap_jmx, sap_http, sap_https **For SAP TCP Ports job:** no default value	discovery is performed only on all known ports in that range if **checkOnlyKnownPorts=true**.
scanUDP	false	This flag indicates whether or not to scan UDP ports. **Note:** UDP scanning is supported only if **useNMap=true** (see below).
UDPports		This parameter contains a list of UDP ports on which discovery is performed. This list can include ranges, separate port numbers, and known protocol names (such as http, ftp, etc.) and must be comma separated. If this list is empty or contains the value *, discovery is performed only on all known UDP ports. If a port range is entered (such as 1000-1100), discovery is performed only on all known ports in that range if **checkOnlyKnownPorts=true**.
useNMap	**For Databases TCP Ports and JEE TCP Ports jobs:** false **For SAP TCP Ports and TCP Ports jobs:** true	This flag indicates whether or not to use nmap during port scanning. **Note:** If no path is specified for **nmapPath** (see above), the nmap from the system path is used.

Note: Only ports on which a port name has been assigned to it in the **ports** or **UDPports** parameters and which are marked as 'discoverable' (**isDiscovered=1**) in the **portNumberToPortName.xml** configuration file are discovered.

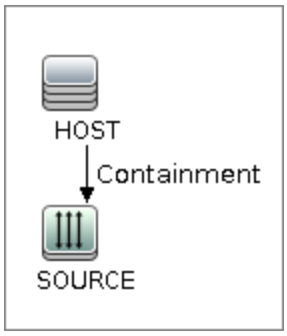
Adapter Information

This adapter discovers TCP ports.

Input CIT

IpAddress

Input Query



Triggered CI Data

Name	Value
ip_address	${SOURCE.name}
ip_domain	${SOURCE.routing_domain}

Used Scripts

- TcpPortScanner.py
- nmap.py

Global Configuration File

portNumberToPortName.xml

Discovered CITs

- Composition
- Containment
- IpAddress
- IpServiceEndpoint
- Node

Troubleshooting and Limitations – SAP ABAP Discovery

- **Problem:** The SAP discovery fails and a Java message is displayed:

  ```
  This application has failed to start because MSVCR71.dll was not found.
  ```

  Solution: Two .dll files are missing. For the solution, read Note #684106 in https://websmp205.sap-ag.de/~form/sapnet?_FRAME=CONTAINER&_OBJECT=012003146900000245872003.

- **Problem:** The SAP ABAP discovery job fails with error "SAP drivers are missing", even if SAP Java Connector drivers are installed.

  Solution 1: The Discovery Probe is trying by default to connect using JCo 3 drivers, but these drivers are not installed. Therefore, install JCo 3.x drivers.

  Solution 2: The Discovery Probe is trying by default to connect using JCo 3 drivers, but the SAP system does not support JCo 3. For the solution, go to **Data Flow Probe Setup** and right-click on the required permission in **SAP Protocol**. Select **Edit using previous interface**, change **JCo version** to **2.x**, even if it is already selected, and save the permission.

- **Problem:** You experience difficulties in loading the SAP JCo dll files.

  Solution: Check you have the latest version of the Microsoft Visual Studio C/C++ runtime redistributable package installed.

SAP Java Discovery

This section includes:

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Topology 769
How to Discover Full SAP Java-related Topology 769
SAP Java Topology by HTTP Job 771
SAP Java Topology by SAP JMX Job 773
SAP Java Topology by WebServices Job 775
SAP J2EE Topology by HTTP Adapter 777
SAP J2EE Topology by JMX Adapter 779
Troubleshooting and Limitations – SAP Java Discovery 782

Overview

UCMDB discovers the SAP Application Java Server, which provides a Java 2 Enterprise Edition (J2EE) environment for developing and running Java Enterprise Edition programs.

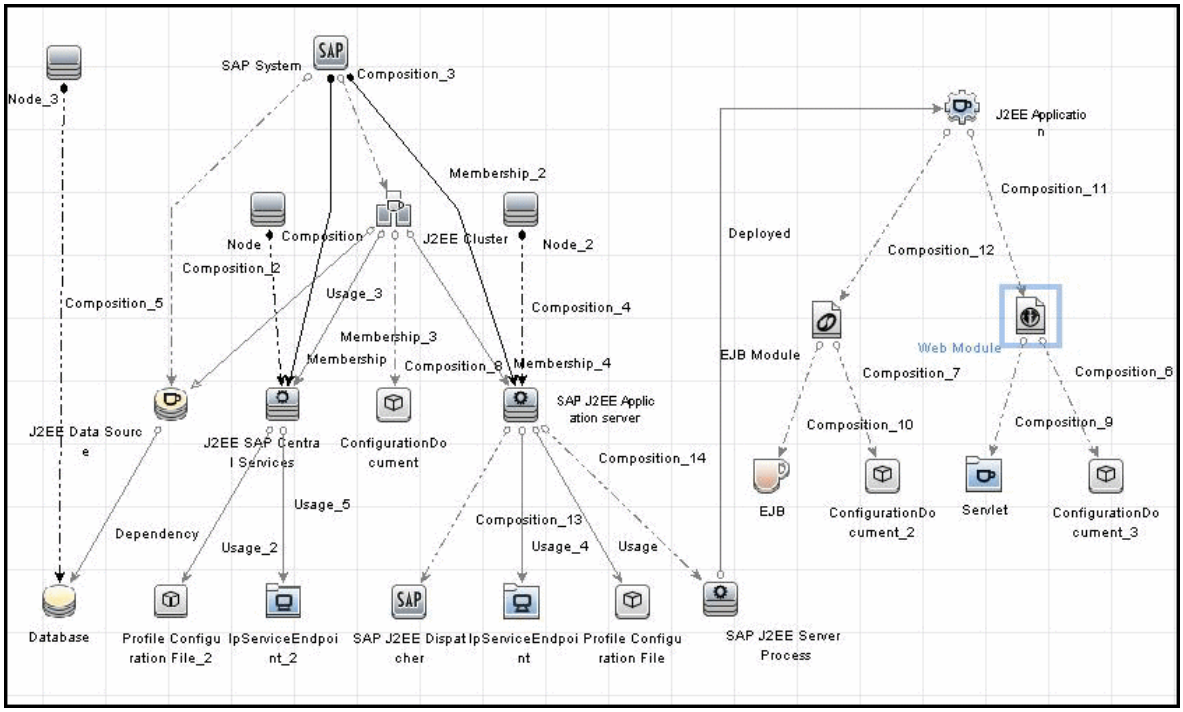
> **Note:** You can discover the whole SAP system by discovering a connection to the SAP Solution Manager. In this way, you create a single set of credentials; and there is no need to create a set of credentials for each SAP system. Universal Discovery discovers all systems (and their topology) with this one set. For details, see "SAP Solution Manager Discovery" on page 783.

Supported Versions

SAP BASIS and SAP AS (Architecture layer)	Versions 3.x to 6.x
SAP J2EE client	The version should match the relevant SAP system version
SAP Solution Manager	Versions 6.x, 7.x

Topology

The following diagram depicts the elements in the SAP Java topology.

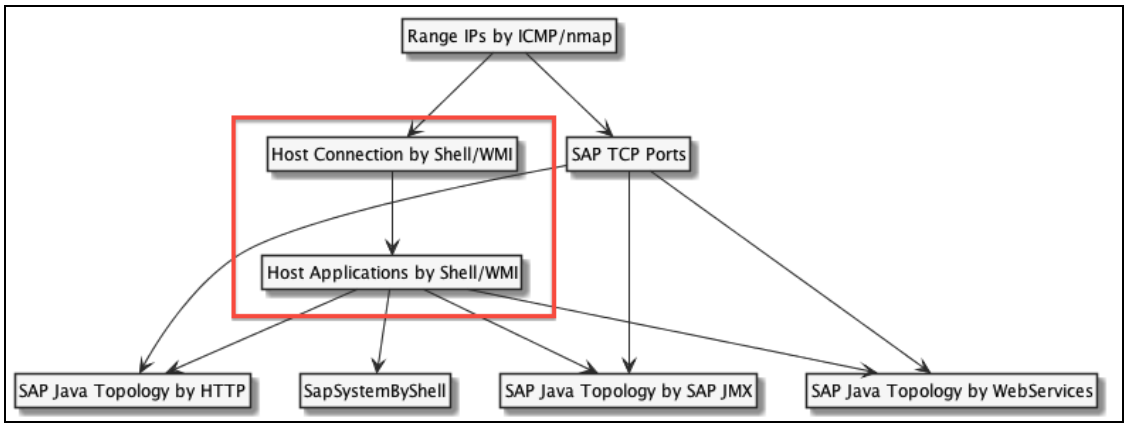


How to Discover Full SAP Java-related Topology

The SAP Java Discovery enables you to discover the full SAP Java-related topology and J2EE applications on the SAP JAVA server.

The jobs that you need to run to perform this discovery are determined by whether shell access is provided to SAP destinations. If shell access is provided, then perform discovery as described in "SAP Java Discovery with Shell Access Provided to SAP Destinations" on the next page. If shell access is not provided to SAP destinations, perform discovery as described in "SAP Java Discovery without Shell Access Provided to SAP Destinations" on page 771.

The following diagram depicts the various scenarios for running SAP Java Discovery.



SAP Java Discovery with Shell Access Provided to SAP Destinations

> **Note:** When shell access is provided to SAP destinations, SAP Java Discovery can be performed either in shallow mode or in deep mode. To perform a shallow discovery, carry out steps 1-3 below. To perform a deep discovery, carry out all of the steps below.

To perform the SAP Java Discovery:

1. In the Universal Discovery window, run the **Range IPs by ICMP** job. This job discovers all reachable IPs.
2. Run the **Host Connection By Shell** job. This job discovers the host's connectivity by shell protocol to application servers.
3. Run the **Host Applications by Shell** job. This job discovers application servers, message and enqueue servers, and their relationships to the SAP system.

   > **Note:** If you want to perform only a shallow discovery, stop here and do not continue to the next step.

4. Run one or more of the following jobs(depending on the type of Java topology you want to discover):
   - **SAP Java Topology by HTTP.** This job discovers the full SAP Java topology, including databases used. It determines system configuration, which is either standalone Java or Double Stack.
   - **SAP Java Topology by SAP JMX.** This job discovers the full SAP Java topology with details about instances. Databases are discovered only when the new MBean model is available (starting from Java application server version 7.1). It is not possible to determine the type of system configuration.

- **SAP Java Topology by WebServices.** This job is the same as the JMX job, but with a different transport.

SAP Java Discovery without Shell Access Provided to SAP Destinations

To perform the SAP Java Discovery:

1. In the Universal Discovery window, run the **Range IPs by ICMP** job. This job discovers all reachable IPs.
2. Run the job **SAP TCP Ports** job.
3. Run one or more of the following jobs (depending on the type of Java topology you want to discover):
   - **SAP Java Topology by HTTP.** This job discovers the full SAP Java topology, including databases used. It determines system configuration, which is either standalone Java or Double Stack.
   - **SAP Java Topology by SAP JMX.** This job discovers the full SAP Java topology with details about instances. Databases are discovered only when the new MBean model is available (starting from Java application server version 7.1). It is not possible to determine the type of system configuration.
   - **SAP Java Topology by WebServices.** This job is the same as the **SAP Java Topology by SAP JMX.** job, but with a different transport.

SAP Java Topology by HTTP Job

This job is based on parsing data from the XML queried HTTP URLs. URLs can differ slightly depending on the system configuration where the application server (instance) resides. There are two main types of configurations that are used by this job:

1. **Pure/standalone Java system configuration**, which has the following type of query:
   - **http(s)://<address>:<port>/sap/monitoring/SystemInfoServlet** (used to query information about the entire system)
2. **Double Stack (DS) configuration**, which has the following type of query:
   - **http(s)://<address>:<port>/monitoring/SystemInfoServlet** (used to query information about the entire system)

Adapter

ID: `sap_java_topology_by_http`

Trigger TQL

This job is triggered on IPs that are part of the host with endpoint `sap_http` or `sap_https`.

Parameters

None

Prerequisites

1. **Set up credentials.** The HTTP client uses the same credentials that are used for the **SAP Java Topology by SAP JMX** job.
2. **Libraries installation on the probe.** There is no need to install external libraries. All required dependencies come with a Probe installation.

Discovery Flow

The discovery flow for the SAP Java Topology by HTTP Job is as follows:

1. Get available SAP JMX credentials for this destination.

   > **Note:** Even if the port in specified in the credentials is different from destination port, such credential are also used.

2. For each credential, this job attempts to perform an HTTP query using the **SystemInfoServlet** URLs mentioned above. Successful output is XML that is parsed to get the following SAP system details:
   - system ID (from the XML: **/SAP_J2EE/SID/@value**)
   - system installation type (from the XML: **/SAP_J2EE/INSTALLATION_TYPE/@value**)
   - version, which is composed of:
     - **/SAP_J2EE/REL/@value**
     - **/SAP_J2EE/PATCH_LEVEL/@value**

- database information (from the XML: **/SAP_J2EE/DB_INSTANCE**)
- SCS (from the XML: **/SAP_J2EE/SCS_INSTANCE**)

  > **Note:** SCS data is not complete because it contains only port and host information, while the instance number is missing. Therefore, this job computes the instance number from the port. Several port patterns considered, such as 3xNN, 81NN (http), 444NN (https), where NN stands for instance number.

- dialog instances (from the XML: **/SAP_J2EE/DIALOG_INSTANCE**)

  > **Note:** **/SAP_J2EE/DIALOG_INSTANCE/INSTANCE_DIR** and **/SAP_J2EE/DIALOG_INSTANCE/NAME** are intentionally skipped from the discovery algorithm as they may contain invalid data.

- central instance (from the XML: **/SAP_J2EE/CENTRAL_INSTANCE**)

  Reporting dialog and central instances contains some additional logic for instance name resolving. To get the instance name, this job collects information on all workers (or servers) and a dispatcher to get runtime properties such as **application.home**, **com.sap.jvmdir**, **java.home**, **rdbms.driverLocation**, and **user.dir**. This job attempts to find a path with the corresponding SID and with a valid instance name from the paths that have been discovered thus far. Usually **application.home** contains such information.

- software components (from the XML: **/SAP_J2EE/SOFTWARE_COMPONENTS/COMPONENT**)

SAP Java Topology by SAP JMX Job

This job uses the SAP Java client to access the MBean server of an application server via the P4 port (5xx04).

> **Note:** The P4 port is usually closed and starting from Java application server version 7.x it is recommended to use the **SAP Java Topology by WebServices** and/or **SAP Java Topology by HTTP** jobs.

Adapter

ID: `SAP_Dis_J2EE_Site`

Trigger TQL

This job is triggered on IPs that are part of the host with endpoint `sap_jmx`.

Prerequisites

1. **Set up credentials.**

   To set up credentials to be used by the Java client discovery, you must provide separate credentials called **SAP JMX**. The **SAP JMX** credentials enable connection to a machine and verification of whether a SAP system is installed on it.

2. **Add java client (jar files) to DataFlowProbe machine.**

   > **Note:** If you create version folders under the **\j2ee\sap** directory on the Data Flow Probe machine, you can connect to several SAP versions by adding **.jar** files to each folder. For example, to connect to versions SAP 6.4 and 7.0, in the SAP folder create two sub-folders called 6.x and 7.x and place the relevant **.jar** files in these folders.

   a. Add the following **.jar** files to the **<DataFlowProbe_root>\runtime\probeManager\discoveryResources\j2ee\sap** directory on the Data Flow Probe machine:

      - sapj2eeclient.jar
      - logging.jar
      - exception.jar
      - sapxmltoolkit.jar

      The files reside in the **\usr\sap\<SID>\<instance name>\j2ee\j2eeclient** directory on one of the SAP instance machines.

   b. Add the **com_sap_pj_jmx.jar** file to the **<DataFlowProbe_root>\runtime\probeManager\discoveryResources\j2ee\sap** directory on the Data Flow Probe machine.

      The file resides in the **\usr\sap\<SID>\<instance name>\j2ee\admin\lib** directory on one of the SAP instance machines.

Discovery Flow

1. Get available credentials for this destination and filter them so that only credentials that do not have a port or with a port that belongs to the list of ports opened on a destination are used.
2. For each credential, this job attempts to establish a connection to the destination.
3. Once the connection is established, this job sends the query **SAP_J2EECluster** to get cluster details. This query returns the following information:
   - **Name.** This attribute contains the name of the cluster/system.
   - **InstanceNames.** This attribute contains the names of the Java application servers available in this system.

   After this query initial topology is reported.
4. To get more details about each instance, this job repeats the **SAP_J2EECluster**query to the same MBean but with the additional attribute `AllInstanceInfos`. The hostname and instance number are determined based on the `Name` value.
5. If the parameter **reportComponentsAsConfigFile** is set to **true**, this job discovers Development Components. The following MBeans are used to query interfaces, libraries, and services respectively:
   - `SAP_J2EEInterfacePerNode`
   - `SAP_J2EELibraryPerNode`
   - `SAP_J2EEServicePerNode`
6. This job discovers SCS (Central Services) application servers using the query `SAP_J2EEInstance` with `name` set to `SCS`.
7. This job discovers information about one or more workers and a dispatcher using the query `SAP_J2EEClusterNode`.
8. This job attempts to discover databases using the query `SAP_ITSAMJ2eeCluster`. However, this works only for the new MBean model (starting from version 7.1).

SAP Java Topology by WebServices Job

This job is based on the same MBean model as the job **SAP Java Topology by SAP JMX**, but uses the SAP WebServices transport. This job also shares the same code base as the **SAP Java Topology by SAP JMX** job, and slightly differs in the discovery flow due to a deserialization limitation.

Adapter

ID: `SAP_Dis_J2EE_Site`

Trigger TQL

This job is triggered on IPs that are part of the host with endpoint **sap_http**.

Parameters

- **remoteJVMArgs.** The JVM parameters that should be passed to the remote process.
- **reportComponentsAsConfigFile.** If **true**, this job reports Java system components as a registry (configuration file). If **false**, this job reports separate CIs per component. The default value is **true**.
- **runInSeparateProcess.** This parameter indicates whether the pattern runs in a separate thread. The default value is **true**.

Prerequisites

1. **Set up credentials**

   The WebServices client uses the same credentials that are used for the **SAP Java Topology by SAP JMX** job.

2. **Libraries installation on the probe**

   There is no need to install external libraries. All required dependencies come with a Probe installation.

Discovery Flow

The flow for this job is very similar to the flow of the **SAP Java Topology by SAP JMX** job, but there are some differences when discovering whole system information.

> **Note:** Due to the deserialization limitation some discovered instances are reported without **instance_name**, as this information is not available.

The discovery flow for the SAP Java Topology by WebServices job is as follows:

1. Gets available credentials for this destination and filter them so that only credentials that do not have a port or have a port that belongs to the list of ports opened on a destination are used.
2. For each credential, this job attempts to establish a connection to the destination using WebServices.
3. Once the connection is established, this job discovers all application servers by their names by sending the query `SAP_J2EECluster` to get cluster details. This query returns the following information:
   - **Name.** This attribute contains the name of the cluster/system.
   - **InstanceNames.** This attribute contains the names of the Java application servers available in this system.

   After this query initial topology is reported.

   > **Note:** At this point, this job misses discovery of the instance details due to the deserialization limitations of the WebServices client.
4. If the parameter **reportComponentsAsConfigFile** is set to **true**, this job discovers Development Components. The following MBeans are used to query interfaces, libraries, and services respectively:
   - **SAP_J2EEInterfacePerNode**
   - **SAP_J2EELibraryPerNode**
   - **SAP_J2EEServicePerNode**
5. This job discovers SCS (Central Services) application servers using the query **SAP_J2EEInstance** with **name** set to **SCS**.
6. This job discovers information about one or more workers and a dispatcher using the query **SAP_J2EEClusterNode**.
7. This job attempts to discover databases using the query **SAP_ITSAMJ2eeCluster**. However, this works only for the new MBean model (starting from version 7.1).

SAP J2EE Topology by HTTP Adapter

This section includes details about the adapter.

ID

`sap_java_topology_by_http`

Input CIT

`IpServiceEndpoint`

Input TQL

The SAP Java Topology by HTTP job is triggered when `IpServiceEndpoint` has the name `sap_http` or `sap_https`.

Triggered CI Data

- **ip_service_name.** The name of the IP service endpoint.
- **ip_port_pair.** The string representation of the endpoint, similar to **address:port**.

Used Scripts

The entry point module is `sap_jee_topology_by_http.py`.

- jmx.py
- sap.py
- db_platform.py
- db.py
- db_builder.py
- sap_db.py
- sap_discoverer.py
- jdbc_url_parser.py
- jdbc.py
- jee.py
- sap_jee.py
- sap_jee_discoverer.py
- sap_jee_topology_by_http.py

Discovered CITs

- Database
- IpAddress
- IpServiceEndpoint
- J2eeCluster
- SapJ2eeApplicationServer
- SapJ2eeCentralServices
- SapJ2eeDispatcher
- SapJ2eeServerProcess
- SapJavaSoftwareComponent
- SapSystem

Parameters

None

SAP J2EE Topology by JMX Adapter

This section includes details about the adapter.

ID

`SAP_Dis_J2EE_Site`

Input CIT

`IpAddress`

Input TQL

The SAP Java Topology by SAP JMX job is triggered when `IpAddress` belongs to the host and `IpServiceEndpoint` exists with the same address. The name of `IpServiceEndpoint` must be or `sap_jmx` or `sap_http`.

Triggered CI Data

- **hostId.** The destination UCMDB ID.
- **ip_address.** The destination IP address.
- **ip_domain.** The destination domain.
- **sap_jmx_port.** The optional port of the endpoint.

Used Scripts

The entry point module is `sap_jee_topology_by_jmx.py`.

- iteratortools.py
- entity.py
- cmdlineutils.py
- command.py
- sap.py
- jee.py
- jmx.py
- sap_jee.py
- db_platform.py
- db.py
- db_builder.py
- jdbc.py
- jdbc_url_parser.py
- sap_db.py
- sap_discoverer.py
- sap_jee_discoverer.py
- flow.py
- sap_flow.py
- sap_jee_topology_by_jmx.py

Discovered CITs

- Composition
- ConfigurationDocument
- Containment
- Database
- Dependency
- Deployed
- Ejb
- EjbModule
- EntityBean
- IpAddress
- IpServiceEndpoint
- J2EE Domain
- J2eeApplication
- J2eeCluster
- JdbcDataSource
- Membership
- MessageDrivenBean
- Node
- RunningSoftware
- SapJ2eeApplicationServer
- SapJ2eeCentralServices
- SapJ2eeDispatcher
- SapJ2eeServerProcess
- SapJavaSystemComponents
- SapSystem
- Servlet
- StatefulSessionBean

- StatelessSessionBean
- Usage
- Web Module

Parameters

The following two parameters declare how to run jobs defined on top of this adapter:

- **runInSeparateProcess.** When this parameter is set to `true`, this job runs in a separate process. The default value is `true`.
- **remoteJVMArgs.** Contains JVM parameters that should be passed to the remote process.

The following parameter influences topology reporting flow:

- **reportComponentsAsConfigFile.** When set to `true`, the job reports Java Development Components as a configuration document. When set to `false`, the job reports separate CIs per component. The default value is `true`.

Troubleshooting and Limitations – SAP Java Discovery

If you complete all prerequisites, but the discovery returns a “Connection Failed” message, review **RemoteProcesses.log** in the DDM Flow Probe logs folder (**C:\hp\UCMDB\DataFlowProbe\runtime\log**). If "NoClassDefFoundError" is displayed there, use the following workaround:

1. Copy the following SAP jar files to the **C:\hp\UCMDB\DataFlowProbe\content\lib\sap** folder:
   - sapj2eeclient.jar
   - logging.jar
   - exception.jar
   - sapxmltoolkit.jar
   - com_sap_pj_jmx.jar

   If the sap folder does not exist, create it.
2. Restart the Data Flow Probe.

If you use this workaround, you may only use one version of SAP jar files.

SAP Solution Manager Discovery

This section includes:

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How to Discover SAP Solution Manager Version 7.2 or Later 787
SAP Solution Manager Connection by CIM Job 788
SAP Solution Manager Topology by CIM Job 790
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Overview

Often, an environment includes more than one SAP system, each one using a different set of credentials (for instance, user name, password, system number, or client number).

It is customary to register all SAP systems in the SAP Solution Manager, to centralize the management of the SAP systems. Data Flow Management (DFM) enables discovery of all the SAP systems by discovering this connection to the SAP Solution Manager. In this way, you create a single set of credentials; there is no need to create a set of credentials for each SAP system. DFM discovers all systems (and their topology) with this one set.

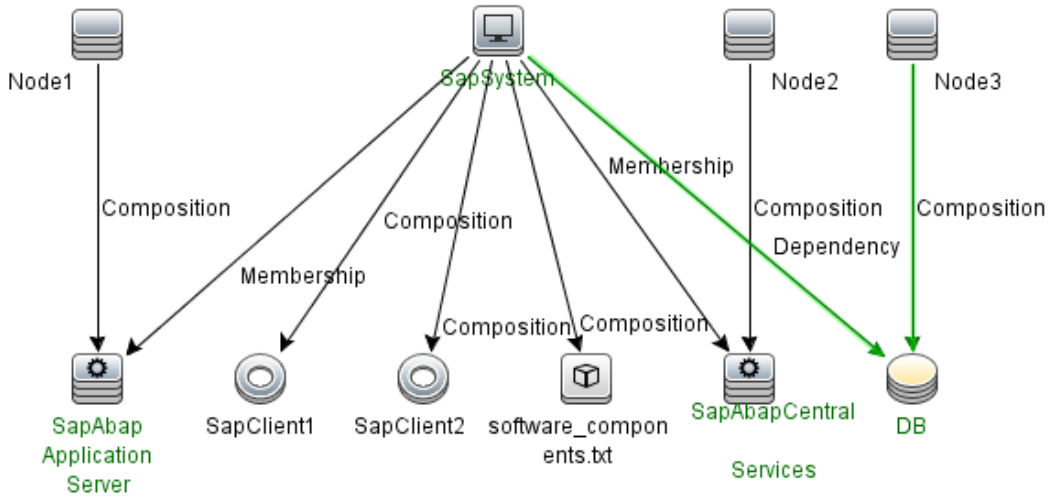
Supported Versions

SAP BASIS and SAP AS (Architecture layer)	Versions 3.x to 6.x.
SAP JCo.	2.x and 3.x (starting from 3.0.7) Version 3.0.7 and newer is recommended
SAP Solution Manager	Versions 6.x, 7.x.

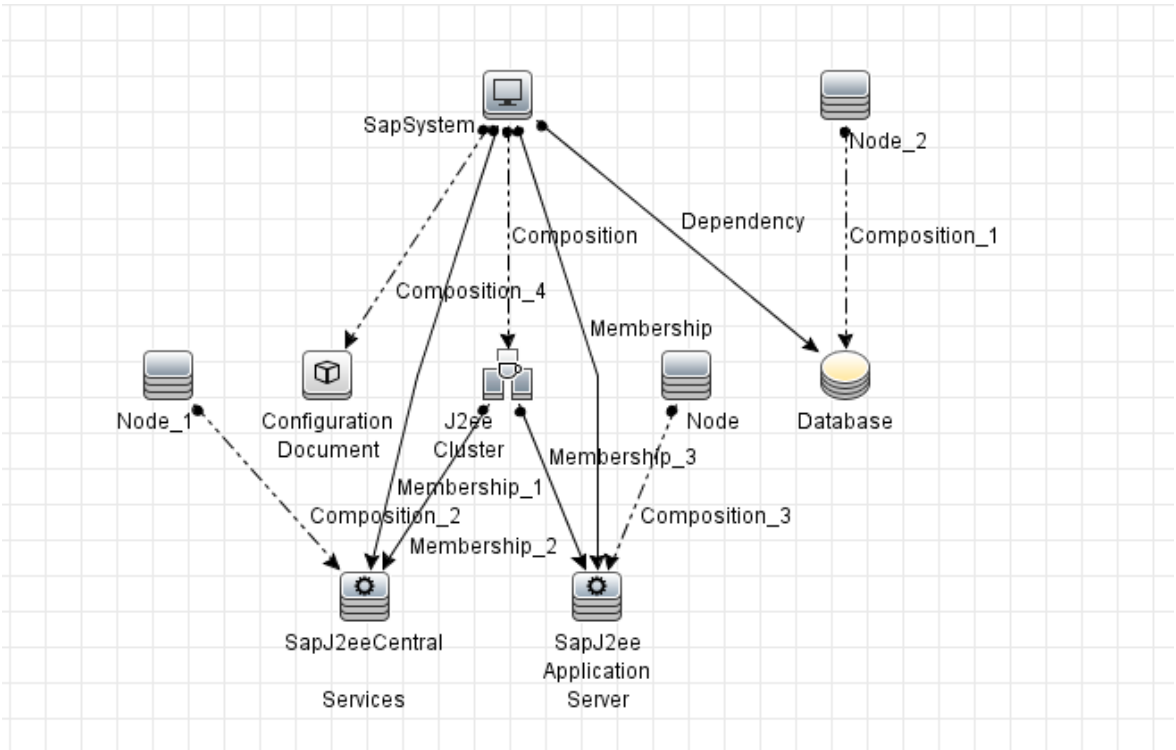
Topology

To view the SAP Solution Manager Topology by SAP JCO topology: **Universal Discovery** > select **Enterprise Applications > SAP > SAP Solution Manager Topology by SAP JCO > Details pane**. Click the **View CIs in Map** button.

The following image displays the topology of SAP ABAP System.



The following image displays the topology of SAP J2EE System.



How to Discover SAP Solution Manager Version 7.1 or Earlier

For SAP Solution Manager version 7.1 or earlier, DFM discovers the SAP business layer and the complete topology of registered SAP systems. It includes the following steps:

1. ## Prerequisite - Set up protocol credentials

   This discovery solution is based on the SAP Protocol.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. ## Prerequisite - Set up permissions

   To run SAP Solution Manager, ask the SAP Solution Manager administrator to give you permissions on the following objects for the given profile:

   - For the **S_RFC** object, obtain privileges: RFC1, SALX, SBDC, SDIF, SDIFRUNTIME, SDTX, SLST, SRFC, STUB, STUD, SUTL, SXMB, SXMI, SYST, SYSU, SEU_COMPONENT.
   - For the **S_XMI_PROD** object, obtain:

     ```
     EXTCOMPANY=MERCURY;EXTPRODUCT=DARM;INTERFACE=XAL
     ```

   - For the **S_TABU_DIS** object, obtain:

     ```
     DICBERCLS=SS; DICBERCLS=SC; DICBERCLS=&NC& ACTVT=03
     ```

3. ## Run the discovery

   For details running jobs, see "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

   Method 1:

   - Run the **SAP TCP Ports** job to discover SAP ports.
   - Run the **SAP ABAP Connection by SAP JCO** job.
   - Run the **SAP Solution Manager Topology by SAP JCO** job to discover complete topology of registered SAP systems.
   - Run the **SAP Solution Manager by SAP JCO** job to discover the SAP business layer .

Method 2:

- Run the **Host Resources by ...** jobs to discover SAP (ABAP or J2EE) Application Server and/or SAP (ABAP or J2EE) Central Services.
- Run the **SAP ABAP Connection by SAP JCO** job.
- Run the **SAP Solution Manager Topology by SAP JCO** job to discover complete topology of registered SAP systems.
- Run the **SAP Solution Manager by SAP JCO** job to discover the SAP business layer .

During the run of the **SAP ABAP Connection by SAP JCO** job, the SAP Systems that are defined as the SAP Solution Manager are triggered on these two jobs: **SAP Solution Manager Topology by SAP JCO** and **SAP Solution Manager by SAP JCO** job.

How to Discover SAP Solution Manager Version 7.2 or Later

For SAP Solution Manager version 7.2 or later, DFM discovers the complete topology of registered SAP systems by accessing SAP Solution Manager with the CIM Protocol. It includes the following steps:

1. ### Prerequisite - Set up protocol credentials

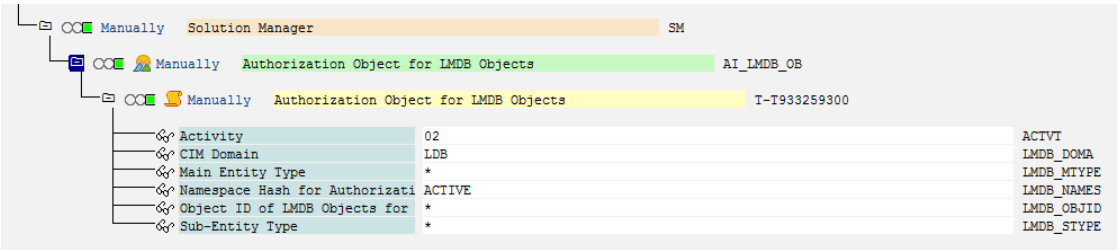
   This discovery solution is based on the CIM Protocol.

   > **Note:** Make sure that you select **SAP** from the **CIM Category** attribute.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. ### Prerequisite - Set up permissions

   To discover SAP Solution Manager 7.2 or later, ask the SAP Solution Manager administrator to give you permissions illustrated as follows:



3. Run the discovery

   For details running jobs, see "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

   - Run the **Range IPs by ICMP** job to discover the IP addresses.
   - Run the **SAP Solution Manager Connection by CIM** job to connect to the SAP Solution Manager with the CIM Protocol.
   - Run the **SAP Solution Manager Topology by CIM** job to discover the complete topology of registered SAP systems.

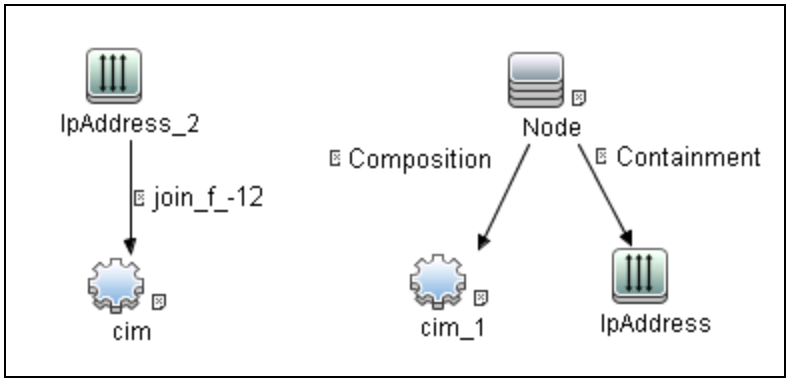
SAP Solution Manager Connection by CIM Job

This section includes details about the job.

Introduction

This job connects to the SAP Solution Manager with the CIM Protocol.

Trigger TQL



CI	Attribute Value
IpAddress	(NOT IP Probe Name Is null) AND (IP Is Broadcast Equal false OR IP Is Broadcast Is null)
IpAddress_2	(NOT IP Probe Name Is null) AND (IP Is Broadcast Equal false OR IP Is Broadcast Is null)

Adapter Information

This job uses the **SAP Solution Manager Connection by CIM** adapter.

Adapter Type

Jython

Input CIT

IpAddress

Input TQL

None

Triggered CI Data

Name	Value
ip_address	${SOURCE.name}
ip_domain	${SOURCE.routing_domain}

Used Scripts

- entity.py
- cim.py
- cim_discover.py
- sap_solman_discoverer_by_cim.py
- sap_solman_connection_by_cim.py

Discovered CITs

- CIM
- Composition (node, cim)

- Containment (node, ip_address)
- IpAddress
- Node

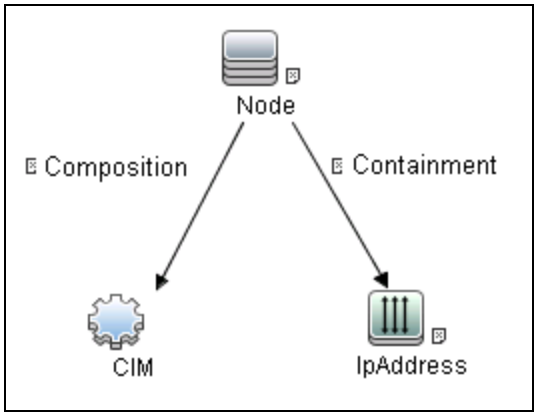
SAP Solution Manager Topology by CIM Job

This section includes details about the job.

Introduction

This job discovers the complete topology of registered SAP systems based on Solution Manager with the CIM Protocol.

Trigger TQL



CI	Attribute Value
IpAddress	(NOT IP Probe Name Is null) AND (NOT UcmdbRoutingDomain Is null)
CIM	(NOT Reference to the credentials dictionary entry Is null) AND CimCategory Contains SAP

Adapter Information

This job uses the **SAP Solution Manager Topology by CIM** adapter.

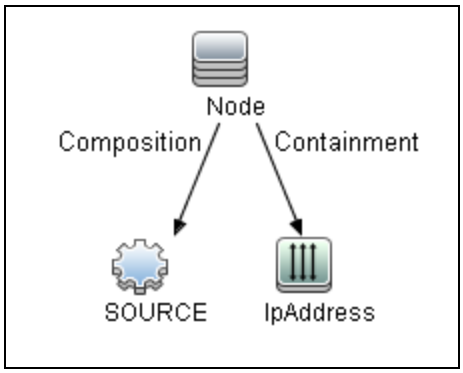
Adapter Type

Jython

Input CIT

CIM

Input TQL



CI	Attribute Value
IpAddress	NOT IP Probe Name Is null

Triggered CI Data

Name	Value
credentialsId	${SOURCE.credentials_id}
ip_address	${SOURCE.application_ip}
ip_domain	${SOURCE.application_ip_domain}

Used Scripts

- cim.py
- cim_discover.py
- entity.py

- sap_solman_discoverer_by_cim.py
- sap_solman_topology_by_cim.py

Discovered CITs

- Composition (node, abap_sap_central_services)
- Composition (node, database)
- Composition (node, j2ee_sap_central_services)
- Composition (node, sap_j2ee_app_server)
- Composition (node, sap_r3_server)
- Composition (sap_system, configuration_document)
- Composition (sap_system, j2eecluster)
- Composition (sap_system, sap_abap_software_component)
- Composition (sap_system, sap_client)
- Composition (sap_system, sap_java_software_component)
- ConfigurationDocument
- Containment (node, ip_address)
- Database
- Dependency (sap_system, database)
- IpAddress
- J2eeCluster
- Membership (j2eecluster, j2ee_sap_central_services)
- Membership (j2eecluster, sap_j2ee_app_server)
- Membership (sap_system, abap_sap_central_services)
- Membership (sap_system, j2ee_sap_central_services)
- Membership (sap_system, sap_j2ee_app_server)
- Membership (sap_system, sap_r3_server)
- Node
- SapAbapApplicationServer

- SapAbapCentralServices
- SapAbapSoftwareComponent
- SapClient
- SapJ2eeApplicationServer
- SapJ2eeCentralServices
- SapJavaSoftwareComponent
- SapSystem

Adapter Parameters

Parameter	Default Value	Description
reportComponentsAsConfigFile	true	Indicates whether to report SapAbapSoftwareComponent and SapJavaSoftwareComponent as ConfigurationDocument.

Troubleshooting and Limitations – SAP Solution Manager Discovery

Problem. The SAP discovery fails and a Java message is displayed:

```
This application has failed to start because MSVCR71.dll was not found.
```

Solution. Two **.dll** files are missing. For the solution, read Note #684106 in https://websmp205.sap-ag.de/~form/sapnet?_FRAME=CONTAINER&_OBJECT=012003146900000245872003.

Chapter 51: Siebel Discovery

This chapter includes:

Overview 795

Supported Versions 795

Topology 796

Siebel Topology View 796

Siebel Web Topology View 797

How to Discover Siebel Topology 798

Siebel Application Server Configuration Job 800

Siebel Application Servers Job 801

Siebel Gateway Connection Job 802

Siebel Web Applications by NTCMD or UDA Job 804

Siebel Web Applications by TTY Job 805

Siebel DB by NTCMD or UDA Job 808

Siebel DB by TTY Job 809

Troubleshooting and Limitations – Siebel Discovery 810

Overview

Using the Siebel adapters, you can run an automatic Siebel discovery to create the Siebel world, together with its components, inside Universal CMDB. During discovery:

- All Siebel-related IT entities that reside in the organization are discovered, and configuration items (CIs) are written to the CMDB.
- The relationships between the elements are created and saved in the CMDB.
- The newly generated CIs are displayed when the Siebel Enterprises view is selected in View Explorer under the Siebel Enterprises root CI.

> **Note:** Verify that all Siebel server IP addresses are included in the range. If not all servers can be covered with one IP range, you can split the range into several ranges.

Supported Versions

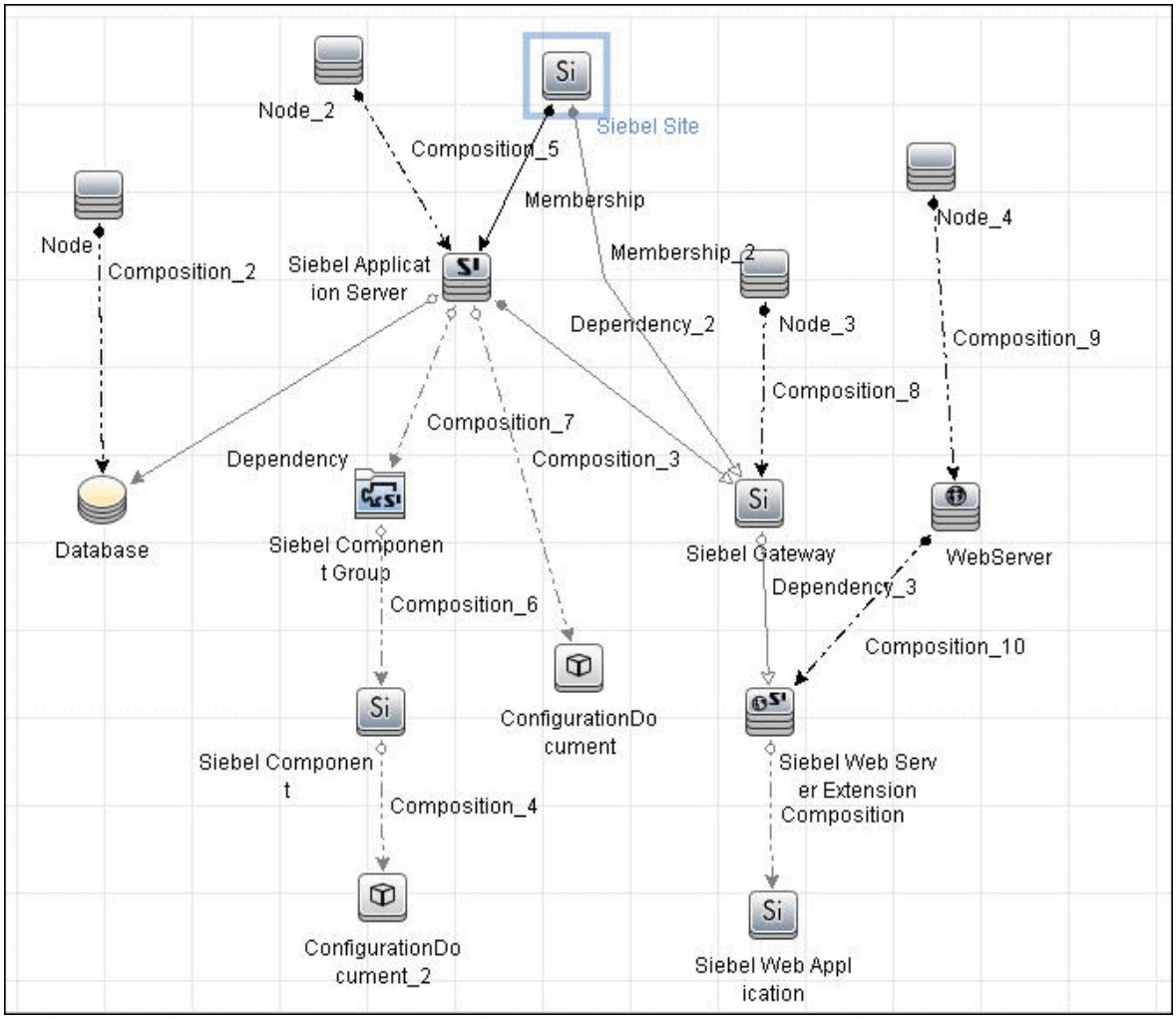
This discovery solution supports the following servers:

- Siebel 7.5
- Siebel 7.7
- Siebel 8.0
- Siebel 8.1
- Siebel 8.2

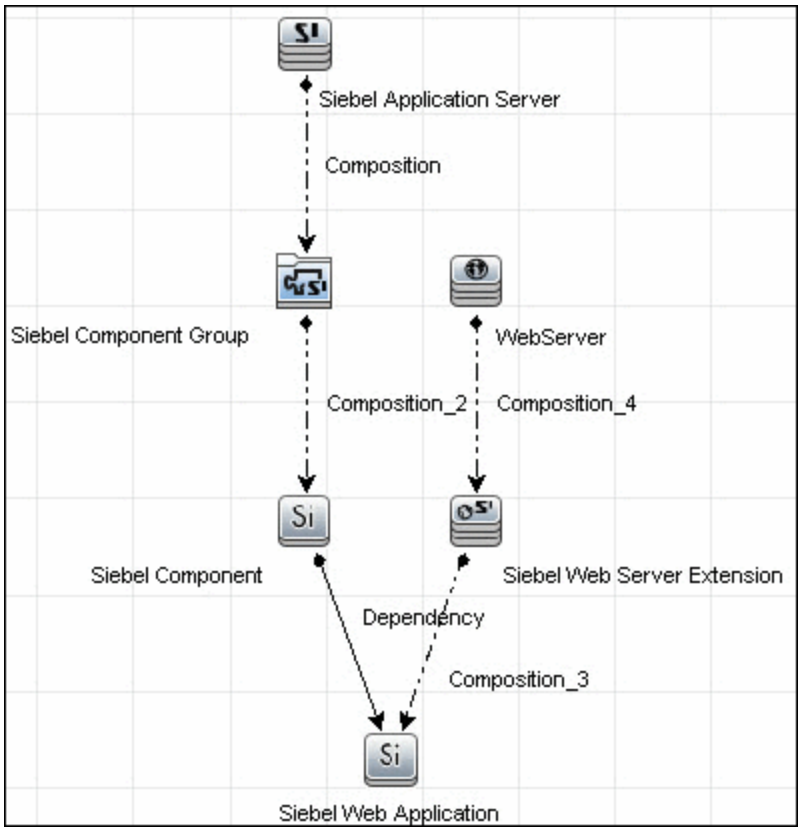
Topology

The following images display the Siebel topologies:

Siebel Topology View



Siebel Web Topology View



How to Discover Siebel Topology

This task describes how to discover Siebel topology. It includes the following steps:

- "Prerequisite - Set up protocol credentials" below
- "Prerequisites - Other" below
- "Run the discovery" on the next page

Prerequisite - Set up protocol credentials

Set up the following protocols:

Platform	Protocol
Windows	• WMI protocol • NTCMD protocol • Siebel Gateway protocol
UNIX	• SSH protocol • Telnet protocol • Siebel Gateway protocol

> **Note:** The Siebel Gateway protocol allows the user to specify which port is used during connection to the gateway.

For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

Prerequisites - Other

The driver tool is used to extract data about the enterprise structure from Siebel.

> **Note:**
>
> - If you are working with different versions of Siebel in your organization, make sure you use a driver tool with a version that is appropriate for the Siebel server.
> - If the Data Flow Probe is installed on a 64-bit machine on a Windows platform, place the **ntdll.dll**, **MSVCR70.DLL**, and **msvcp70.dll** drivers together with the Siebel drivers in the Siebel driver folder on the Probe machine. You enter details of this folder in the Siebel set of

> credentials (**Path to Siebel Client**). These drivers usually exist on a 32-bit machine and can be copied to the 64-bit machine.
>
> For details, see "Siebel Gateway Protocol" in the *HPE Universal CMDB Data Flow Management Guide*.

To copy the driver tool to the Data Flow Probe:

1. Copy the driver Command Line Interface (CLI) tool from the Siebel server to any folder on the Data Flow Probe machine.
2. (Recommended) Run the Siebel connection test to validate the driver installation. To run the connection test, open the command line on the Data Flow Probe machine and change directory to the location of the **driver.exe** file.
3. Run from the command line:

   ```
   >driver /e [site_name] /g [gateway_host] /u [username] /p [password]
   ```

   If the connection is established successfully, the Command Prompt window displays the `driver` prompt and a status message about the number of connected servers.

Run the discovery

1. To trigger the discovery of Siebel networking features, add a Network CI to the CMDB. For details, see "New CI/New Related CI Dialog Box" in the *HPE Universal CMDB Modeling Guide*.
2. In the Universal Discovery window, activate jobs in the following order:
   a. Range IPs by ICMP, or Range IPs by nmap
   b. Host Connection by Shell
   c. Host Connection by WMI
   d. Host Resources by Shell
   e. Host Resources by WMI
   f. Host Applications by Shell
   g. Host Applications by WMI
   h. Siebel Web Applications by NTCMD or UDA, and/or Siebel Web Applications by TTY
   i. Siebel Gateway Connection
   j. Siebel Application Servers

k. Siebel Application Server Configuration

l. Siebel DB by NTCMD or UDA, and/or Siebel DB by TTY

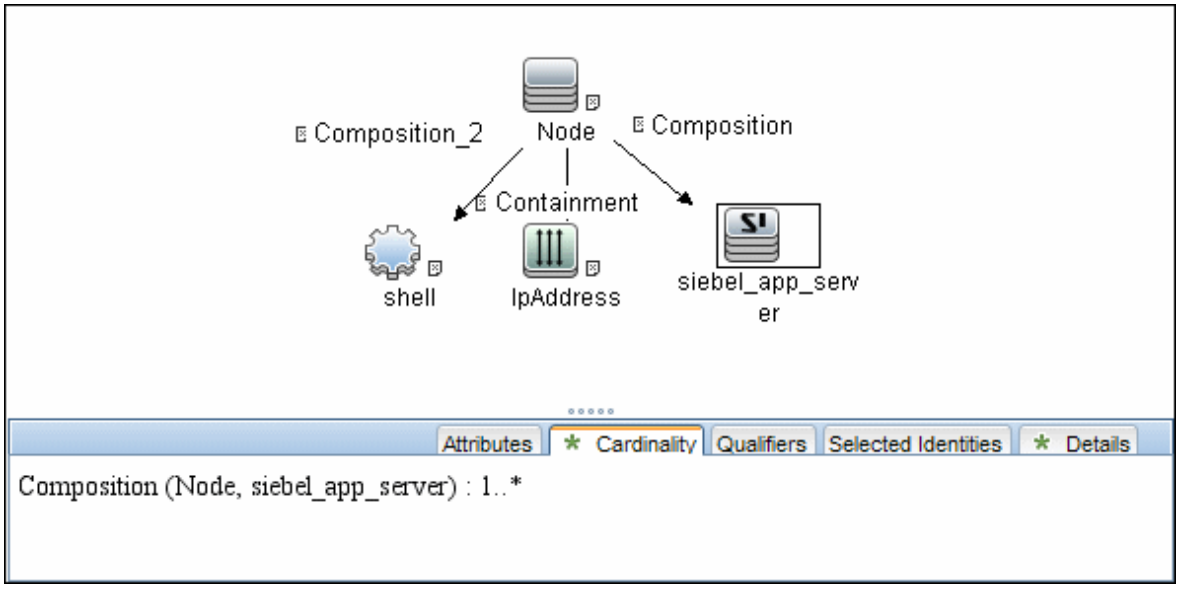
> **Note:** The following enrichment adapters automatically run in the background during discovery:
> **Siebel_Route_WebApp_To_Component.** Builds the route between Siebel Web Application CIs and Siebel Component CIs.
> **Siebel_Web_To_Middle_Tier.** Builds the route between the Web tier and the middle tier when the Siebel enterprise uses a Resonate server for load balancing.

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

Siebel Application Server Configuration Job

This section includes details about the job.

Trigger Query



Adapter

This job uses the **SIEBEL_DIS_APP_SERVER_CONFIG** adapter.

Used Scripts

- file_ver_lib.py
- siebel_discover_appserver_config.py

Discovered CITs

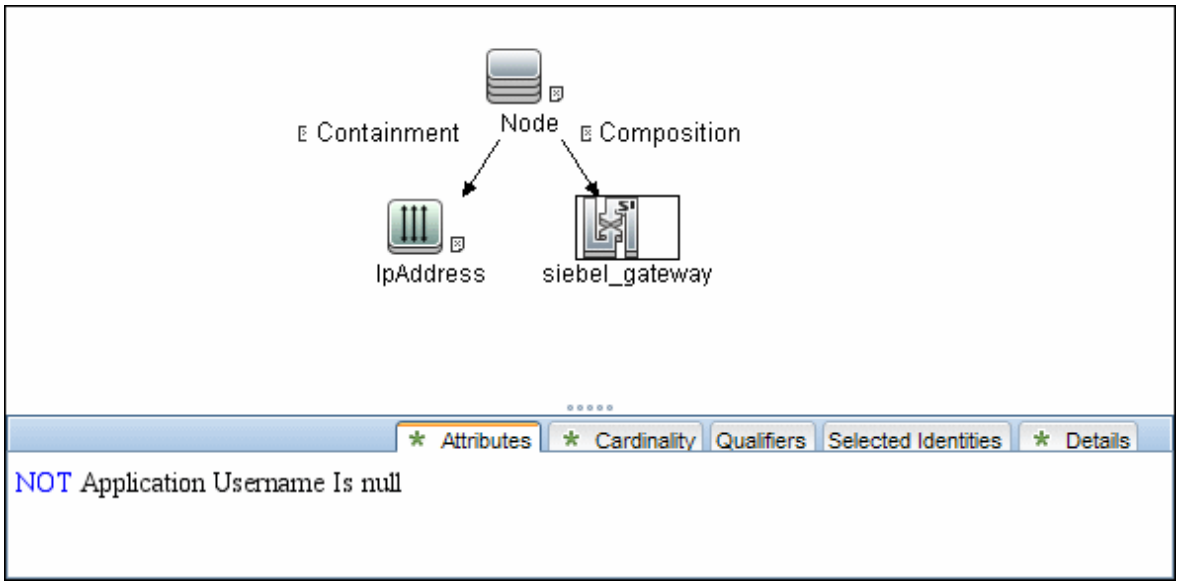
- Composition
- ConfigurationDocument
- Siebel Application Server

> **Note:** To view the topology, see "Siebel Topology View" on page 796.

Siebel Application Servers Job

This section includes details about the job.

Trigger Query



Adapter

This job uses the **SIEBEL_DIS_APP_SERVERS** adapter.

Used Scripts

- siebel_common.py
- siebel_discover_enterprise.py

Discovered CITs

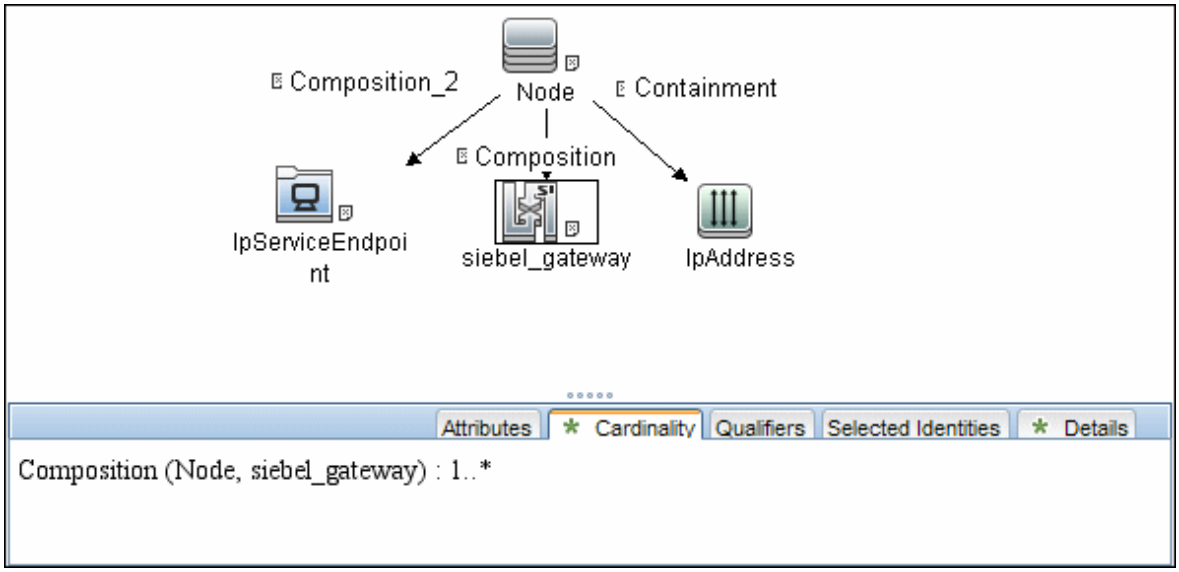
- Composition
- ConfigurationDocument
- Containment
- Dependency
- IpAddress
- Membership
- Node
- Siebel Application
- Siebel Appication Server
- Siebel Component
- Siebel Component Group

> **Note:** To view the topology, see "Siebel Topology View" on page 796.

Siebel Gateway Connection Job

This section includes details about the job.

Trigger Query



Adapter

This job uses the **SIEBEL_DIS_GATEWAY_CONNECTION_(GTWY)** adapter.

Used Scripts

- siebel_common.py
- siebel_discover_gateway.py

Discovered CITs

For details on the CIs that are discovered, see the Statistics table in the **Details** tab.

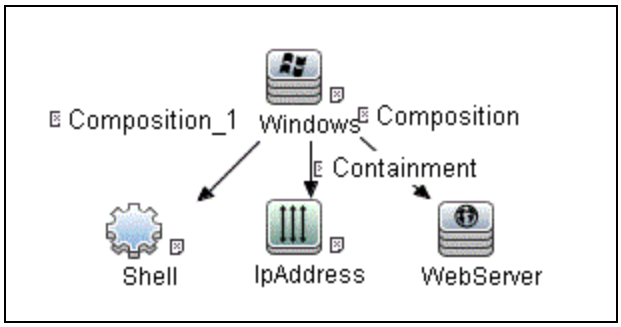
- Composition
- Membership
- Siebel Enterprise
- Siebel Gateway

> **Note:** To view the topology, see "Siebel Topology View" on page 796.

Siebel Web Applications by NTCMD or UDA Job

This section includes details about the job.

Trigger Query



Node Name	Condition
Windows	None
Shell	NOT Reference to the credentials dictionary entry Is null AND (CI Type Equal ntcmd OR CI Type Equal uda)
IpAddress	NOT IP Probe Name Is null
WebServer	None

Adapter

This job uses the **SIEBEL_DIS_WEBAPPS_NT** adapter.

Used Scripts

- NTCMD_HR_REG_Software_Lib.py
- siebel_discover_wse.py

Discovered CITs

- Composition

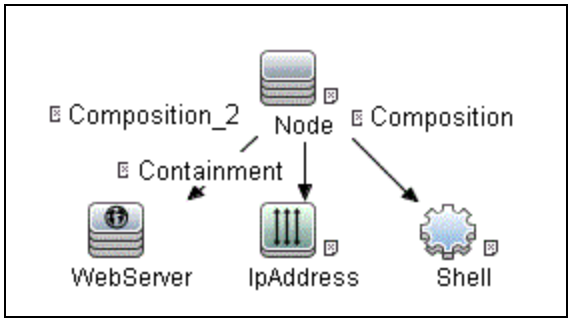
- ConfigurationDocument
- Containment
- Dependency
- IpAddress
- Node
- Route
- Siebel Enterprise
- Siebel Gateway
- Siebel Web Application
- Siebel Web Server Extension
- WebServer

Note: To view the topology, see "Siebel Web Topology View" on page 797.

Siebel Web Applications by TTY Job

This section includes details about the job.

Trigger Query



Node Name	Condition
Node	NOT CI Type Equal nt
WebServer	None

Node Name	Condition
IpAddress	NOT IP Probe Name Is null
Shell	NOT Reference to the credentials dictionary entry Is null

Adapter

This job uses the **SIEBEL_DIS_WEBAPPS_UNIX** adapter.

Used Scripts

- siebel_discover_wse.py
- NTCMD_HR_REG_Software_Lib.py

Discovered CITs

- Composition
- ConfigurationDocument
- Containment
- Dependency
- IpAddress
- Node
- Route
- Siebel Enterprise
- Siebel Gateway
- Siebel Web Application
- Siebel Web Server Extension
- WebServer

> **Note:** To view the topology, see "Siebel Web Topology View" on page 797.

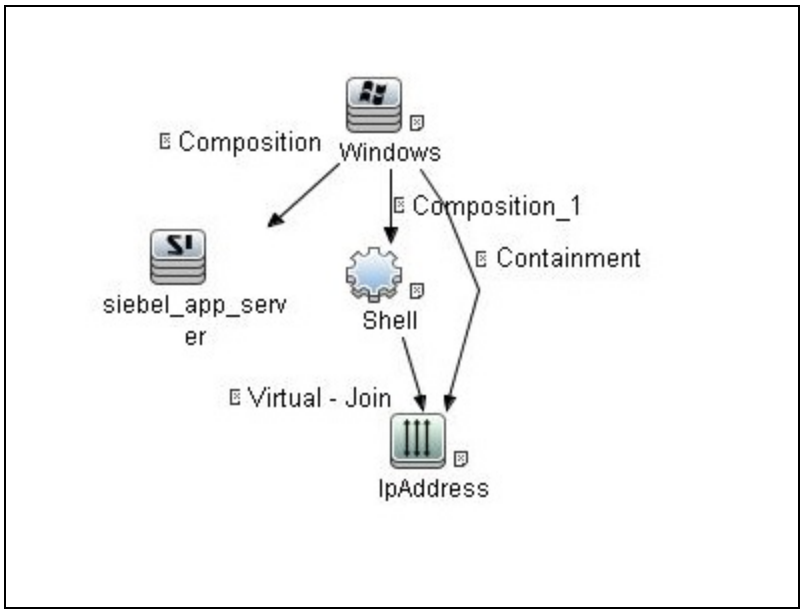
Parameters

- **eappsCfgPath.** The path to the Siebel Webserver Extension configuration file (eapps.cfg).

Siebel DB by NTCMD or UDA Job

This section includes details about the job.

Trigger Query



Adapter

This job uses the **SIEBEL_DIS_DB_NT** adapter.

Used Script

- db_platform.py
- db.py
- db_builder.py
- siebel_discover_odbc.py

Discovered CITs

- Composition
- Containment
- Database
- Dependency
- IpAddress
- Node

> **Note:** To view the topology, see "Siebel Topology View" on page 796.

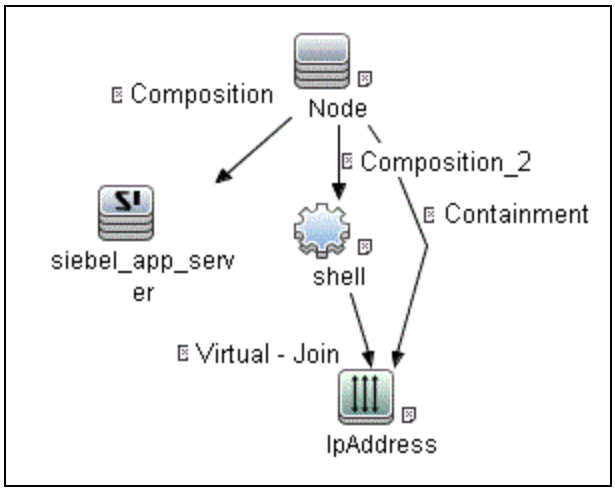
Parameter

- **oracle_name.** Can include several ORACLE_NAME paths (for different machines), comma separated. If empty, a hard-coded (in the script) registry is used.

Siebel DB by TTY Job

This section includes details about the job.

Trigger Query



Node Name	Condition
Node	NOT CI Type Equal nt
siebel_app_server	None
IpAddress	NOT IP Probe Name Is null
Shell	NOT Reference to the credentials dictionary entry Is null

Adapter

This job uses the **SIEBEL_DIS_DB_UNIX** adapter.

Used Script

- db_platform.py
- db.py
- db_builder.py
- siebel_discover_odbc.py

Discovered CITs

- Composition
- Containment
- Database
- Dependency
- IpAddress
- Node

> **Note:** To view the topology, see "Siebel Topology View" on page 796.

Troubleshooting and Limitations – Siebel Discovery

The Siebel DB by TTY job cannot discover virtual Siebel application servers (with a different name and configuration to the actual Siebel application server) running on UNIX machines.

Part 7: Hosts and Resources

Chapter 52: Application Signatures

This chapter includes:

- Overview 813
  - Method Capabilities 813
  - Signature Repository 814
  - Input Data 814
- Topology 815
- Application Signatures Mechanism 817
  - Jobs and Adapters 818
  - Jobs and Default Behavior 818
  - Host Resources Jobs Flow 819
  - Application Signatures Flow 820
- Application Signatures Configuration File 823
  - Configuration File Structure 824
  - Elements and Attributes 824
- Plug-Ins 829

Overview

Application signatures is a method of identifying applications running on a target host, based on previously discovered host resources data; specifically:

- Processes
- Open ports (optional)

However, depending on context, application signatures can mean the:

- Method of identification in general
- Discovery module that implements the method
- Configuration file describing signatures

Method Capabilities

The capabilities of the application signatures method include:

- Identification of applications based on full or partial match of process names.
- Identification of applications based on presence of specific open ports.
- Identification of applications based on presence of specific substrings in command lines of the processes.
- Distinction between instances of applications where several are running on the same host. (Limitations apply.)
- Reporting specific subclasses of RunningSoftware CIT if enough identification information is available.
- Completing additional attributes for RunningSoftware CIs. Data can be taken from processes by using parse rules.
- Support for plug-ins. Whenever an application is found, it is possible to execute additional commands and enrich the topology of the application with more data.

For more information, see "Application Signatures Mechanism" on page 817.

Signature Repository

Application Signatures uses a repository of signatures stored in a configuration file called **applicationsSignature.xml**. This XML file contains a number of Application-Component elements, each describing a signature for specific application or flavor of application. For example, the signature for Microsoft IIS Web server may look as follows:

Microsoft IIS Web server signature

```
<Application-Component name="Microsoft IIS WebServer" ci_type="iis"
category="Web Server"
     vendor="microsoft_corp" installedSoftwareName="\s*IIS\s+.*" supported_
versions="5.1, 6.0, 7.0">
          <process name="inetinfo.exe" ports="all,None" cmdline=""
          description="Microsoft Internet Information Service process." />
          <process name="w3wp.exe" ports="None" cmdline=""
          description="Microsoft Internet Information Service worker process."
/>
</Application-Component>
```

For more information, see "Application Signatures Configuration File" on page 823.

Input Data

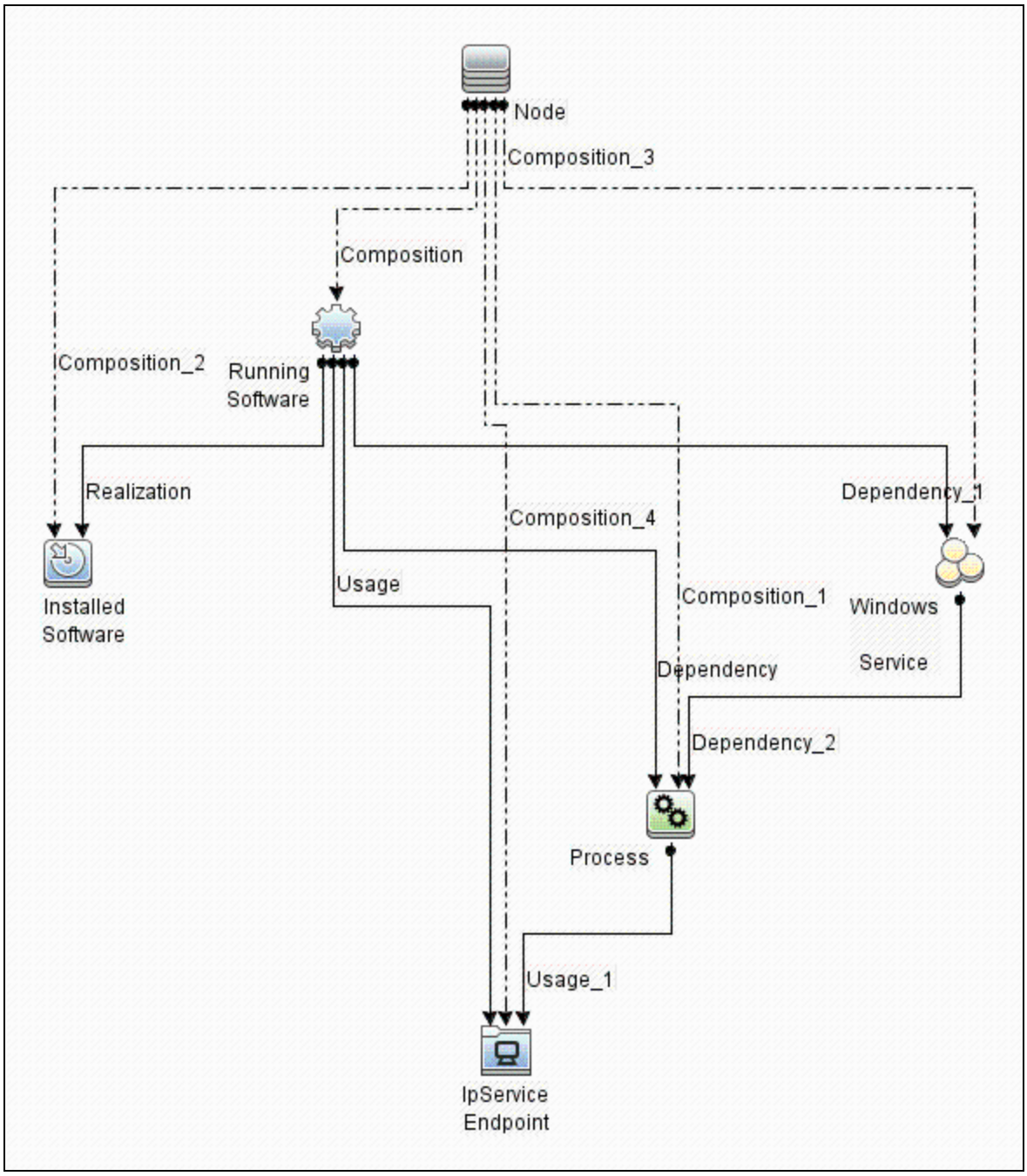
Application Signatures uses the following input data:

- Processes running on the host, including"
  - name
  - PID
  - command line, executable path, arguments
  - owner
- Ports of processes (optional)
  - regular open ports and listening ports
  - which interfaces the ports are open on
- Installed Software (optional)
- Services (optional)

Processes and ports information is used in identification of applications. Information about services and installed software is not used in identification, but allows the building of relationships to corresponding topologies.

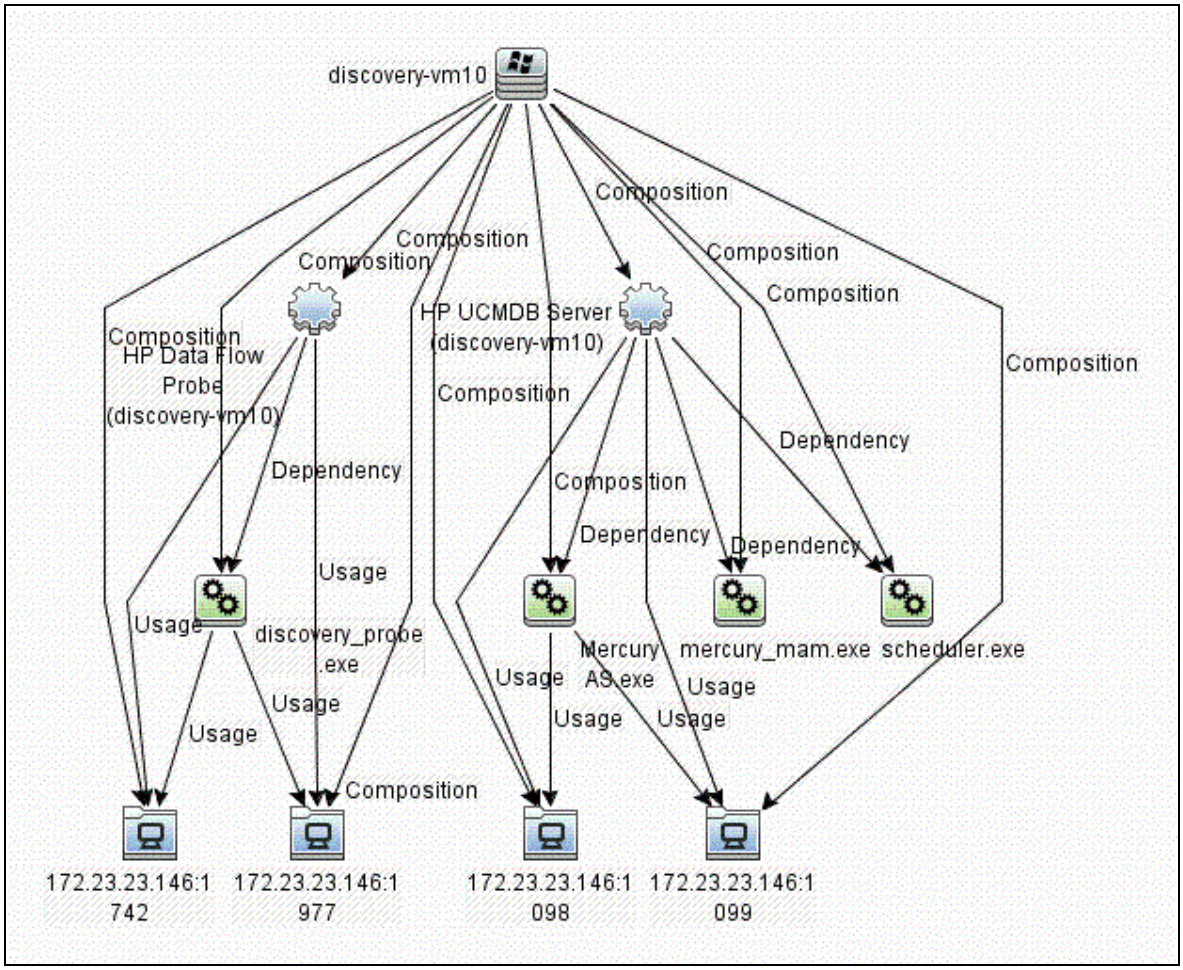
Topology

The main element of Application Signatures topology is the RunningSoftware CIT, representing running applications. The following image shows the type of topology reported by Application Signatures.


Node
Composition_3
Composition
Composition_2
Running
Software
Realization
Dependency_1
Composition_4
Installed
Software
Usage
Composition_1
Windows
Service
Dependency
Dependency_2
Process
Usage_1
IpService
Endpoint

Topology Example

The following image is an example of topology found which includes HPE UCMDB Server and Data Flow Probe running on the same host.



Application Signatures Mechanism

This part includes:

- "Jobs and Adapters" on the next page
- "Jobs and Default Behavior" on the next page
- "Host Resources Jobs Flow" on page 819
- "Application Signatures Flow" on page 820

Jobs and Adapters

Application Signatures run as a part of host resources jobs. There are several adapters implementing host resources discovery, and for each there are two jobs:

- **Adapter: Host Resources by TTY (TTY_HR_All.xml)**
  - Job: Host Applications by Shell
  - Job: Host Resources by Shell
- **Adapter: Host Resources by WMI (WMI_HR_ALL.xml)**
  - Job: Host Applications by WMI
  - Job: Host Resources by WMI
- **Adapter: Host Resources by SNMP (SNMP_HR_ALL.xml)**
  - Job: Host Applications by SNMP
  - Job: Host Resources by SNMP
- **Adapter: Host Resources by PowerShell (PowerShell_HR_All.xml)**
  - Job: Host Applications by PowerShell
  - Job: Host Resources by PowerShell

Jobs and Default Behavior

The jobs **Host Resources by X**, by default:

- Discover and report CPUs
- Discover and report Disks
- Discover and report Memory
- Discover and report Users
- Discover and report Network Shares
- Discover processes, and save data to Probe database
- Discover process ports, and save data to Probe database
- Discover and report process-to-process topology
- Do not run Application Signatures discovery

The jobs **Host Applications by X**, by default:

- Discover processes, and save data to Probe database
- Discover process ports, and save data to Probe database
- Discover installed software
- Discover and report process-to-process topology
- Run Application Signatures discovery

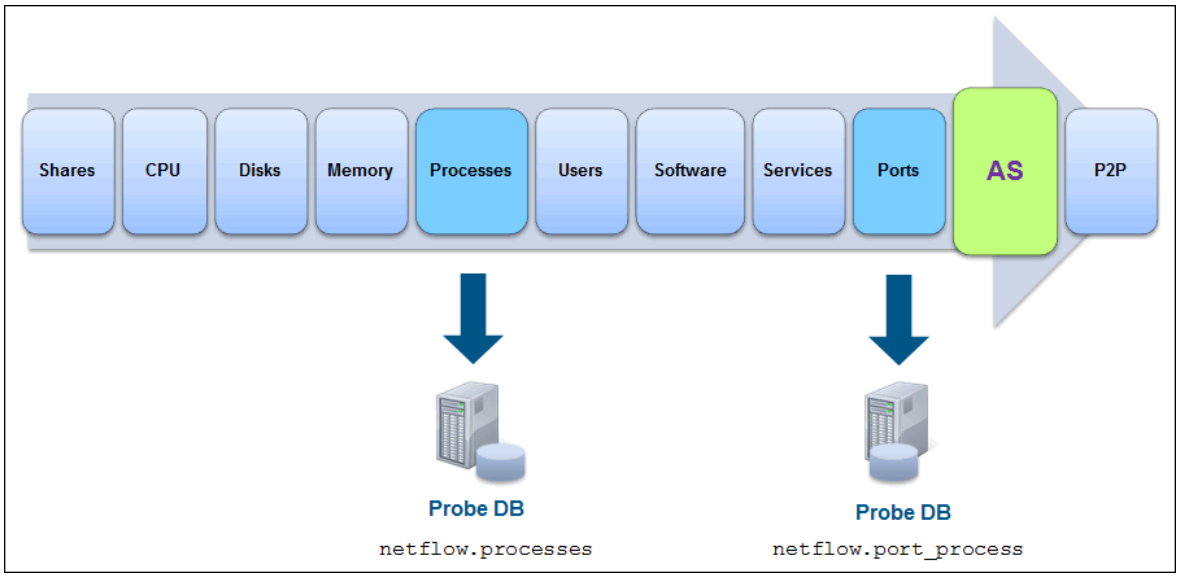
> **Note:** None of the listed jobs discover Services by default.

Jobs provide parameters that control which part of the host resources topology should be reported. You may create a new custom job based on the same adapters, where the parameters can be changed to desired values. See "Host Resources and Applications Discovery" on page 842.

Application Signatures discovery is also available as a part of Management Zones discovery. To invoke applications discovery using Application Signatures, you should configure a Basic Software Configuration Discovery. See "Universal Discovery Activities" in the *HPE UCMDB Discovery and Integrations Content Guide - Discovery Activities* document.

Host Resources Jobs Flow

The following image shows the general flow of Host Resources jobs, though some parts of the flow may be enabled or disabled via parameters:



The flow of host resources jobs related to Application Signatures is as follows:

1. Processes discovery runs as a part of the Host Resources job. Discovered processes are saved to the Probe's database (in the table netflow.processes). If the job's parameter **discoverProcesses** is set to true, these processes are added to the results vector at this point. Otherwise the processes are not reported immediately.
2. TCP discovery runs, which discovers all open ports; both listening ports and regular client ports. This data is saved to the Probe's database (in the table table netflow.port_process).
3. The Application Signatures engine is configured, and discovered processes and open ports are passed to the engine as input data. If Services and Installed Software objects were discovered, they are also passed to the Application Signatures engine.
4. Application Signatures runs, and performs identification of applications, and reports corresponding topology.
5. Process-to-process discovery runs, reporting client-server links between processes.

Application Signatures Flow

Application Signatures performs the following activities to identify and reports applications and related topology:

1. Engine reads configuration from applicationsSignature.xml file.
2. Engine tries to relate discovered processes to each signature.
3. Engine validates and discards unmatched signatures and signatures with unsatisfied requirements.
4. Engine makes a decision about the number of instances of applications for each signature.
5. Engine creates OSH objects corresponding to applications.
6. Engine performs updates of application attributes by evaluating expressions using parse rules if they are present. Attribute updates may be optional or required. If a parse rule used in the expression of required attribute fails to match, the application instance is skipped. Optional attribute update has no such effect.
7. Engine finds all suitable plug-ins for particular application and executes them. Plug-in has ability to run additional commands with the same client, update attributes, enhance topology, and even make a decision to skip the application.
8. Engine forms results vector with all application objects. Also at this stage, it links application and processes with installed software and services.

Identifying application instances

Many applications support instancing - multiple independent sub-applications running on the same host. It is common for such instances to have names or other identifiers in order to distinguish them. Instancing support in Application Signatures is based on the idea that for each instance, there is a corresponding designated process running. It means there is a 1:1 relationship between the number of such processes and the number of application instances. Identifying and marking such processes in the Application Signatures configuration file enables reporting of such instanced applications. For this purpose, the **main-process** boolean attribute was introduced for the element **process** in the signatures.

The attribute **main-process** affects the topology of the application as follows:

- When the **main-process** attribute is not set for any process in **application-component**, or is set to **false** (default), a single **RunningSoftware** CI is created, and all processes are linked to this CI.
- When the **main-process** attribute is set to **true** for a process, the process is regarded as the one that identifies the application instance. The number of such processes defines the number of application instances and the number of **RunningSoftware** CIs created. Each instance of main process is linked to only one corresponding **RunningSoftware** CI. All other processes are considered 'shared' and are linked to all **RunningSoftware** CIs created.

Example of signature of instanced application

```
<Application-Component name="A" >
     <process name="P1" main-process="true" ports="None" cmdline=""
      required="true" />
     <process name="P2" ports="None" cmdline="" />
</Application-Component>
```

- Signature of application A consists of process **P1** with **main-process** attribute set to **true** and process **P2**.
- Discovered data contains 2 instances of process **P1** (P11, P12) and 2 instances of process **P2** (P21, P22).
- Resulting topology is the following:
- Two **RunningSoftware** CIs **A1** and **A2** since there are two processes marked as main.
- **A1** is linked to processes **P11, P21,** and **P22**.
- **A2** is linked to processes **P12, P21,** and **P22**.

> **Note:** Instancing for applications without designated process(es) per instance with a 1:1 relationship, is not supported.

Attribute updates and expressions evaluation

Application Signatures supports attribute updates - declarations in the signature of applications that specific attributes of reported **RunningSoftware** CIs should be filled with specified values. Values may be:

- constants
- expressions containing strings and references to values of evaluated parse rules

A parse rule is a pattern declared in the signature that is matched against the data of the applications, such as command lines or paths of the processes. Patterns of a parse rule either match or do not match. A parse rule pattern is a regex (regular expressions) pattern. When a parse rule matches, corresponding matched string or groups can be used in expressions of attribute updates. If a parse rule is declared to match against the property of process, matching of the parse rule is performed against every process, one by one until the first match.

The following is an example of signature for the **Active Directory Application Mode** application, where attribute update with a parse rule is used:

Active Directory Application Mode with attribute updates

```
<Application-Component name="Active Directory Application Mode" ci_type="adam"
category="Enterprise App" vendor="microsoft_corp">
     <parse-rule id="instance_name" name="cmdline">.+\s+-sn:([\w-]
       +).*</parse-rule>
     <process name="dsamain.exe" main-process="true" ports="ldap,636,
       None" required="true" cmdline="" description="Main AD
       Application Mode process" />
<attribute name="name" value="${instance_name(1)}" type="string" />
</Application-Component>
```

The flow for this signature is as follows:

- Process **dsamain.exe** that is found on the target host allows this signature to match and produces **RunningSoftware** of type **adam.**
- When the engine gets to the point of attribute updates, all parse rules are matched for this application:

  - The pattern of parse rule **instance_name** is matched against command lines of processes found.
  - The pattern uses capturing groups; the matched pattern exposes both the whole matched string and group 1 captured. This group contains the value of ADAM instance.
- Expression of attribute update ${instance_name(1)} is evaluated, and it translates to a string containing the instance name of ADAM extracted from the command line,
- The value is reported to attribute **name** of application CI.

Ports matching and reporting

The element **process** in the signature can specify port values that affect whether this **process** element matches, and what ports are reported. Ports are specified using the attribute **ports**: a comma-separated list of values.

The following rules apply:

- If among the values of the **ports** attribute there is a 'None' string, the **process** element always matches, regardless of ports discovered for this process.
- Otherwise, in order for the element **process** to match, the discovered process should have all corresponding ports open that are specified in the attribute.
- Only ports specified in the attribute **ports** are reported
- Application Signatures can also report all ports of the application listened to. There are two ways to enabled this:
  - Only for specific application and specific process by including the keyword 'all' in the value of the **ports** attribute
  - Globally via boolean parameter **discoverAllListenPorts** in the configuration file **globalSettings.xml**. For example:

    globalSettings.xml

    ```
    <property name="discoverAllListenPorts">false</property>
    ```

Application Signatures Configuration File

The configuration file **applicationsSignature.xml** is a repository of signatures for application signature discovery. Each signature contains a set of processes associated with the application. An example

signature follows:

Signature for PostgreSQL Database Application

```
<Application-Component name="PostgreSQL" category="Database" vendor="PostgreSQL"
  supported_versions="7.x, 8.x" installedSoftwareName="PostgreSQL.*">
  <process name="pg_ctl.exe" ports="postgresql,None" cmdline=""
description="PostgreSQL Server." />
  <process name="postmaster" ports="postgresql,None" cmdline=""
description="PostgreSQL Server." />
</Application-Component>
```

Configuration File Structure

The element **Applications** is the root of the configuration file, it contains a list of signatures represented as **Application-Component** elements. The additional element **Default-Application-Type** specifies the CIT to use when reporting applications.

Signature for PostgreSQL Database application

```
<Applications parserClassName="com.hp.ucmdb.discovery.library.
communication.downloader.cfgfiles.ApplicationSignatureConfigFile">

     <Default-Application-Type>running_software</Default-Application-Type>

     <Application-Component name= ... >
         <process name= ... />
     </Application-Component>

     ...

     <Application-Component name= ... >
          <process name= ... />
     </Application-Component>

</Applications>
```

Elements and Attributes

Application-Component element

The **Application-Component** element defines a signature for a specific application, or type of application. It may contain the attributes described in the following table:

Attribute	Optional?	Description
name	No	The name of application. This value is reported to the **DiscoveredProductName** attribute of the application CI.
app_id	Yes	The ID of the signature. If this attribute is not set, the value of the attribute **name** is used for ID. **Note:** All ID values must be unique within the configuration file.
category	Yes	The category of the application. This value is passed to the application's **application_category** attribute. Examples: Database, Cluster.
vendor	Yes	The application vendor. This value is passed to the application's **vendor** attribute. Example: hewlett_packard_co.
supported_versions	Yes	A list of versions for which the signature applies. This information has no impact on reported topology and is present for informational purposes only.
installedSoftwareName	Yes	The regex (regular expression) pattern used to report relationships with Installed Software. Whenever the name of Installed Software matches the pattern, corresponding relationships are reported.
ci_type	Yes	The CIT name that should be used when the application is reported. If not specified, the default CIT is used: RunningSoftware. Example: <Application-Component name="Oracle DB" ci_type="oracle"> says that this application should be reported as CIT "oracle".
discover	Yes	A boolean attribute which enables (**true**) or disables (**false**) the signature. **Default:** True.

The **Application-Component** should contain one or more **process** elements, which define what processes should be discovered in order for this application to be reported. A process element may contain the attributes described in the following table:

Attribute	Optional?	Description
name	No	The name of the process.

Attribute	Optional?	Description
ports	No	A comma-separated list of ports the process should listen to, or should have open, in order to be matched. Each port may have one of the following values: • None. The process matches even if it does not listen to any port. • Numeric value or a named port that resolves to numeric value. The process should listen to this port, or should have this port open in order to match. Examples: 1521, mysql. Port names are resolved against the portNumberToPortName.xml configuration file. • All. Specifies that all ports listened to should be reported All ports matched through this pattern are reported as IpServiceEndpoint CIs.
cmdline	Yes	The substring that should be present in the command line of the process for it to match.
description	Yes	The description of the process. The value of this attribute is passed to the **description** attribute of processes CIs that match this process element.
startswith	Yes	A boolean attribute that enables partial matching of the process names. When this attribute is set to **true**, any process whose name starts with the string specified in the attribute **name**, matches.
required	Yes	A boolean attribute which, if set to **true**, specifies that the process is required for the application to be reported. If this process element does not match to any process, the application is not reported.
main-process	Yes	A boolean attribute indicating, if set to **true**, that this process is the main process of the application. For each main process found on the host, a separate application topology is reported.
ignore-case	Yes	A boolean attribute specifying whether the process name matching is case-sensitive (**true**) or not (**false**). **Default:** False.

Parse-rule element

A parse-rule element defines a parse rule that is applied to a specific property of a process that is found, in order to extract some values. A parse rule is essentially a regular expression that should match against a process property. If this regex contains capturing groups, it is possible to extract the values of these groups and use them in expressions of attribute updates. This regular expression is written in the text part of the element. A parse-rule element may contain the attributes described in the following table:

Attribute	Optional?	Description
id	No	ID of the parse rule; a unique string identifying this parse rule.
name	No	Name of process property this rule should be matched against. Supported properties: • **cmdline** • **ip** • **name** • **owner** • **path** • **port**
method	Yes	The method to use when matching the pattern, being one of the following: • **match**. The entire property is matched against the pattern. It behaves like the regular expression 'match' operation. • **search**. The pattern is searched for within the string. It behaves like the regular expression 'search' operation. **Default:** Match.

Attribute element

When the element **Attribute** appears under an **Application-Component** element, it means that the specified attribute of the reported application CI should be set to the specified value. The value may be a constant, string, or an expression with parse rule references. An attribute element may contain the attributes described in the following table:

Attribute	Optional?	Description
name	No	The name of the attribute to set.
value	No	An expression that defines the value of the attribute. This expression may contain regular text which will be used without modification, and references to parse rules. Parse rule reference is defined as follows: • ${rule_id} - A whole match of the parse rule with ID rule_id is inserted into the resulting string during expression evaluation. • ${rule_id(group_numer)} - When parse rule with ID rule_id matches the value of capturing group number group_number is inserted into result string.

Attribute	Optional?	Description
required	Yes	A boolean attribute specifying whether (**true**) or not (**false**) the attribute is required. If the attribute is required, an application is skipped whenever the expression of attribute fails evaluation. If the attribute is not required and expression evaluation fails, the application is reported without this attribute set. **Default:** True.

clustered-application element

An Application-Component element may contain the additional element **clustered-application** which marks the application as clustered. Marking an application as clustered results in reporting the parent Node CI for this particular application as a weak Node by the application IP. Applications not marked as clustered use the parent Node CI restored from CMDB ID.(The default behavior).

Example of usage of clustered-application element

```
<Application-Component name="MSSQL DB" category="Database" ci_type="sqlserver"
vendor="microsoft_corp">

     <clustered-application/>

</Application-Component>
```

application-ip-source element

A process element may contain the additional element **application-ip-source**. This element marks processes as a source of application IP, and affects how an application IP is chosen for a particular application. When one of the processes is marked as a source of application IP, only IP addresses this process listens to are considered for application IP. When none of the processes are marked, all IPs of all processes are considered for application IP. (The default behavior).

Example of usage of application-ip-source element

```
<Application-Component name="MSSQL DB" category="Database" ci_type="sqlserver"
vendor="microsoft_corp">

     <process name="sqlservr.exe" main-process="true" ports="sql,None"
cmdline="" required="true" description="Provides storage, processing and
controlled access of data and rapid transaction processing." >

          <application-ip-source />
```

```
    </process>

</Application-Component>
```

service-endpoint-name element

A process element may contain an additional element: **service-endpoint-name**. When a process has this additional element, all IpServiceEndpoint CIs of this process are reported with the specified name. If this element is not used, the name of IpServiceEndpoint CIs is resolved using the portNumberToPortName.xml file. (This is the default behavior.)

Example of usage of service-endpoint-name element

```
<Application-Component app_id="Weblogic on Windows" name="WebLogic AS"
category="J2EE Server" ci_type="weblogicas" vendor="bea_systems_ltd">

    <process name="java.exe" main-process="true"
ports="weblogic,weblogicSSL,None" cmdline="-Dweblogic.Name=" >

            <service-endpoint-name>weblogic</service-endpoint-name>

        </process>

</Application-Component>
```

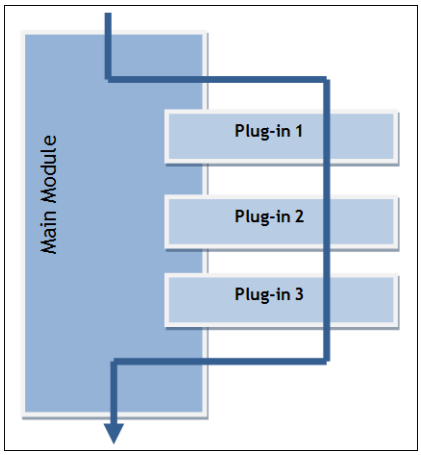
Plug-Ins

Application Signatures plug-ins are ways of dynamically adding or removing functionality . Usually plug-ins are independent of each other and perform a single task.

In Universal Discovery, there is always a flow of execution similar to the following:

- Discovery job starts
- Job performs some activity (that is, executes commands)
- Job formats results as a vector of Object State Holders
- Job returns results and the execution ends

To add plug-ins to this job, the job at some point should pass control to the plug-ins and allow them to affect the results. This can be seen in the following diagram, where the arrow represents execution flow:



In general, for this mechanism to work at the point where the main module passes control to plug-ins, the answers to the following questions must be known:

- What plug-ins exist in the system?
- What plug-ins, from the whole set of plug-ins, should run along with this module?
- What is the order of plug-ins?
- Where is the plug-in's code, and how can it be instantiated?
- How does a plug-in pass its results to main module?

Plug-Ins Framework Overview

AutoDiscoveryContent package includes the python library **plugins.py**. This library contains the following classes that are used by the plug-ins feature:

- **Plugin**

  This is a base class for plug-ins. You should extend it to create a new plug-in. It contains the following methods:

  - isApplicable(context) – Method that is called by the plug-ins' framework, where the plug-in has a chance to perform a runtime check against a passed data in order to verify that required conditions are met. For example, in Application Signatures you can verify that a found application has information about a process with a specific name, and this process has a non-empty command line. Method should return True(1) if requirements are met. Implementation of this method is optional.
  - process(context) - Main method of the plug-in; where the main functionality should reside.

- **PluginContext**

This class represents an object that allows sharing data between the main module and a plug-in, and between plug-ins. The main module can pass relevant data and support objects to the plug-in, such as a Discovery Framework object, and initialized clients. In turn, the plug-in can use these objects for its work and store the results in the same context. Both methods of the Plugin class - **isApplicable()** and **process()** - accept single parameter context.

> **Note:** The base class **PluginContext** does not have any methods out-of-the-box, since such methods are mostly defined by the data that plug-ins want to use and may differ from module to module. If you who want to add support for plug-ins to a module, you must create the appropriate context class.

- **PluginEngine**

  This is a main class that encapsulates all work with plug-ins. Its purpose is to find appropriate plug-ins, instantiate them, and run them when the client code passes control to it. The client module should create this object and use it without being concerned how the plug-in mechanisms are implemented. This class has one public method:

  - process(context, filter) – Main method of the plug-ins engine. In this method, engine forms a chain of plug-ins using the provided filter object. (See "PluginFilter", below.) For each such plug-in, it calls the isApplicable() method while passing context. If the plug-in returns **true**, the plug-in's method process() is called with the same context. This way the context is passed from plug-in to plug-in.

- **PluginFilter**

  This represents a class encapsulating the logic of filtering plug-ins: selecting only the required plug-ins from the pool of all available plug-ins. PluginFilter defines asingle method:

  filterPlugins(pluginDescriptors) – method that accepts the list of plug-in descriptors(described further) and returns the list of only those descriptors that satisfy some criteria. This method is called from PluginEngine.

- **QualifyingFilter**

  This is an implementation of **PluginFilter**, where the decision whether some plug-in should be included in the chain, is based on qualifiers defined in the plug-in descriptor and qualifiers of the filter itself. (See "Qualifiers" on page 835.) This class has the additional method: **addQualifier(type, value)** which adds a qualifier to this filter with a specific type and value.

Plug-In Packages Overview

Plug-ins are organized into plug-in packages. Each such package is a collection of plug-ins that usually

have a common theme. For example: all discover SQL database version by shell. Usually the code for plug-ins is in one python module (a .py file) but it is possible to use multiple scripts if required.

Each plug-in package contains the following files:

- package configuration file
- one or more python scripts containing code for the plug-ins (one subclass of Plugin class per plug-in)

Plug-in Package Configuration File

The plug-in package configuration file is an XML file with meta information describing the plug-ins. For example:

db_versions.package.xml

```
<?xml version="1.0" encoding="UTF-8" ?>
<package parserClassName="com.hp.ucmdb.discovery.
library.communication.downloader.cfgfiles.PluginsPackageConfigFile">
    <plugins>
      <plugin id="mysql_version_by_shell">
         <name>MySql version by shell</name>
         <description>Sets MySQL version attribute for discovered
          MySQL Server CI</description>
         <module>plugins_appsignature_dbversion_by_shell</module>
         <class>MySQLVersionShellPlugin</class>
         <qualifiers>
           <qualifier type="application">MySQL DB</qualifier>
           <qualifier type="protocol">ntadmin</qualifier>
           <qualifier type="protocol">ssh</qualifier>
           <qualifier type="protocol">uda</qualifier>
           <qualifier type="protocol">telnet</qualifier>
         </qualifiers>
         <dependencies>
           <module>file_ver_lib</module>
           <module>mysql_version_by_shell</module>
         </dependencies>
       </plugin>
     ...
     </plugins>
</package>
```

```
<?xml version="1.0" encoding="UTF-8" ?>
<package parserClassName="com.hp.ucmdb.discovery.
library.communication.downloader.cfgfiles.PluginsPackageConfigFile">
    <plugins>
```

```
      <plugin id="mysql_version_by_shell">
         <name>MySql version by shell</name>
         <description>Sets MySQL version attribute for discovered
          MySQL Server CI</description>
         <module>plugins_appsignature_dbversion_by_shell</module>
         <class>MySQLVersionShellPlugin</class>
         <qualifiers>
           <qualifier type="application">MySQL DB</qualifier>
           <qualifier type="protocol">ntadmin</qualifier>
           <qualifier type="protocol">ssh</qualifier>
           <qualifier type="protocol">uda</qualifier>
           <qualifier type="protocol">telnet</qualifier>
         </qualifiers>
         <dependencies>
           <module>file_ver_lib</module>
           <module>mysql_version_by_shell</module>
         </dependencies>
       </plugin>
     ...
     </plugins>
</package>
```

The format of this configuration file is as follows:

- Attribute **id** of the **plugin** element defines the unique identification string for this plug-in. It is required to uniquely maintain the scope in all deployed packages.
- Element **name** contains the user-friendly name of this plug-in, which may appear in the UI.
- Element **description** contains a user-friendly description of the plug-in.
- Element **module** defines the name of python module (.py file) with the code of the plug-in.
- Element **class** defines the name of class that extends **Plugin** class, and which the plug-ins engine tries to instantiate.
- Elements **qualifier** defines all qualifiers of plug-in; each such element has the attribute **type**, which is a type of qualifier.
- Elements **module** enclosed in **dependencies** elements, defines the modules that should be loaded before loading the module of the plugin, and which are used by this plugin module.

Plug-In Python Module

The plug-ins python module is a regular python script that contains the code for plug-ins. Each plug-in should extend the **Plugin** class from **plugins.py**. You can have more than one plug-in in one python

script, and you can have more than one script in one plug-ins package. Also, you are not limited in adding your own methods or classes.

Taking the "Plug-in Package Configuration File", the corresponding script follows:

plugins_appsignature_dbversion_by_shell.py

```
#coding=utf-8
import re
import sys
import logger
import mysql_version_by_shell
from file_ver_lib import getLinuxFileVer


from plugins import Plugin


class MySQLVersionShellPlugin(Plugin):
     """
         Plugin set MySQL version by shell, depends on OS type.
     """

     def __init__(self):
          Plugin.__init__(self)
          self.__client = None
          self.__process = None
          self.__isWinOs = None
          self.__cmd = None

     def isApplicable(self, context):
          self.__client = context.client
          try:
            if self.__client.isWinOs():
               self.__isWinOs = 1
               self.__process = context.application.getProcess
               ('mysqld-nt.exe')
               if not self.__process:
               self.__process = context.application.getProcess
               ('mysqld.exe')
         else:
               self.__process = context.application.getProcess
               ('mysqld')
         if self.__process:
               return 1
       except:
         logger.errorException(sys.exc_info()[1])

   def process(self, context):
```

```
      applicationOsh = context.application.getOsh()
      mysql_version_by_shell.setVersion(applicationOsh, self.__
      process.executablePath, self.__client)
...
class MySQLVersionShellPlugin(Plugin):
     """
         Plugin set MySQL version by shell, depends on OS type.
     """

     def __init__(self):
          Plugin.__init__(self)
          self.__client = None
          self.__process = None
          self.__isWinOs = None
          self.__cmd = None

     def isApplicable(self, context):
          self.__client = context.client
          try:
            if self.__client.isWinOs():
               self.__isWinOs = 1
               self.__process = context.application.getProcess
               ('mysqld-nt.exe')
               if not self.__process:
               self.__process = context.application.getProcess
               ('mysqld.exe')
         else:
               self.__process = context.application.getProcess
               ('mysqld')
         if self.__process:
               return 1
       except:
         logger.errorException(sys.exc_info()[1])

   def process(self, context):
      applicationOsh = context.application.getOsh()
      mysql_version_by_shell.setVersion(applicationOsh, self.__
      process.executablePath, self.__client)
...
```

Notice that script name and class name correspond to data in the configuration file.

Qualifiers

Qualifiers is the way to specify meta information for plug-in, which others can query and use. For example, you can say that a plug-in can run only on Windows, or is using a shell protocol. Qualifiers are

like tags, but they contain two bits of information: **qualifier type** and **qualifier value**. Qualifiers are not limited in any way, so it is possible to use arbitrary textual values.

We use the qualifiers mechanism to select which plug-ins should run at a particular time. We create the QualifyingFilter instance and specify qualifiers on that filter. This filter selects only those plug-ins which specify qualifiers of the same type and the same values, or do not have qualifier of that type at all.

For example, in the "Plug-in Package Configuration File" on page 832, there are 2 qualifiers:

- The qualifier **application** specifies that the plug-in should run only for applications with the name “MySQL DB”.
- The qualifier **protocol** specifies that the plug-in works with the following protocols: NTCMD, SSH, UDA, and Telnet.

Qualifiers information is accessible from the plug-in configuration file before the plug-in is even instantiated. This enables the static filtering of plug-ins.

How to Create a New Plug-In

1. You must become familiar with specific implementations of the **PluginContext** class in order to know what data a plug-in passes on. For Application Signatures, refer to **applications.py** where the **ApplicationSignatureContext** class is located.
2. Create a new python module and add an implementation of the **Plugin** class there. In particular, you should write the code for methods **isApplicable()** and **process()** which accept context instance. The results of plug-in work should be saved to context.
3. Create a new plug-ins package configuration file with meta information about the plug-in; you should specify there information such as the python module name, class name , and so on. See "Application Signatures Configuration File" on page 823.

   > **Note:** In particular, if necessary, you should specify the qualifiers for your plug-in which will be used to decide whether this plug-in should be run. You should know which qualifiers are actually used. For example, in Application Signatures, only 'application’ and ‘protocol’ qualifiers are specified.

4. Add the newly created file to a discovery package - either new or existing.

Plug-In Limitations

The downside of qualifiers and pluggability is that it can be difficult to determine how many plug-ins

exist, and which of them run for any particular discovered RunningSoftware.

Chapter 53: Host Resources and Applications by PowerShell Discovery

This chapter includes:

Overview 839

How to Discover Host Resources and Applications by PowerShell 839

Host Resources by PowerShell and Host Applications by PowerShell Jobs 840

Overview

Windows PowerShell is Microsoft's task automation framework, consisting of a command-line shell and associated scripting language built on top of, and integrated with, the .NET Framework. PowerShell provides full access to COM and WMI, enabling administrators to perform administrative tasks on both local and remote Windows systems.

How to Discover Host Resources and Applications by PowerShell

The following steps describe how to discover host resources and applications by PowerShell.

1. Prerequisites - Set up protocol credentials

   This discovery solution is based on the PowerShell protocol. The corresponding credentials must be filled in order to use it.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

   Before starting the discovery ensure that PowerShell v2.0 or later is installed on the Data Flow Probe machine.

2. Run the discovery

   To discover the topology:

   a. Run the **Range IPs by ICMP** or **Range IPs by nmap** job to discover the Windows system IP addresses.

   b. Run the **Host Connection by PowerShell** job to discover how Windows connects with the PowerShell agent and networking topology.

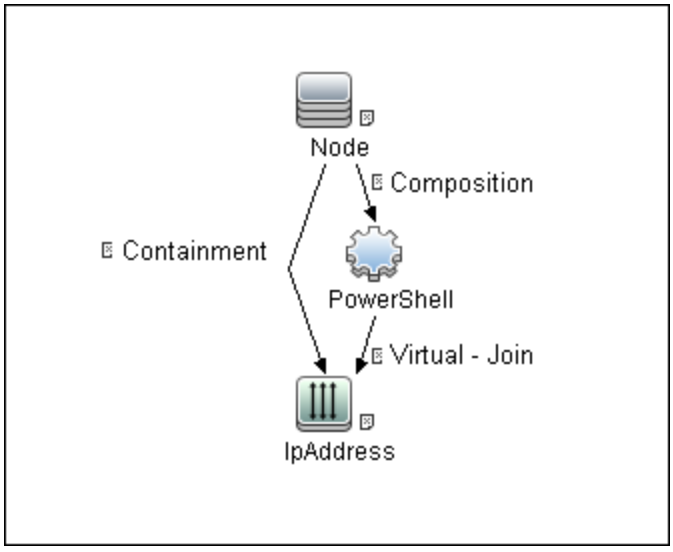
   c. Run the **Host Resources by PowerShell** and **Host Applications by PowerShell** jobs to discover the host resources topology.

      For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

Host Resources by PowerShell and Host Applications by PowerShell Jobs

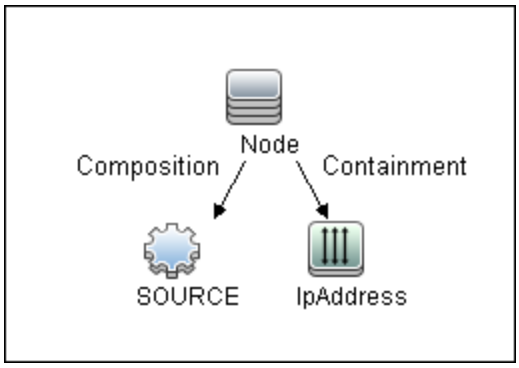
This section includes:

Trigger Query



Adapter

- Input CIT: PowerShell
- Input TQL Query:



Discovered CITs

- ClientServer
- Composition
- Containment
- Cpu
- Dependency
- FileSystem
- FileSystemExport
- IIS Application Pool
- InstalledSoftware
- IpAddress
- IpServiceEndpoint
- Node
- OS User
- Process
- Realization
- RunningSoftware
- Usage
- Windows Device Driver
- WindowsService

Chapter 54: Host Resources and Applications Discovery

This chapter includes:

Overview 843

Topology 843

How to Discover Host Resources and Applications 844

How to Revert to Previous Method of Discovering Installed Software 845

Host Resources and Applications Discovery 846

Troubleshooting and Limitations – Host Resources and Applications Discovery 852

Overview

The **Hosts and Resources** module discovers resources that exist on a host (for example, Disk, CPU, Users) as well as applications that run on that host. The module also discovers the relationships between the application and the relevant processes, the appropriate services, and the relevant IP Service Endpoint (port).

The **Host Resources by Shell/SNMP/WMI** and **Host Applications by Shell/SNMP/WMI** jobs:

- Discover the TCP connections of the discovered machines, using Shell or SNMP.
- Store the information in the Data Flow Probe-dedicated `netflow` database.
- Query the Data Flow Probe database for TCP information.

The **Host Resources by Shell** and the **Host Applications by Shell** jobs also gather connectivity information (either by running `netstat` commands or the **lsof** command).

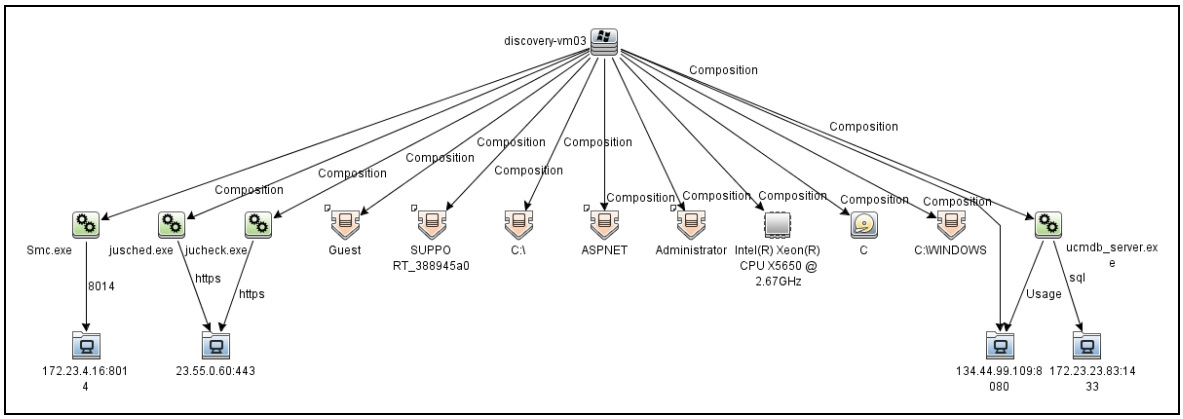
The relationships between processes and the relevant IP Service Endpoint (server port) can be discovered on Windows 2003 and Windows XP, SunOS, Hewlett-Packard UniX (HP-UX), AIX, and Linux operating systems.

For the HP-UX and AIX machines, you should install `lsof` software, which can be downloaded from the Internet from, for example, **http://www.netadmintools.com/html/lsof.man.html**. You can install **lsof** software also on SunOS. If you do not, the **pfiles** software that is installed on SunOS is used.

> **Note:** Process to process (**P2P**) discovery is the name given to the discovery of processes running on hosts in the environment.

Topology

> **Note:** For a list of discovered CITs, see "Discovered CITs" on page 852.



How to Discover Host Resources and Applications

This task includes the following steps:

1. Prerequisites - Set up protocol credentials

   To run this module, define the following protocols:

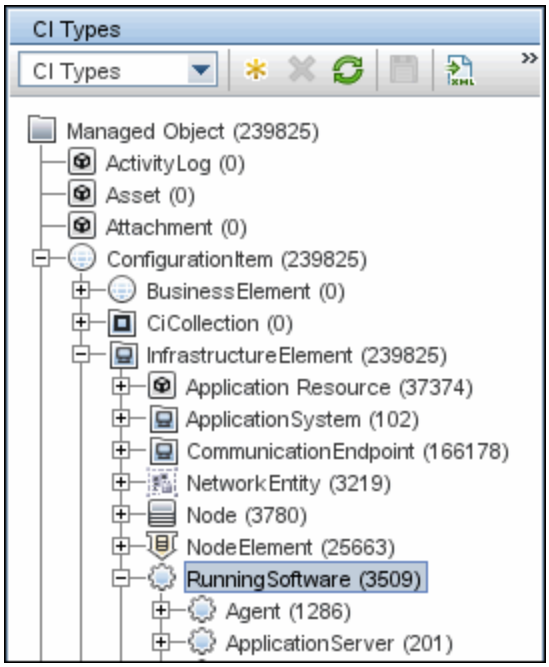
   - NTCMD Protocol
   - SNMP Protocol
   - SSH Protocol
   - Telnet Protocol
   - WMI Protocol

   Users do not need root permissions, but do need the appropriate credentials to enable connecting to the remote machines and running the relevant commands.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Prerequisites - Other

   Verify that the CMDB already contains the Agent and Shell CITs: **Modeling > CI Type Manager**. Search for **RunningSoftware**, and verify that Agent and Shell are present:



3. Run the Host Resources by Shell/SNMP/WMI and Host Applications by Shell/SNMP/WMI discovery

   Activate the relevant **Host Resources by Shell/SNMP/WMI** and **Host Applications by Shell/SNMP/WMI** jobs.

   The former jobs discover resources that exist on a node (for example, Disk, CPU, Users) and the latter discover applications that run on that host. (See "Application Signatures" on page 812.) The jobs are scheduled to run every day.

How to Revert to Previous Method of Discovering Installed Software

The Host Applications by WMI job discovers installed software that is installed using the WMI Windows Installer Provider.

If the software is not installed with the Windows Installer, you must use the previous mechanism to discover the software.

To revert to the previous discovery mechanism for this job:

1. Access the Host Resources and Applications by WMI adapter: **Adapter Management > Host_Resources_By_WMI > Adapters > WMI_HR_All**.
2. In the **Adapter Definition** tab, locate the **Adapter Parameters** pane.
3. Double-click the **discoverInstalledSoftwareByOldMechanism** parameter to change the default value from **false** to **true**.
4. Save the change.

   A warning message is added to the communication log.

Host Resources and Applications Discovery

This section includes:

- "Job Threads" below
- "Locale-Based Processes" on the next page
- "Adapter Parameters for the Host Resources by Shell and Host Applications by Shell Jobs" on page 848
- "Adapter Parameters for the Host Resources by SNMP and Host Applications by SNMP Jobs" on page 851
- "Adapter Parameters for the Host Resources by WMI and Host Applications by WMI Jobs" on page 851
- "TCP Discovery" on page 851
- "Discovered CITs" on page 852
- "Used Scripts" on page 852

Job Threads

Each job is run using multiple threads. You can define a maximum number of threads that can be used concurrently when running a job. If you leave the box empty, the Data Flow Probe's default threading value is used (8).

The default value is defined in **DataFlowProbe.properties** in the **defaultMaxJobThreads** parameter.

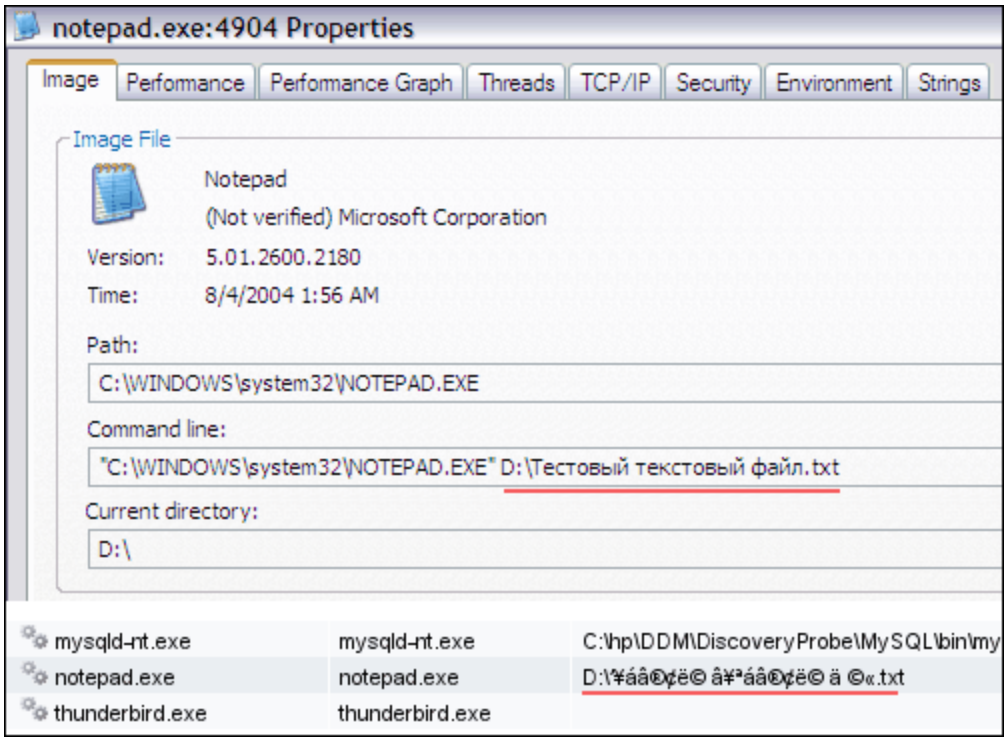
- **regularPoolThreads.** The maximum number of worker threads allocated to the multi-threaded activity (the default is 50).

- **priorityPoolThreads.** The maximum number of priority worker threads (the default is 20).

  > **Note:**
  >
  > - The number of actual threads should never be higher than `regularPoolThreads + priorityPoolThreads`.
  > - The jobs in this module require a permanent connection to the Data Flow Probe's internal database. Therefore, these jobs are limited to a maximum number of 20 concurrent threads (which is the maximum number of concurrent connections permitted to the internal database).
  > - For details on the Max. Threads field, see "Execution Options Pane" in the *HPE Universal CMDB Data Flow Management Guide*.

Locale-Based Processes

Discovery detects the locale used on a remote machine by searching for known keywords, adjusting the encoding, and using the correct regular expressions and strings. However, output may include characters in more than one language, in which case the characters may become corrupted. For example, in the following graphic, the command line uses a text file with Russian file name on an English Windows machine:



To prevent character corruption, Discovery uses a **wmic** command that saves the file in UTF-16 encoding. This is controlled by the **useIntermediateFileForWmic** parameter in the **globalSettings.xml** file (**Adapter Management > AutoDiscoveryContent > Configuration Files**). **True**: the parameter is enabled. The default value is **false**.

Adapter Parameters for the Host Resources by Shell and Host Applications by Shell Jobs

For details, see "Adapter Parameters Pane" in the *HPE Universal CMDB Data Flow Management Guide*.

Parameter	Description
checkHostName	Checks whether the host name from input CI is the same with the current one. If the host name from input CI is different from the current one, the relationship between IP address and node is removed. **Default:** False.
discoverCPUs	Enable to discover CPUs. **Default:** True.
discoverDisks	Enable to discover disks. **Default:** True.
discoverDrivers	Enable to discover Windows device drivers. **Default:** False.
discoverFcHBAs	Enable to discover Fibre Channel HBAs. **Default:** False. Supported platforms and protocols: • Windows over Shell-based and WMI protocols • SunOs over Shell-based protocol • HP-UX over Shell-based protocol
discoverInstalledSoftware	Perform software discovery. If set to true, all installed software (with or without a signature) is reported. **Default:** False. **Note:** Setting this parameter to true may adversely affect performance on the destination machine.

Parameter	Description
discoveriSCSIInfo	Enable to discover the iSCSI information. **Default:** False. **Note:** • Only Windows servers (2008 and later versions) support this feature. • If the namespace **root\microsoft\winodows\storage** does not exist on devices, this feature cannot work.
discoverMemory	Enable to discover memory. **Default:** True.
discoverModules	Specifies whether to perform module discovery. **Default:** False. **Note:** This parameter is applicable to the **Host Resources by SNMP** job only.
discoverP2P	Specifies whether to report TCP connections for running processes. • True. TCP connections for running processes are reported. • False. TCP connections for running processes are not reported. **Default**: True.
discoverProcesses	• **False**: Processes are not reported except in the following two scenarios: ◦ If you set the **discoverP2P** parameter to true, the processes that are related to TCP connections are reported regardless of the **discoverProcesses** parameter value. ◦ If you set the **discoverRunningSW** parameter to true, the processes that are related to the running software are reported regardless of the **discoverProcesses** parameter value. (The running software is specified in the **applicationsSignature.xml** file). • **True**. All processes are reported. **Default**: False.
discoverRunningSW	Specifies whether or not to discover Running Software. **Default:** False.

Parameter	Description
discoverServices	• **False**: Services are not reported. • **True**: All services are discovered. **Default**: False.
discoverShares	**True**: Shared resources are discovered, and **FileSystemExport** CITs are created. **Default**: True.
discoverUsers	Enable to discover users. **Note:** For Windows machines, only local users are discovered. **Default:** True.
filterP2PProcessesByName (formerly `filterProcessesByName`)	The names of the processes that are not reported. **Note:** This parameter only affects the P2P discovery. **Default:** system, svchost.exe, lsass.exe, System Idle Process. To prevent P2P running, enter an asterisk (*) as the value.
ignoreP2PLocalConnections	**False**: P2P discovery does not ignore local connections. That is, when a client and server are installed on the same host and the client-server relationship connects between them, P2P discovery should report this relationship.
ignoreUnnamedPorts	Specifies whether to report ports without service names. **Default:** False.
knownListeningPorts	Port numbers or port names that should be reported as IP service endpoint(* to report all).
lsofPath	The path to the `lsof` command that enables process communication discovery on UNIX machines. The default value is **/usr/local/bin/lsof,lsof,/bin/lsof**.
P2PServerPorts	Only processes connected to these ports (as client or server) are discovered, together with this port. This parameter can include a number or a known name. You separate entries with commas. An asterisk (*) signifies all ports. The default value is *.
useLSOF	**True:** Discovery tries to use lsof utility to discover port-to-process mappings on UNIX machines. **Default:** True.

Parameter	Description
useNetstatOnly	Specifies whether or not to run additional commands (LSOF) or to use the netstat command only. **Default:** False .
wmicPath	Specifies the location of the wmic.exe utility on Windows. **Default:** %SystemRoot%\system32\wbem\.
workInTopDown	Specifies whether it is a top-down discovery. **Default:** False .

Adapter Parameters for the Host Resources by SNMP and Host Applications by SNMP Jobs

For definitions of the parameters, see "Adapter Parameters for the Host Resources by Shell and Host Applications by Shell Jobs" on page 848.

Adapter Parameters for the Host Resources by WMI and Host Applications by WMI Jobs

For definitions of the parameters, see "Adapter Parameters for the Host Resources by Shell and Host Applications by Shell Jobs" on page 848.

TCP Discovery

The Client/server relationship. When checking connections between two destinations (IP and port pairs), DFM uses the following logic to decide which side is the server and which the client (descending, in order of importance):

- If one of the ports is a listening port (that is, is marked as listening in the `port_process` table), then this port is a server port.
- If one of the ports is used by a process that is known to be a server process, then this port is the server port.
- If a local port is not listening and the remote side has not yet been processed (TCP discovery has not yet run on the remote side), it is assumed that the remote port is the server port.
- If neither port is listening and none of the processes is known to be a server process, DFM does not report P2P connectivity.

Discovered CITs

Select a specific adapter in the **Resources** pane, and then go to the **Adapter Definition** tab **> Discovered CITs** pane.

For details, see "Discovered CITs Pane" of "Adapter Definition Tab" in the *HPE Universal CMDB Data Flow Management Guide*.

> **Note:** To view the topology, see "Topology" on page 843.

Used Scripts

Select a specific adapter in the **Resources** pane, and then go to the **Adapter Definition** tab **> Used Scripts Pane** pane.

For details, see "Used Scripts Pane" of "Adapter Definition Tab" in the *HPE Universal CMDB Data Flow Management Guide*.

Troubleshooting and Limitations – Host Resources and Applications Discovery

This section describes troubleshooting and limitations for Host Resources and Applications discovery.

- To discover processes and software running on a Solaris machine, verify that the **/usr/ucb/ps** utility is installed on the Solaris machine.
- Discovery of processes that have names with spaces is not supported on UNIX machines.
- Discovery of non-English content brought by ssh and telnet clients from UNIX machines is not supported.
- The installation date of installed software is not reported if the software was installed under a non-English-locale user.
- When DFM discovers installed software by WMI, and the software does not include a defined name, DFM does not report the software entity to the CMDB.
- The jobs **Host Resource by SNMP** and **Host Applications By SNMP** produce corrupted multibyte characters if the name or description of host resources (for example: processes, windows services, users, installed software) contains multibyte characters.

- Discovery of processes are not supported on VMware ESX servers.
- Discovery of CPUs, disks, and memory are not supported on Mac OS X.

Chapter 55: IBM i by Eview Discovery

This chapter includes:

Overview 855
Areas of Discovery 855
Supported Versions 856
Topology 856
IBM i Resources 856
IBM i Objects 857
Discovery Mechanism 858
How to Discover iSeries 858
IBM i Connection Job 858
IBM i Objects Job 859
IBM i Resources Job 862

Overview

The IBM i by Eview discovery is a full iSeries Agent based discovery for iSeries (AS400) servers. It uses the EView Technology iSeries client and Agent to perform the discovery on the iSeries system. The EView Agent is installed on the iSeries node to execute the discovery.

> **Note:** Refer to the EView 400 iSeries documentation for installation instructions.

The iSeries EView Client is installed on each probe that will be used to do IBM i by Eview Discovery jobs.

Areas of Discovery

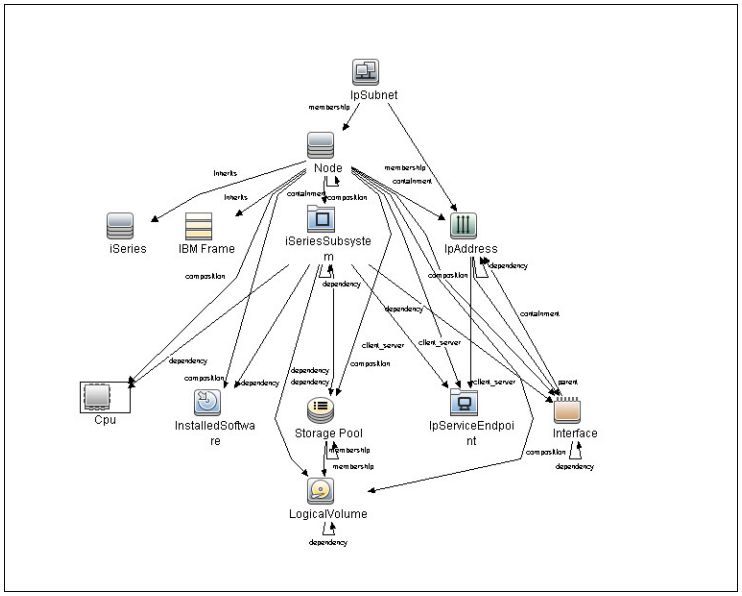
- **IBM i Resources**
  - Local Storage with ASPs
  - Memory
  - Lpars
  - CPUs
  - Network Connectivity
  - Installed Software
  - Selected System Values
  - Subsystems
  - Active Jobs
- **IBM i Objects**
  - Job Queues
  - Output Queues
  - Libraries
  - Program Objects

Supported Versions

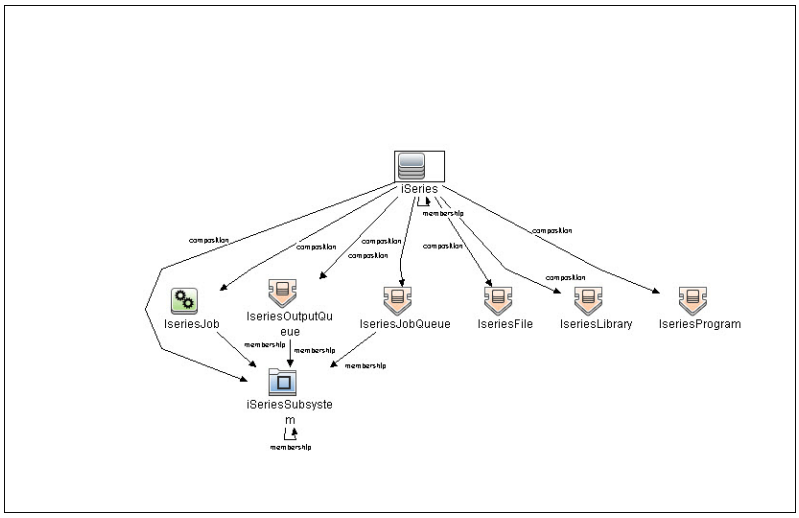
UCMDB Version	iSeries Version
9.x	OS/400 releases V5R1M0 and above

Topology

IBM i Resources



IBM i Objects



Discovery Mechanism

The discovery jobs use EView 400 Client and Agent. When activated, the discovery script uses the EView 400 client installed on the probe. The EView 400 client is accessed as a local shell.

The EView 400 client sends the commands issued by the script to the EView 400 agent running on the iSeries node. These commands are OS/400 and EView Agent commands. The result of the command execution is returned to the client, and then passed on to the calling script.

How to Discover iSeries

This task describes how to discover iSeries CIs using the EView Client and Agent.

1. Prerequisites

   Install **EView Agent** on the iSeries side, and **EView Client** on the DFM probe side. For instructions, refer to the EView 400 Discovery Installation Guide.

2. Run the Discovery

   a. Run the **Range IPs by ICMP** job to discover the target IPs.

   b. Run the **IBM i Connection** job to discover the target iSeries host .

   c. Run the **IBM i Resources** job to discover resource information from the iSeries LPAR, such as Cpus, Memory, Auxiliary Storage Pools and Disks, Subsystems, and Network Connectivity.

   d. Run the **IBM i Objects** job to discover object information from the iSeries LPAR, such as queues, jobs, program objects, and libraries.

IBM i Connection Job

This section includes details about the job.

Input CIT

• Discovery Probe Gateway

Used Scripts

- eview400_connection.py
- eview400_lib.py
- file_mon_utils.py
- file_ver_lib.py

Discovered CITs

- composition
- containment
- EView
- IpAddress
- iSeries

Adapter Parameters

Parameter	Description
EViewInstallationFolder	The installation root directory of the EView client on the probe server.
debugMode	This may be set to **true** or **false**. If set to **true**, it enables detailed logging in the probe's debug log. **Default**: false

IBM i Objects Job

This section includes details about the job.

Trigger TQL

Input CIT: EView

Trigger CI Data

Name	Value
ApplicationPath	${SOURCE.application_path:NA}
LparName	${HOST.name}
NodeName	${SOURCE.discovered_product_name}

Used Scripts

- eview400_objects.py
- eview400_lib.py

Discovered CITs

- Composition
- IseriesFile
- IseriesJob
- IseriesJobQueue
- IseriesLibrary
- IseriesOutputQueue
- IseriesProgram
- Membership
- iSeries
- iSeriesSubsystem

Adapter Parameters

Parameter	Description
commandTimeout	The timeout value (in seconds) after which the command issued against the EView agent will timeout.

Parameter	Description
	Default: 60
debugMode	This may be set to **true** or **false**. If set to **true**, it enables detailed logging in the probe's debug log. **Default**: false
discover_Jobs	This may be set to **true** or **false**. If set to **true**, the job will discover the Active Jobs on the iSeries LPAR. **Default**: false
discover_Library	This may be set to **true** or **false**. If set to **true**, the job will discover ISeries Library Objects. **Default**: true
discover_Program	This may be set to **true** or **false**. if set to **true**, the job will discover iSeries Program Objects. **Default**: false **Note:** Discovery of program objects is a time consuming job. Therefore, if setting this parameter to **true**, it is recommended to increase the value of the **commandTimeout** parameter.
discover_Queue	This may be set to **true** or **false**. if set to **true**, the job will discover the Queues (Job, Output). **Default**: true

IBM i Resources Job

This section includes details about the job.

Trigger TQL Query

Input CIT: EView

Trigger CI Data

Name	Value
ApplicationPath	${SOURCE.application_path:NA}
LparName	${HOST.name}
NodeName	${SOURCE.discovered_product_name}

Used Scripts

- eview400_resources.py
- eview400_lib.py

Discovered CITs

- ClientServer
- Composition
- Comtainment
- Cpu
- Dependency
- IBM Frame
- InstalledSoftware
- Interface
- IpAddress

- IpServiceEndpoint
- IpSubnet
- LogicalVolume
- Membership
- Node
- Parent
- Storage Pool
- iSeries
- iSeries Subsystem

Adapter Parameters

Parameter	Description
commandTimeout	The timeout value (in seconds) after which the command issued against the EView agent will timeout. **Default**: 60
debugMode	This may be set to **true** or **false**. If set to **true**, it enables detailed logging in the probe's debug log. **Default**: false
discover_ASP	This may be set to **true** or **false**. If set to **true**, the job will discover Auxillary Storage Pools and Disk Units. **Default**: false
discover_CPUs	This may be set to **true** or **false**. If set to **true**, the job will discover iSeries LPAR CPU CIs. **Default**: true
discover_Network	This may be set to **true** or **false**. If set to **true**, the job will discover ISeries Interface CIs. **Default**: true
discover_Software	This may be set to **true** or **false**. if set to **true**, the job will discover iSeries Installed Software CIs. **Default**: false

Parameter	Description
discover_Subsystems	This may be set to **true** or **false**. if set to **true**, the job will discover iSeries Subsystem CIs. **Default**: true
discover_TCP_UDP	This may be set to **true** or **false**. if set to **true**, the job will discover iSeries LPAR TCP ports and connectivity and UDP ports. **Default**: false

Chapter 56: Inventory Discovery

Inventory Discovery, which also includes Infrastructure discovery, determines which devices are in your network and gathers information about each of them. It also serves as the foundation for the other modules of discovery.

Inventory Discovery is typically managed and run based on Management Zones, using wizard-driven activities. For information about Inventory Discovery activities, see Inventory Discovery Activity in the *HPE UCMDB Discovery and Integrations Content Guide - Discovery Activities* document. For other information, see the section about Inventory Discovery in the *HPE Universal CMDB Data Flow Management Guide*.

Chapter 57: Inventory by Scanner Discovery

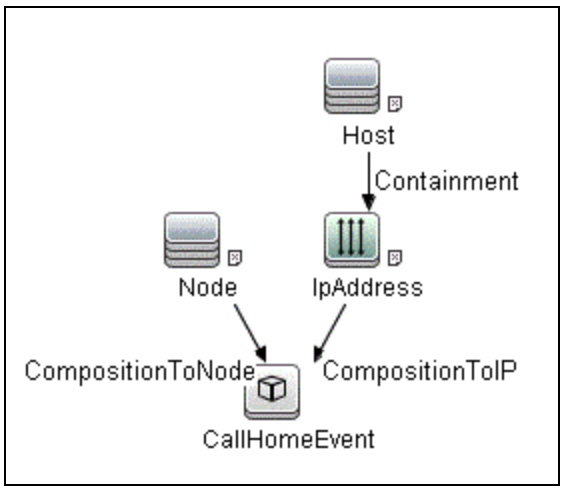
This chapter includes:

Call Home Processing Job 866
Adapter Information 866
Inventory Discovery by Manual Scanner Deployment Job 867
Introduction 868
Adapter Information 868
Inventory Discovery by Scanner Job 870
Introduction 870
Adapter Information 871

Call Home Processing Job

This section includes details about the job.

Trigger TQL



Adapter Information

This job uses the **Call Home Processing** adapter.

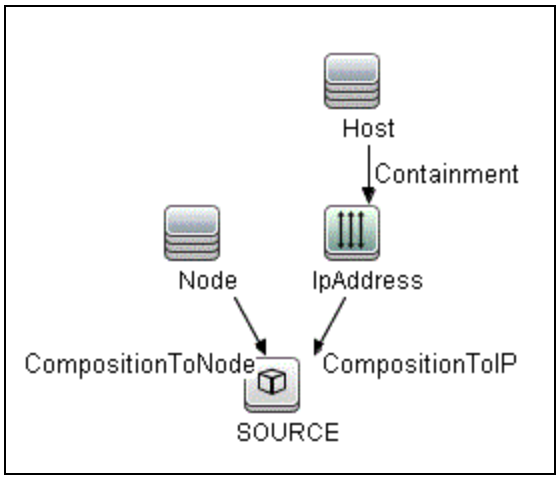
Adapter Type

Jython

Input CIT

CallHomeEvent

Input TQL



Triggered CI Data

Name	Value
domain_name	${SOURCE.domain_name}
ip_address	${SOURCE.ip_address}

Used Scripts

CallHomeProcessing.py

Inventory Discovery by Manual Scanner Deployment Job

This section includes details about the job.

Introduction

This job runs hardware and installed software inventory discovery by manually deployed scan files.

Trigger TQL

Adapter Information

This job uses the **Inventory Discovery by Manual Scanner Deployment** adapter.

Adapter Type

Work Flow adapter

Input CIT

Discovery Probe Gateway

Input TQL

Triggered CI Data

Name	Value
probeName	${SOURCE.name}

Workflow Steps

Step Name	Module	Failure-policy
Parse Manually Enriched Scan File	ParseManuallyEnrichedScanFile.py	mandatory

Discovered CITs

- Composition
- Containment
- Cpu
- DiskDevice
- DisplayMonitor
- FileSystem
- FileSystemExport
- GraphicsAdapter
- HardwareBoard
- InstalledSoftware
- InventoryScanner
- IpAddress
- Node

Global Configuration Files

- EnricherServiceSettings.ini
- HardwareMappingConfig.xml

Adapter Parameters

Parameter	Default Value	Description
MappingConfiguration		Specifies scan file model mapping configurations.

Parameter	Default Value	Description
discoverPorts	false	Specifies whether to discover TCP and UDP ports. If **true**, TCP ports with the listening or established status and all UDP ports are reported. **Note:** If this parameter is enabled, UD Full (UDF) license is required instead of UD Inventory (UDI).
discoverProcesses	false	Specifies whether to discover processes. **Note:** If this parameter is enabled, UD Full (UDF) license is required instead of UD Inventory (UDI).
discoverRunningSW	Microsoft Hyper-V Hypervisor, VMware VirtualCenter, Virtualization Layer Software	Determines which running software should be reported.

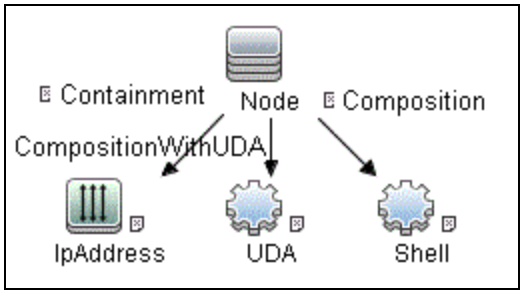
Inventory Discovery by Scanner Job

This section includes details about the job.

Introduction

This job runs hardware and installed software inventory discovery by scanners.

Trigger TQL



CI	Attribute Value
IpAddress	NOT IP Probe Name Is null
Shell	NOT CI Type Equal telnet

Adapter Information

This job uses the **Inventory Discovery By Scanner Adapter**.

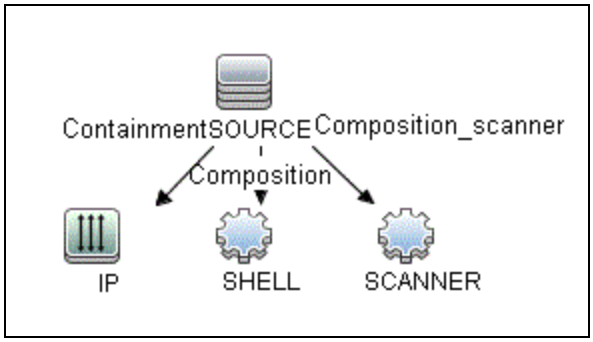
Adapter Type

Work Flow adapter

Input CIT

Node

Input TQL



Triggered CI Data

Name	Value
ProtocolList	${SHELL.root_class}
codepage	${SHELL.codepage:NA}
credentialsId	${SHELL.credentials_id:NA}
hostId	${SOURCE.root_id}

Name	Value
hostName	${SOURCE.name:NA}
ipTaggingList	${IP.ip_lease_time:NA}
ip_address	${SHELL.application_ip}
macList	${SHELL.arp_mac:NA}
nodeGUID	${SOURCE.ud_unique_id:NA}
nodeIpList	${IP.name:NA}
nodeMacList	${IP.arp_mac:NA}
primaryDNSName	${SOURCE.primary_dns_name:NA}
scanFileLastDownloadedTime	${SCANNER.scan_file_last_downloaded_time:NA}
scannerVersion	${SCANNER.version:NA}

Workflow Steps

Step Name	Module	Failure-policy
Remove Local Scan Log File	RemoveLocalScanLog.py	optional
Scanner Connect	ScannerConnect.py	mandatory
Lock Scanner Node	LockScannerNode.py	mandatory
UD Unique ID check	UDUniqueIDCheck.py	mandatory
Check Scan File Existence	CheckScanFileExistence.py	optional
Upgrade Scanner	UpgradeScanner.py	mandatory
Run Scanner	RunScanner.py	mandatory
Check Scanner Finished	CheckScannerFinished.py	optional
Download Scan File	DownloadScanFile.py	mandatory
Remove Scan Data	RemoveScanData.py	optional
Unlock Scanner Node	UnlockScannerNode.py	optional
Wait XML Enricher Process	WaitEnricherProcess.py	mandatory
Parse Enriched Scan File	ParseEnrichedScanFile.py	mandatory

Final Step Module
ReleaseResources.py

Used Scripts

- RemoveLocalScanLog.py
- ScannerConnect.py
- LockScannerNode.py
- UDUniqueIDCheck.py
- CheckScanFileExistence.py
- UpgradeScanner.py
- RunScanner.py
- CheckScannerFinished.py
- DownloadScanFile.py
- RemoveScanData.py
- UnlockScannerNode.py
- WaitEnricherProcess.py
- ParseEnrichedScanFile.py
- inventoryerrorcodes.py
- LockUtils.py
- InventoryUtils.py
- host_discoverer.py
- Dis_TCP.py
- applications.py
- process_to_process.py
- process_discoverer.py
- cmdlineutils.py
- process.py

Discovered CITs

- Composition
- Containment
- Cpu
- Dependency
- DiskDevice
- DisplayMonitor
- FileSystem
- FileSystemExport
- GraphicsAdapter
- HardwareBoard
- InstalledSoftware
- InventoryScanner
- IpAddress
- IpServiceEndpoint
- Network Adapter
- Node
- Process
- Realization
- RunningSoftware
- Usage
- Window Device Driver

Global Configuration Files

- ScannersConfigurationByPlatform.xml
- InventoryDiscoverySettings.xml
- EnricherServiceSettings.ini

- HardwareMappingConfig.xml
- PrePostScanScriptingConfiguration.xml
- applicationsSignature.xml

Adapter Parameters

Parameter	Default Value	Description
DownloadScanFileBeforeExecution	true	Specifies whether to download the scan file from the remote machine before execution.
IsPrePostScriptAllowed	false	Specifies whether to allow scanners to run pre-scan or post-scan scripts.
IsScannerDowngradeAllowed	true	Specifies whether the scanner downgrade is allowed.
IsScannerUpgradeAllowed	true	Specifies whether the scanner upgrade is allowed.
MappingConfiguration		Specifies scan file model mapping configurations.
P2PServerPorts	*	Only processes connected to these ports (as client or server) are discovered, together with this port. This parameter can include a number or a known name. You separate entries with commas. An asterisk (*) signifies all ports.
PrePostScriptExecTimeout	5	The Pre-scan or post-scan script maximum runtime (in minutes).
RemoveScanData	false	Specifies whether to remove the scan data on the remote host after it was downloaded on the Data Flow Probe machine.
ScannerConfigurationFile		Specifies the configuration file name that should be uploaded with the scanner and used for the scanner execution.
ScannerLogLevel	info	The scanner log level. This parameter can be **info**, **debug**, or **trace**.
collectIPv6Connectivity	false	Specifies whether to collect the IPv6 related connectivity.

Parameter	Default Value	Description
discoverPorts	false	Specifies whether to discover TCP and UDP ports. If **true**, TCP ports with the listening or established status and all UDP ports are reported. **Note:** If this parameter is enabled, UD Full (UDF) license is required instead of UD Inventory (UDI).
discoverProcesses	false	• **False**: Processes are not reported except in the following two scenarios: ◦ If you set the **discoverP2P** parameter to true, the processes that are related to TCP connections are reported regardless of the **discoverProcesses** parameter value. ◦ If you set the **discoverRunningSW** parameter to true, the processes that are related to the running software are reported regardless of the **discoverProcesses** parameter value. (The running software is specified in the **applicationsSignature.xml** file). • **True**. All processes are reported. **Note:** If this parameter is enabled, UD Full (UDF) license is required instead of UD Inventory (UDI).
discoverRunningSW	Microsoft Hyper-V Hypervisor, VMware VirtualCenter, Virtualization Layer Software	Determines which running software should be reported.
discoverWPAR	false	Specifies whether to report IBM Workload partitions (WPARs). **Note:** If this parameter is enabled and WPARs are discovered, UD Full (UDF) license is required instead of UD

Parameter	Default Value	Description
		Inventory (UDI).
enableStamping	true	Determines whether **ud_unique_id** is stamped on the managed computer.
filterP2PProcessesByName	system, svchost.exe, lsass.exe, System Idle Process	The names of the processes that are not reported. **Note:** This parameter only affects the P2P discovery. To prevent P2P running, enter an asterisk (*) as the value.
ignoreP2PLocalConnections	false	If false, P2P discovery does not ignore local connections. That is, when a client and server are installed on the same host and the client-server relationship connects between them, P2P discovery should report this relationship.
onlyStampingClient	true	Determines whether to only stamp the client machine. If false, both data-center and client machine are stamped.
udaConnectionOrder	first	The position of UD in the order of protocol connections. Possible values are: **first**, **last**, and **none**.
uploadScannerToAgentPath	true	Specifies whether to upload scanner to the installation path of UD agent. **Note:** This parameter is only for Windows and eligible when Universal Discovery Protocol is used.

Chapter 58: Mainframe by SNMP Discovery

The **Mainframe TCP by SNMP** and **Mainframe topology by SNMP** jobs are legacy ones. The Mainframe by SNMP discovery is replaced by the EView Agent discovery. For details about the EView Agent discovery, see Mainframe.

Chapter 59: Storage Discovery

This chapter includes:

- Brief Introduction to Storage Discovery 880
  - Overview 880
  - Supported Protocols 880
  - Supported Discoveries 880
- NetApp Filer Discovery 881
  - Overview 882
  - Supported Versions 882
  - Topology 882
  - How to Discover NetApp Filers 884
  - NetApp Filer Connection by WebServices Job 887
  - NetApp Filer by WebServices Job 889
- SMI-S Discovery 892
  - Overview 893
  - Supported Versions 893
  - Discovery Mechanism 893
  - How to Discover SMI-S 893
  - Storage Devices Connection by CIM Job 894
  - Storage Devices Connection by CIM Adapter 895
  - Storage Devices Topology by CIM Job 897
  - Storage Devices Topology by CIM Adapter 901

Brief Introduction to Storage Discovery

Overview

The Storage discovery enables you to discover storage structures and connections between storage systems and remote servers.

- Storage structures

  Universal Discovery discovers both physical and logic relationships between components in storage systems. Generally, the components include storage array, storage pool, Logical Unit Number (LUN), storage processor, logical volume, physical volume, fibre channel port, Small Computer System Interface (SCSI), Internet Small Computer System Interface (iSCSI), and file export.

- Connections between storage systems and remote servers

  Universal Discovery discovers the following three types of connections: Network File System (NFS), iSCSI, and Storage Area Networks (SAN).

Supported Protocols

The Storage discovery uses the following protocols:

- NetApp protocol
- CIM protocol

Supported Discoveries

The Storage discovery includes the following discoveries:

- NetApp Filer discovery

  The storage discovery via the NetApp protocol is the NetApp Filer discovery.

This discovery is based on NetApp Data ONTAP API (ONTAPI) that can be used to access and manage the storage system.

The discovery jobs are **NetApp Filer Connection by WebServices** and **NetApp Filer by WebServices**.

For details, see "NetApp Filer Discovery" below.

- SMI-S discovery

  The storage discovery via the CIM protocol is the SMI-S discovery.

  This discovery is based on Storage Management Initiative Specification (SMI-S).

  The SMI-S discovery supports the following storage device brands:

  - Brocade
  - EMC
  - Hitachi
  - HPE
  - Huawei
  - IBM
  - NetApp

  The discovery jobs are **Storage Devices Connection by CIM** and **Storage Devices Topology by CIM**.

  For details, see "SMI-S Discovery" on page 892.

NetApp Filer Discovery

This section includes:

Overview 882
Supported Versions 882
Topology 882
How to Discover NetApp Filers 884
NetApp Filer Connection by WebServices Job 887
NetApp Filer by WebServices Job 889

Overview

Universal CMDB can retrieve NetApp network attached storage (NAS) information directly from NetApp Filers and NetApp clusters. Discovery involves synchronizing devices, topology, and hierarchy of storage infrastructure in the UCMDB database (CMDB). This enables change management and impact analysis across all business services mapped in UCMDB from a storage point of view.

The discovery involves a UCMDB initiated discovery on the NetApp WebService API. The discovery also synchronizes physical relationships between various hardware, and logical relationships between logical volumes and hardware devices, to enable end-to-end mapping of the storage infrastructure.

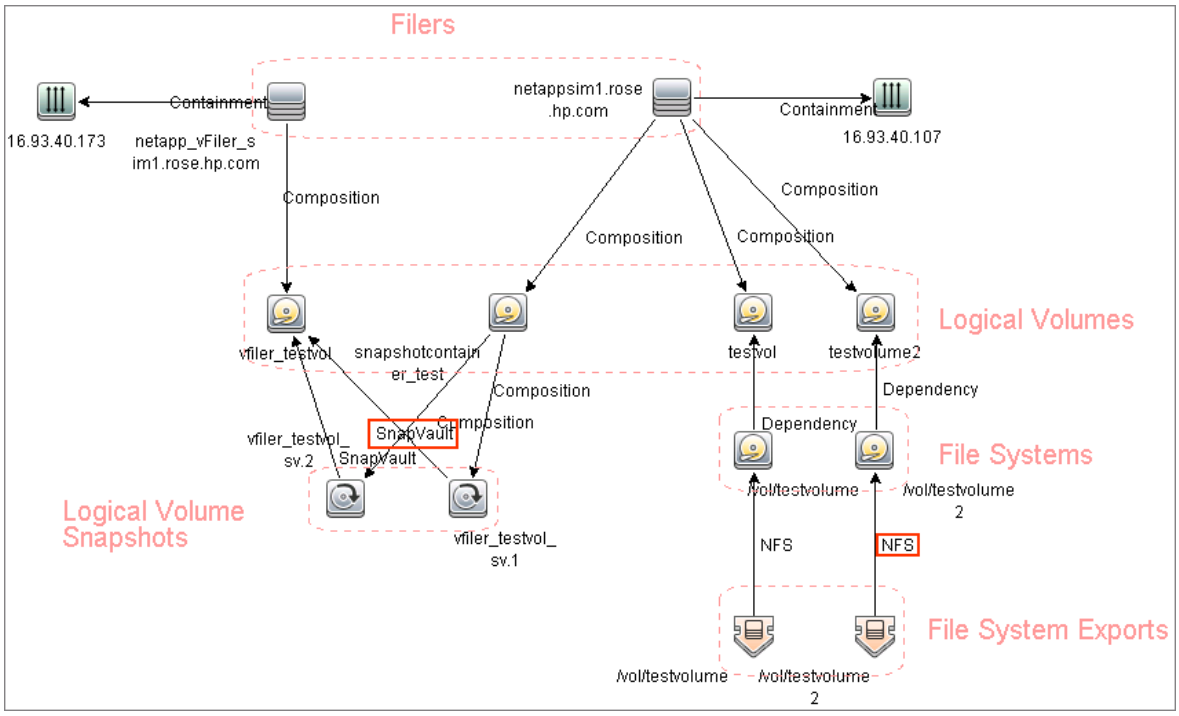
Supported Versions

This discovery supports NetApp Data ONTAP 7.2.x, 7.3.x, 8.x, and 9.x.

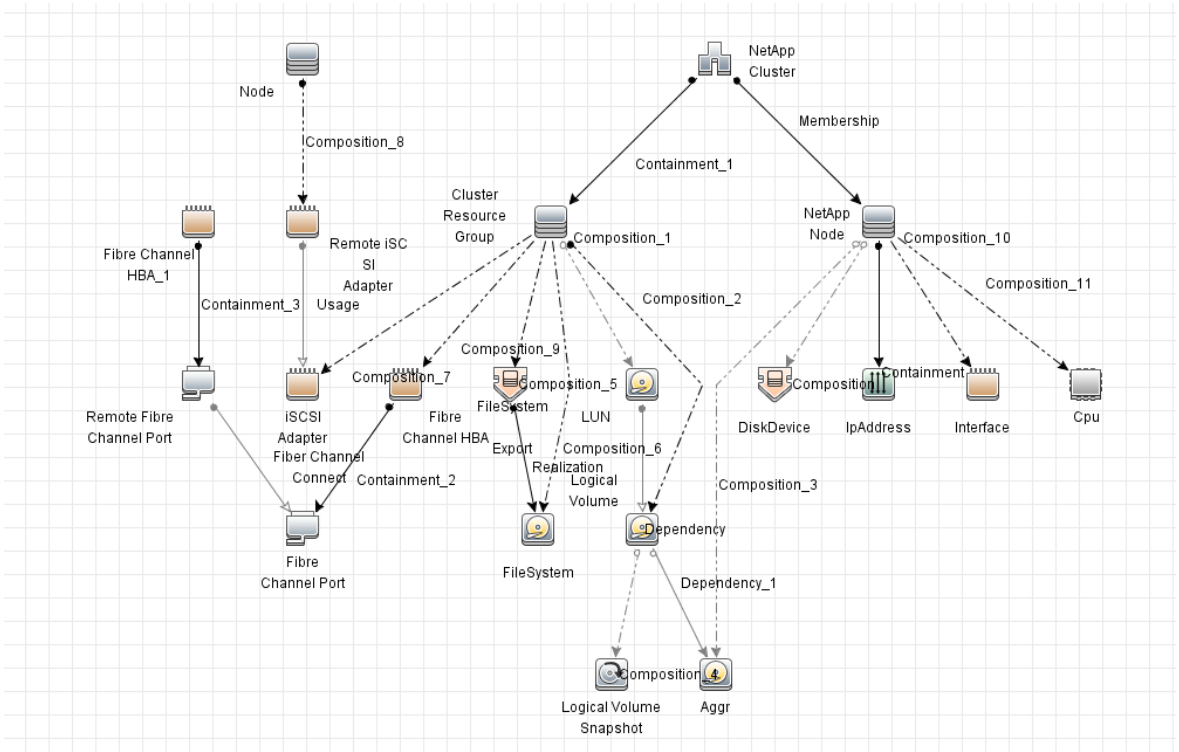
Topology

The following image displays the topology of the NetApp Filer discovery with sample output:

> **Note:** For a list of discovered CITs, see "Discovered CITs" on page 891.



The following image displays the topology of the NetApp cluster discovery:



How to Discover NetApp Filers

This task describes how to discover NetApp Filers.

1. Prerequisite - Set up protocol credentials

   This discovery includes the NetApp protocol for NetApp WebServices. To use the NetApp protocol, configure the appropriate credentials and port to the NetApp WebService API. The discovery uses the NetApp ONTAP SDK to get information from NetApp Filers and clusters.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Prerequisite - Permissions

   > **Note:** For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

   Ensure the user has the appropriate permissions on the Netapp Filer system to run the following discovery commands:

Command	Description
`aggr-get-iter`	Get the information on what possibilities and parameters exist for aggregates on a given filer.

`api-cifs-session-list-iter-start`
`api-cifs-session-list-iter-next`
`api-cifs-session-list-iter-end`
	Get details on CIFS sessions on this appliance. (Requires **cifs** license.)

`api-cifs-share-list-iter-start`
`api-cifs-share-list-iter-next`
`api-cifs-share-list-iter-end`
	Get details on CIFS shares on this appliance. (Requires **cifs** license.)

`api-ipspace-list-info`	Get information about ipspaces including IP addresses and relevant IP details. (Requires **vfiler** license.)
`api-nfs-exportfs-list-rules`	Get details on NFS shares on this appliance.
`api-security-api-vfiler` `api-nfs-exportfs-list-rules-2`	Get details on vFilers.
`api-snapshot-list-info`	Get details on snapshots for a specified

Command	Description
	volume.
api-snapvault-<SnapvaultLevel> -relationship-status-list-iter-start api-snapvault-<SnapvaultLevel> -relationship-status-list-iter-next	Get snapvault details from the appliance. <SnapvaultLevel> can be either **primary** or **secondary** or both of these.
api-system-cli api-cli-ifconfig	Get details on network interfaces.
api-system-get-info	Get appliance details including CPU and backplane information. (Head information in a sysconfig -a command). I/O information is not included.
api-system-get-ontapi-version	Required to Get current ONTAPI major and minor versions.
api-volume-list-info-iter-start api-volume-list-info-iter-next api-volume-list-info-iter-end	Get details on volumes in the appliance.
cifs-server-get-iter	Retrieve the list of CIFS servers on the cluster and their basic configurations.
cifs-session-get-iter	Retrieve the list of the established CIFS sessions.
cifs-share-get-iter	Give the information about one or more CIFS shares.
cluster-identity-get	Return the cluster identity information.
fcp-initiator-get-iter	List all initiators connected to FCP target Logical Interfaces LIFs.
fcp-interface-get-iter	Iterate over a list of FCP Target Logical Interfaces (LIFs).
fcp-service-get-iter	Iterate over a list of FCP Services.
iscsi-connection-get-iter	Iterate over a list of iSCSI Connection objects.
iscsi-initiator-get-iter	Iterate over a list of remote iSCSI initiator objects.
iscsi-service-get-iter	Iterate over a list of iSCSI Services.
iscsi-tpgroup-get-iter	Iterate over a list of iSCSI Target Portal Group

Command	Description
	objects.
`login-http-admin`	Required permission for the discovery. You cannot authenticate or log in to a NetApp Filer using the NetApp WebServices API without it.
`lun-get-iter`	Iterate over a list of Logical Unit Number (LUN) objects.
`net-interface-get-iter`	Iterate over a list of network interface objects.
`options-get`	Get values for optional parameters.
`snapshot-get-iter`	Iterate over a list of snapshot objects.
`storage-disk-get-iter`	Get the disk information about one or more disks from the Storage Subsystem. Clustered ONTAP iterator APIs return all information about all disks in the cluster.
`system-get-node-info-iter`	Obtain the node information when the node is a part of the cluster in an iteration.
`volume-get-iter`	Iterate over a list of volume objects.
`vserver-get-iter`	Display the information about Vservers, including the information about Admin Vserver, Node Vserver, and Cluster Vservers.

3. Run the discovery

> **Note:** For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

Run the following jobs in the following order:

a. Run the **Range IPs by ICMP** job.

b. Run the **Host Connection by SNMP** job to identify NetApp Filers.

c. Run the **NetApp Filer Connection by WebServices** job to connect to NetApp Filers or clusters. For job details, see "NetApp Filer Connection by WebServices Job" on the next page.

d. Run the **NetApp Filer by WebServices** job. For job details, see "NetApp Filer by WebServices Job" on page 889.

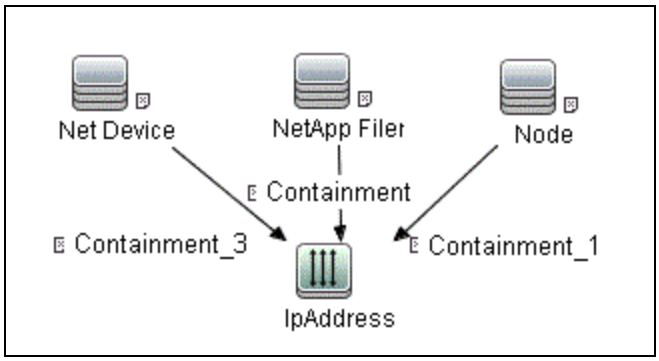
NetApp Filer Connection by WebServices Job

The NetApp Filer discovery package is bundled in **NetAppFiler.zip**.

This section includes details about the job.

Trigger Query

This trigger TQL has the **include subtypes** option unselected for **Net Device** and **Node**, which will exclude IPs associated with CIs that are not NetApp Filers (such as Windows, UNIX, and so on).



CI	Attribute Value
NetApp Filer	Node Is Virtual Not equal true OR Node Is Virtual Is null
IpAddress	Is Virtual Not equal true OR Is Virtual Is null

Adapter

This job uses the **NetApp Filer Connection by WebServices** adapter.

- Input CI Type: IpAddress
- Input Query: None

Used Scripts

- netapp_webservice_utils.py
- NetApp_Filer_Connection.py

Discovered CITs

- Containment
- IpAddress
- Node
- RunningSoftware

> **Note:** To view the topology, see "Topology" on page 882.

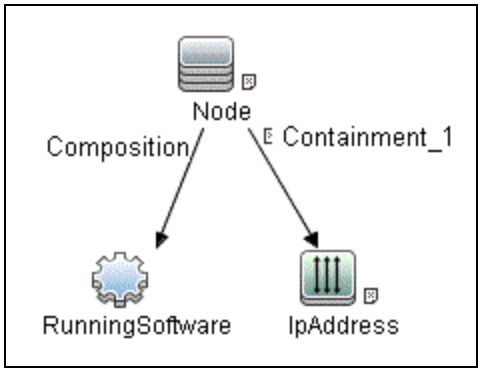
NetApp Filer by WebServices Job

The NetApp Filer discovery package is bundled in **NetAppFiler.zip**.

This section includes details about the job.

Trigger Query

This trigger TQL has **Node** with **IpAddress** and **RunningSoftware**.The discovered product name of **RunningSoftware** is NetApp Filer or NetApp Cluster.

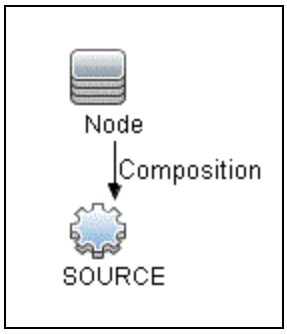


CI	Attribute Value
RunningSoftware	(DiscoveredProductName Equal NetApp Filer OR DiscoveredProductName Equal NetApp Cluster) AND NOT Application IP Is null AND NOT Reference to the credentials dictionary entry Is null
IpAddress	(Is Virtual Not equal true OR Is Virtual Is null) AND NOT IP Probe Name Is null

Adapter

This job uses the **NetApp Filer by WebServices** adapter.

- Input CI Type: RunningSoftware
- Input Query:



CI	Attribute Value
SOURCE	DiscoveredProductName Equal NetApp Filer OR DiscoveredProductName Equal NetApp Cluster

- Triggered CI Data

Name	Value
credentialId	${SOURCE.credentials_id}
ip_address	${SOURCE.application_ip}
product_name	${SOURCE.discovered_product_name}

- Adapter Parameters

Parameter	Description
chunksize	Maximum number of objects pulled from NetApp Operations Manager per SOAP call. To reduce the load on the NetApp Filer, set this parameter to a value lower than 1000 (default).
getNetworkShareInfo	**True:** Network Shares discovery is performed. **False:** No Network Shares discovery is performed.
getSnapShotInfo	**True:** Logical Volume Snapshots discovery is performed. **False:** No Logical Volume Snapshots discovery is performed.
getSnapVaultInfo	**True:** SnapVault discovery is performed. **False:** No SnapVault discovery is performed.

Used Scripts

- netapp_webservice_utils.py
- netapp_topology.py
- netapp_cluster_discoverer.py
- NetApp_Filer_by_WebServices.py

Discovered CITs

- Composition
- Containment
- Cpu
- Dependency
- DiskDevice
- Fibre Channel HBA
- Fibre Channel Port
- FileSystem
- FileSystemExport
- Interface
- IpAddress
- Logical Volume Snapshot
- LogicalVolume
- Membership
- NetApp Cluster
- NetApp Filer
- NetApp Node
- Node
- Realization
- SCSI Adapter

> **Note:** To view the topology, see "Topology" on page 882.

SMI-S Discovery

This section includes:

Overview 893
Supported Versions 893
Discovery Mechanism 893
How to Discover SMI-S 893
Storage Devices Connection by CIM Job 894
Storage Devices Connection by CIM Adapter 895
Storage Devices Topology by CIM Job 897
Storage Devices Topology by CIM Adapter 901

Overview

The Storage Networking Industry Association (SNIA) evolved and developed the Storage Management Initiative Specification (SMI-S) as a standard way of managing Storage Area Networks (SAN). The specification, which is ratified as an ISO standard, includes data accessible from a CIM server through a WEBM client.

This package discovers storage-related data using the CIM protocol.

Supported Versions

This discovery supports SMI-S version 1.50, TPD, CIMV2, EVA, LsiArray13, EMC, Brocade, Huawei, Hitachi, and IBM namespaces, and gives generic support for the CIM namespace.

Discovery Mechanism

Using the CIM protocol, the discovery connects to the target machine running storage management and the CIM agent. After connecting, the discovery counts the CIM classes, parses attributes, and maps to the UCMDB class model.

How to Discover SMI-S

This task includes the following steps:

1. Prerequisite - Set up protocol credentials

   The discovery uses the CIM protocol. You should define the CIM protocol entry, with port, namespace, and http/https transport.

   > **Note:** The CIM protocol supports http and https sub transports. The supported namespaces are
   >
   > - **root/brocade1**
   > - **root/tpd**
   > - **root/cimv2** (with limited support)
   > - **root/eva**

- **root/LsiArray13**
- **root/emc**
- **root/huawei**
- **root/smis/current**
- **root/ibm**

For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Run the jobs

   a. Run the **Range IPs by ICMP** job to discover the IP address of the server used by SMI-S.

   b. Run the **Storage Devices Connection by CIM** job to discover a proper credential and create a CIM CI.

   c. Run the **Storage Devices Topology by CIM** job to discover storage topology.

   For details on running jobs, see "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

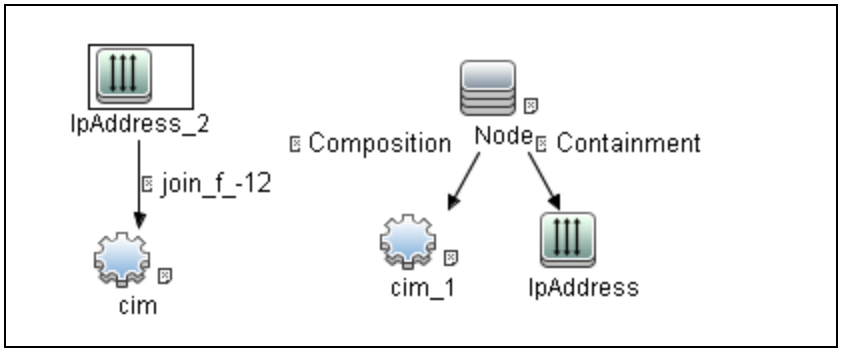
Storage Devices Connection by CIM Job

This section includes details about the job.

Adapter

This job uses the **Storage Devices Connection by CIM** adapter.

Trigger TQL



Discovery Flow

The discovery checks to see if it is possible to retrieve instances of one of the CIM classes depending on the namespace:

- Namespace: "root/brocade1"-> Brocade_Fabric
- Namespace: "root/cimv2" -> CIM_OrganizationalEntity
- Namespace: "root/tpd" -> TPD_StorageSystem
- Namespace: "root/eva" -> HPEVA_StorageSystem
- Namespace: "root/LsiArray13" -> LSISSI_StorageSystem
- Namespace: "root/emc" -> EMC_ComputerSystem
- Namespace: "root/huawei" -> HuaSy_Product
- Namespace: "root/smis/current" -> HITACHI_StorageSystem
- Namespace: "root/ibm" -> IBMTSSVC_Product

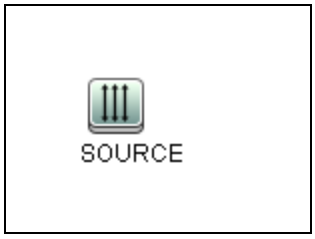
Storage Devices Connection by CIM Adapter

This section includes details about the adapter.

Input CIT

IP Address

Input TQL Query



Triggered CI Data

Name	Value
ip_domain	${SOURCE.routing_domain}
ip_address	${SOURCE.name}

Used Scripts

- cim.py
- entity.py
- smis_discoverer.py
- smis_connection.py
- cim_discover.py
- smis.py
- smis_cimv2.py
- smis_brocade.py
- smis_huawei.py
- smis_emc.py
- smis_hitachi.py
- smis_ibm.py
- smis_netapp.py
- smis_tpd.py

- smis_eva.py

Discovered CITs

- CIM
- Composition
- Containment
- IpAddress
- Node

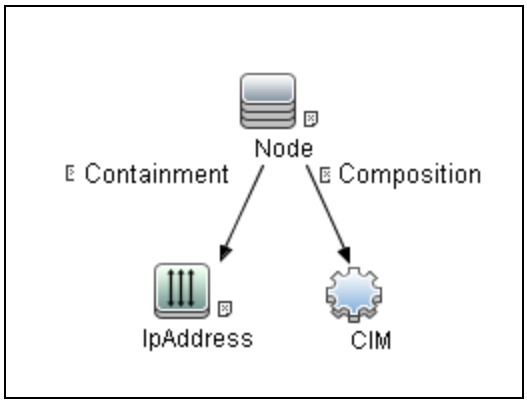
Storage Devices Topology by CIM Job

This section includes details about the job.

Adapter

This job uses the **Storage Devices Topology by CIM** adapter.

Trigger TQL Query



Node Name	Condition
IpAddress	NOT IP Probe Name Is null
IpAddress	NOT UcmdbRoutingDomain Is null

Node Name	Condition
CIM	NOT Reference to the credentials dictionary entry Is null
CIM	CimCategory Contains Storage

Discovery Flow

In this discovery, the classes for those instances retrieved and parsed are listed for each namespace:

- **Namespace "root/brocade1"**
  - Brocade_Fabric
  - Brocade_Switch
  - Brocade_SwitchFCPort
  - Brocade_NodeFCPort
  - CIM_ComputerSystem
- **Namespace "root/tpd"**
  - TPD_AllocatedFromStoragePool
  - TPD_DynamicStoragePool
  - TPD_FCPort
  - TPD_NodeSystem
  - TPD_SCSIController
  - TPD_StoragePool
  - TPD_StorageSystem
  - TPD_StorageVolume
- **Namespace "root/cimv2"**
  - CIM_FCPort
  - CIM_NodeSystem
  - CIM_StoragePool
  - CIM_StorageSystem
  - CIM_StorageVolume

- **Namespace "root/eva"**
  - HPEVA_StoragePool
  - HPEVA_StorageSystem
  - HPEVA_DiskFCPort
  - HPEVA_StorageVolume
  - HPEVA_ProtocolControllerForVolume
  - HPEVA_ViewProtocolController
  - HPEVA_StorageProcessorSystem
  - HPEVA_DiskExtent
- **Namespace "root/LsiArray13"**
  - LSISSI_StoragePool
  - LSISSI_StorageSystem
  - LSISSI_FCPort
  - LSISSI_StorageVolume
  - LSISSI_ControllerCanister
  - LSISSI_ControllerFirmwareIdentity
  - LSISSI_StorageProcessorSystem
  - LSISSI_DiskExtent
- **Namespace "root/emc"**
  - EMC_StoragePool
  - EMC_StorageSystem
  - EMC_FCPort
  - EMC_StorageVolume
  - EMC_StorageSystemSoftwareIdentity
  - EMC_ArrayChassis
  - EMC_SCSIProtocolController
  - EMC_StorageProcessorSystem
  - EMC_DiskExtent

- **Namespace "root/huawei"**
  - HuaSy_ClusterI
  - HuaSy_Node
  - HuaSy_StorageControllerSystem
  - HuaSy_StorageSystem
  - CIM_StoragePool
  - HuaSy_AllocatedFromStoragePool
  - HuaSy_StorageHardwareID
  - HuaSy_DiskExtent
  - HuaSy_LocalFileSystem
  - HuaSy_ResidesOnExtent
  - CIM_FileShare
  - CIM_SharedElement
  - HuaSy_FrontEndFCPort
- **Namespace "root/smis/current"**
  - HITACHI_StorageSystem
  - HITACHI_StorageProcessorSystem
  - HITACHI_ComponentCS
  - HITACHI_StoragePool
  - CIM_StorageHardwareID
  - HITACHI_DiskExtent
  - HITACHI_FreeSpace
  - HITACHI_FCPort
- **Namespace "root/ibm"**
  - IBMTSSVC_Cluster
  - IBMTSSVC_FCPort
  - IBMTSSVC_IOGroup
  - IBMTSSVC_Node

- IBMTSSVC_SAPAvailableForElement
- IBMTSSVC_BackendVolume
- IBMTSSVC_StorageVolume
- CIM_StoragePool
- CIM_HostedStoragePool
- CIM_ProtocolControllerForUnit
- CIM_StorageHardwareID
- CIM_AssociatedPrivilege

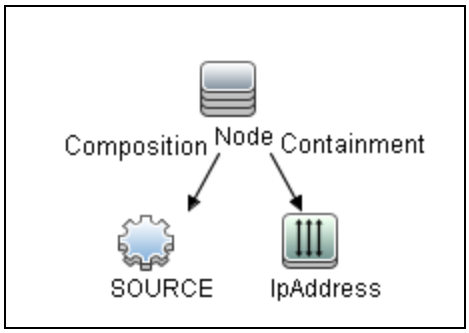
Storage Devices Topology by CIM Adapter

This section includes details about the adapter.

Input CIT

CIM

Input TQL Query



Node Name	Condition
IpAddress	NOT IP Probe Name Is null

Used Scripts

- cim.py

- entity.py
- smis.py
- smis_discoverer.py
- smis_topology.py
- cim_discover.py
- smis_cimv2.py
- smis_brocade.py
- smis_huawei.py
- smis_emc.py
- smis_hitachi.py
- smis_ibm.py
- smis_netapp.py
- smis_tpd.py
- smis_eva.py

Discovered CITs

- Composition
- Fibre Channel Connect
- Fibre Channel Port
- IpAddress
- iSCSI Initiator
- iSCSI Target
- LogicalVolume
- LUN
- Node
- Storage Array
- Storage Pool

Part 8: Mainframe

Chapter 60: EView Agent Discovery

This chapter includes:

- Overview 905
- Supported Versions 905
- Topology 906
  - EView Connection 906
  - LPAR Resources by EView 907
  - CICS by EView 908
  - DB2 by EView 909
  - IMS by EView 910
  - MQ by EView 911
- How to Discover Mainframe by EView 912
- Discovery Mechanism 913
- LPAR Resources by EView Job 914
- EView Connection Job 915
- CICS by EView Job 916
- DB2 by EView Job 916
- IMS by EView Job 917
- MQ by EView Job 918
- Troubleshooting and Limitations – EView Agent Discovery 919

Overview

Many enterprise applications span mainframe and distributed (Linux/UNIX/Windows) environments. Sometimes the level of mainframe involvement is light (for example, only for backend database solutions), while at other times the mainframe can host more than the distributed side (for example, running through queues, middle-tier applications, and multiple mainframe subsystems).

The goal of HPE Data Flow Management (DFM) is to properly map applications across the infrastructure, regardless of where those applications reside. There are normally three parts to mapping an application across the infrastructure:

1. Discovering the infrastructure
2. Discovering the application
3. Mapping the application dependencies

The current discovery solution covers the first two parts on the mainframe by discovering z/OS host and network resources, as well as applications such as DB2, IMS, CICS, and MQ.

The Mainframe by EView discovery is an agent-based discovery solution. It uses an application called **EView/390z Discovery for z/OS** to discover the Mainframe topology.

For more information about the discovery mechanism, see "Discovery Mechanism" on page 913.

To run the discovery, see "How to Discover Mainframe by EView" on page 912.

Supported Versions

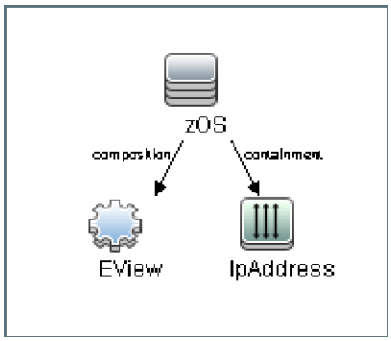
Target Platform	Version
z/OS	1.10, 1.11, 1.12, 1.13, 2.1, 2.2
DB2 for z/OS	8, 9, 10, 11
CICS	3.x, 4.x, 5.1
WebSphere MQ on z/OS	6.0, 7.0
IMS	9+

Topology

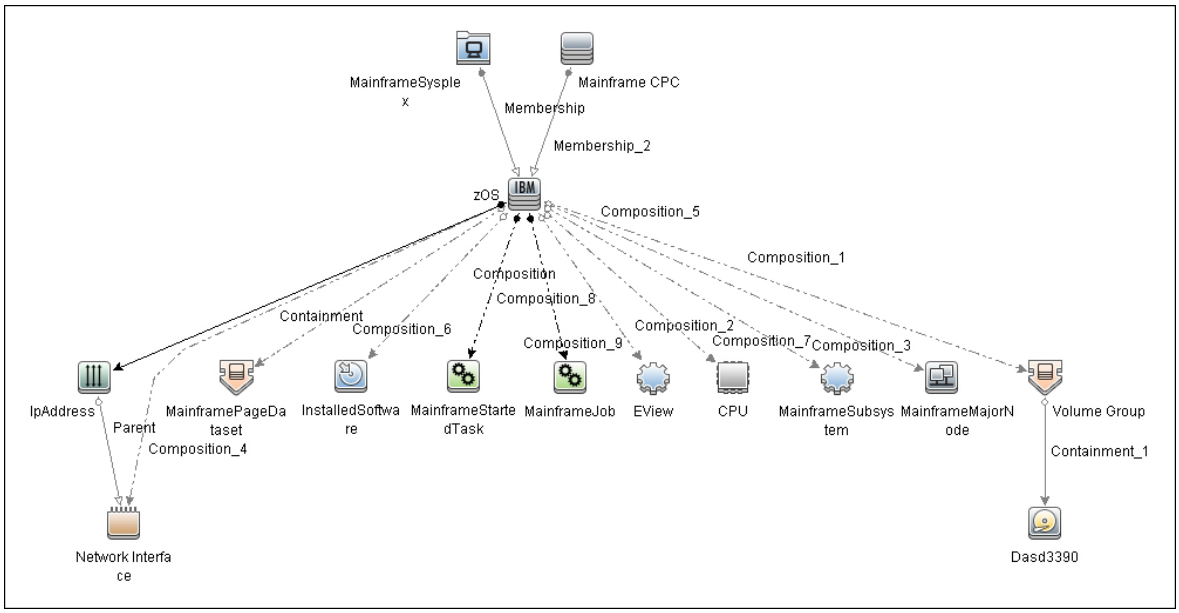
This section displays topology maps for the following jobs:

EView Connection 906
LPAR Resources by EView 907
CICS by EView 908
DB2 by EView 909
IMS by EView 910
MQ by EView 911

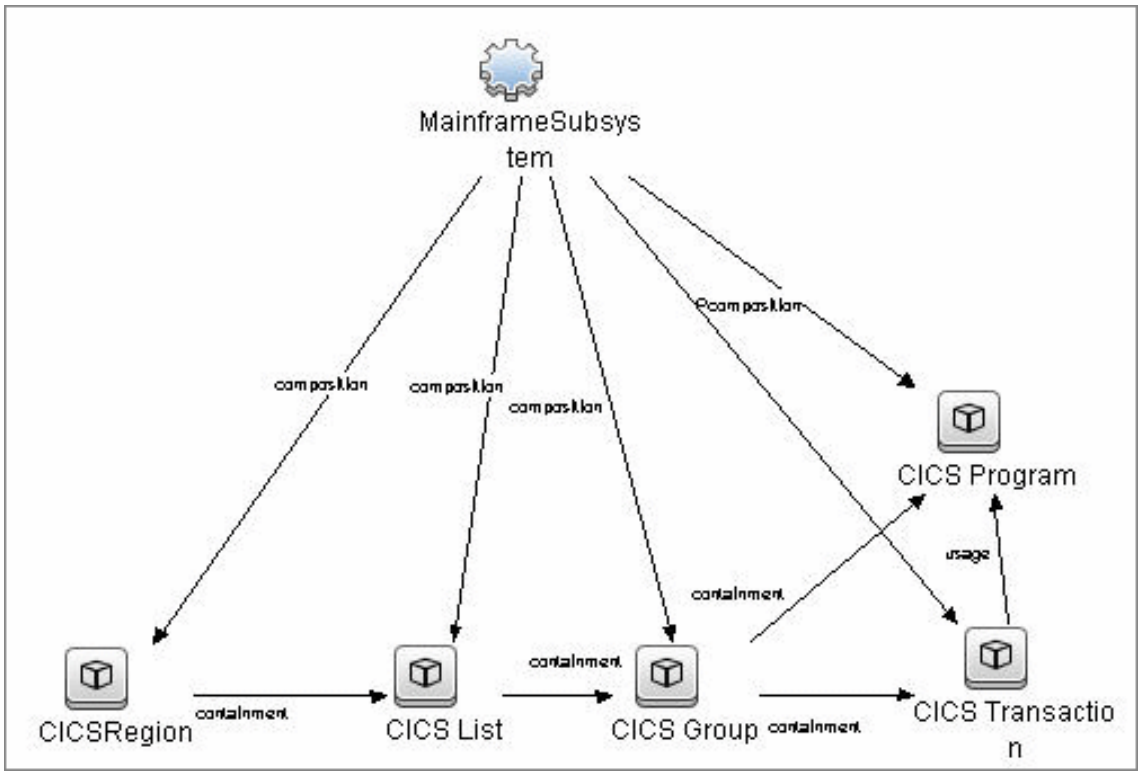
EView Connection



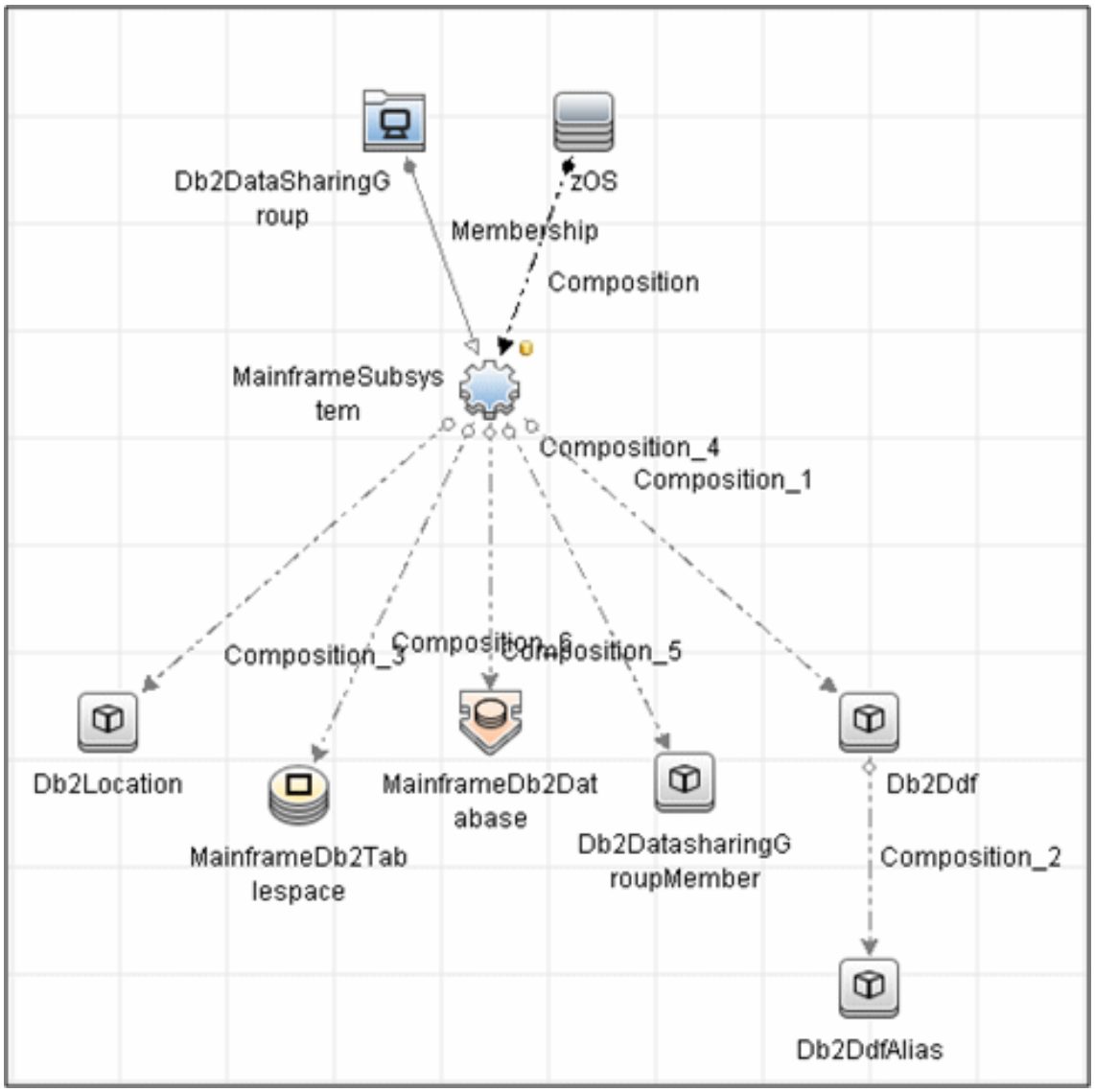
LPAR Resources by EView



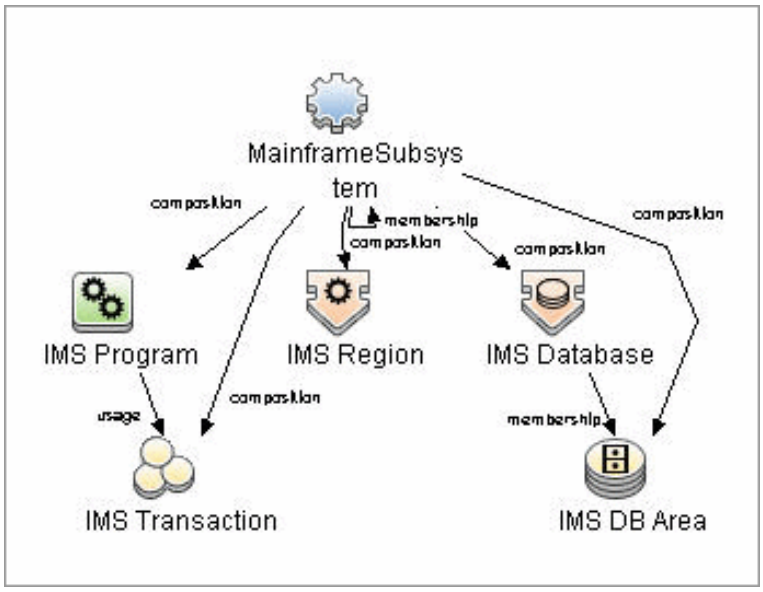
CICS by EView



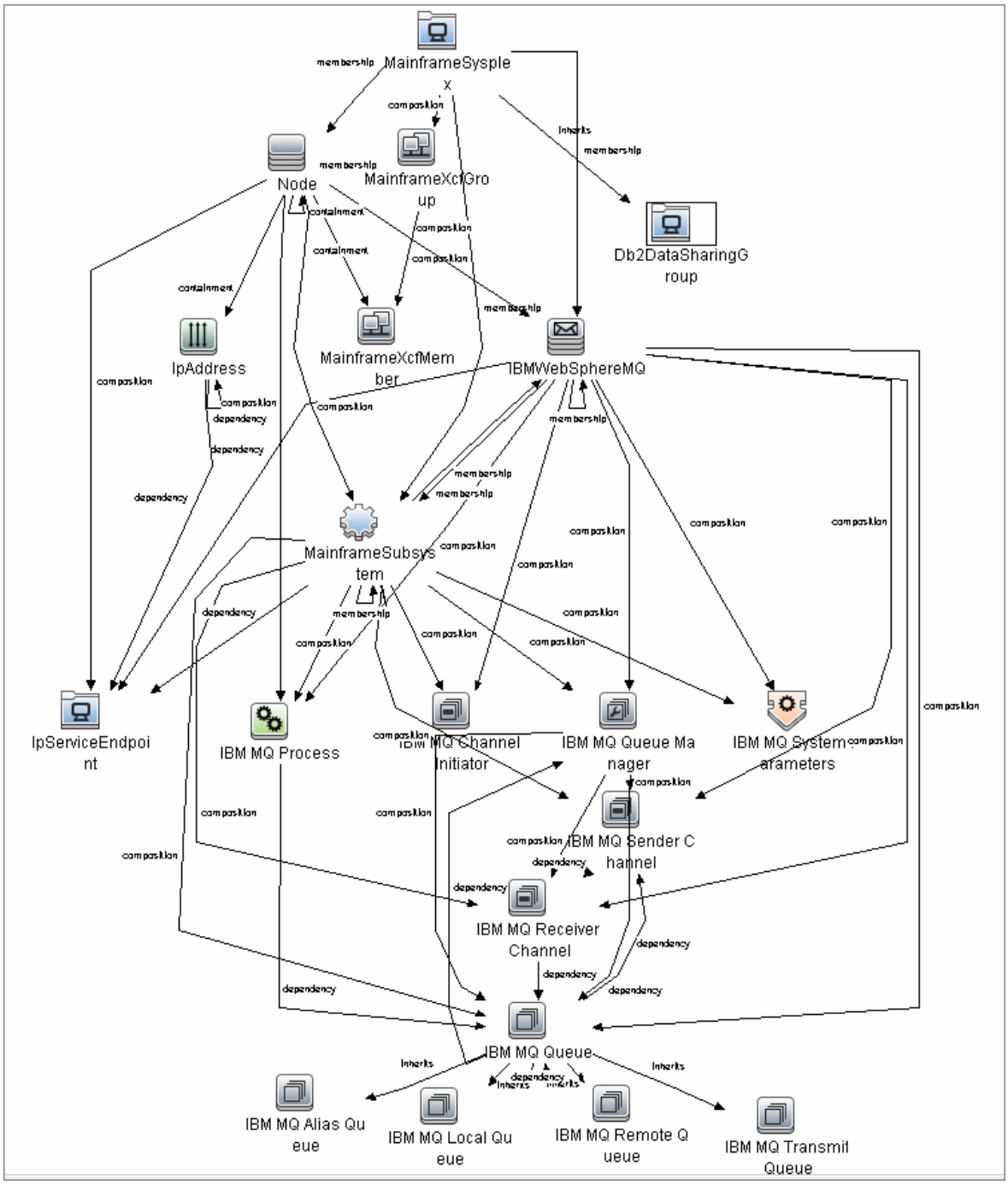
DB2 by EView


Db2DataSharingGroup
zOS
Membership
Composition
MainframeSubsystem
Composition_4
Composition_1
Composition_3
Composition_6
Composition_5
Db2Location
MainframeDb2Database
Db2Ddf
MainframeDb2Tablespace
Db2DatasharingGroupMember
Composition_2
Db2DdfAlias

IMS by EView


MainframeSubsys
tem
composition
membership
composition
composition
composition
IMS Program
IMS Region
IMS Database
composition
usage
membership
IMS Transaction
IMS DB Area

MQ by EView


MainframeSysplex
Node
MainframeXcfGroup
Db2DataSharingGroup
IpAddress
MainframeXcfMember
IBMWebSphereMQ
MainframeSubsystem
IpServiceEndpoint
IBM MQ Process
IBM MQ Channel Initiator
IBM MQ Queue Manager
IBM MQ System Parameters
IBM MQ Sender Channel
IBM MQ Receiver Channel
IBM MQ Queue
IBM MQ Alias Queue
IBM MQ Local Queue
IBM MQ Remote Queue
IBM MQ Transmit Queue
membership
containment
composition
dependency
Inherits

How to Discover Mainframe by EView

The following steps describe Mainframe by EView discovery.

1. Prerequisites

   - Make sure that the EView/390z Agent (version 6.3 or later) is installed on every LPAR whose resources and applications have to be discovered.
   - Make sure that the EView/390z Discovery Client (version 6.3 or later) is installed on the same machine as the Data Flow Probe that will be used to discover the mainframe infrastructure.
   - Make sure that LPARs in the EView/390z Discovery Client are properly configured.
   - Make sure that all Security requirements have been set up for this discovery.

     For more information about these prerequisites, refer to the EView/390z Discovery for z/OS documentation: http://www.eview-tech.com/eview-discovery-for-hpe-software-ucmdb-documentation.html.

2. Run the EView Connection job

   > **Note:** You must run this job before running any of the other Mainframe by EView discovery jobs.

   a. Configure the EView Connection discovery job's **EViewInstallationFolder** parameter by providing the absolute path to the EView/390z Discovery Client installation on the Data Flow Probe machine.

      For example:

      ```
      C:\EviewTechnology\EView390
      ```

   b. Activate the discovery job to discover the EView/390z Agent objects configured for every node in the EView/390z Discovery Client configuration on the Data Flow Probe machine.

3. Run the discovery jobs

   Activate the following jobs to discover the Mainframe topology:

   - Activate the **LPAR Resources by EView** job to discover the z/OS LPAR host and network resources. For details about this job, see "LPAR Resources by EView Job" on page 914.
   - Activate the **CICS by EView** job to discover the CICS subsystem and its resources. For

details about this job, see "CICS by EView Job" on page 916.

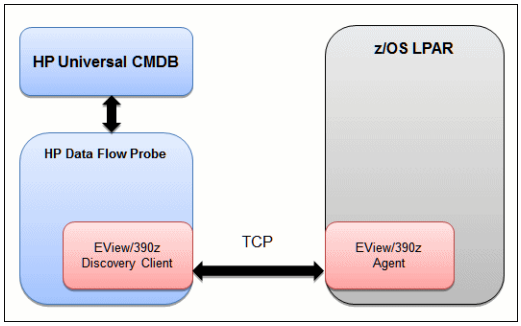
- Activate the **DB2 by EView** job to discover the DB2 subsystem and its resources. For details about this job, see "DB2 by EView Job" on page 916.
- Activate the **IMS by EView** job to discover the IMS subsystem and its resources. For details about this job, see "IMS by EView Job" on page 917.
- Activate the **MQ by EView** job to discover the MQ subsystem and its resources. For details about this job, see "MQ by EView Job" on page 918.

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

Discovery Mechanism

The Mainframe by EView discovery is an agent-based discovery solution. To discover infrastructure resources and applications on z/OS LPARs, an agent component must be deployed on every LPAR that has to be discovered.

A high-level architectural diagram for this discovery solution is illustrated in the following image:



The discovery process works as follows:

1. Connection job:
   a. The **EView Connection** job is the first job that discovers CIs for this discovery. It triggers against all the configured Probe Gateway CIs in the UCMDB.
   b. On the Data Flow Probe, the **eview_connection.py** discovery script first looks for the presence of the EView/390z Discovery Client in the pre-configured EView/390z Discovery Client installation path in the discovery job. It then looks for the z/OS LPAR nodes that have been configured in the EView/390z Discovery Client.

c. For every configured z/OS LPAR node in the EView/390z Discovery Client, the discovery job creates an eview agent CI connected to a zOS CI along with a CI for its primary IP address.

2. Resource and application discovery jobs:

   a. The remaining jobs are all activated on the TQL query **eview_agent**, which invokes the job against all discovered eview agent CIs.

   b. The discovery scripts execute various MVS commands against the z/OS LPAR using the EView/390z Agent, parse the returned output, and create the relevant CI types.

For details on running the discovery, see "How to Discover Mainframe by EView" on page 912.

LPAR Resources by EView Job

This section includes details about the job.

Trigger Query

Trigger query name: **eview_agent**

Discovery Parameters

Parameter	Description
commandTimeout	Timeout value (in seconds) after which the command issued against the EView/390z Agent will timeout
maxCommandSize	Maximum size (in bytes) allocated for command output on the z/OS LPAR
debugMode	Set to true to enable detailed logging in the probe debug log
discover_CPUs	Looks for zOS LPAR CPU CIs
discover_Jobs	True/False flag indicating whether or not to discover the Address Spaces (Jobs, Started Tasks). **Default:** False
discover_ MajorNodes	Looks for zOS Major Node CIs
discover_ PageDatasets	Looks for zOS Page Dataset CIs

Parameter	Description
discover_Software	Looks for zOS Installed Software CIs
discover_ Subsystems	Looks for zOS Subsystem CIs
discover_TCP_ UDP	Looks for z/OS LPAR TCP ports and connectivity and UDP ports
discover_DASD	Looks for z/OS Dasd Storage Devices and Storage Groups. **Default:** False **Note:** If set to True, you should increase the value of the command timeout parameters on the EView/390 client.
job_Regex	This parameter contains a UNIX style regular expression value to determine what jobs will be discovered. **Default:** * **Note:** If set to the default value, all jobs are discovered if **discover_ Jobs** is set to **true**.

Note: To see a topology map of this discovery, see "LPAR Resources by EView" on page 907.

EView Connection Job

This section includes details about the job.

Trigger Query

Trigger query name: **probe**

Discovery Parameters

Parameter	Description
EViewInstallationFolder	Installation root directory of the EView/390z Discovery Client on the Data Flow Probe machine
EViewStartedTask	Started task name of the EView Agent (e.g. VP390)

Note: To see a topology map of this discovery, see "EView Connection" on page 906.

CICS by EView Job

This section includes details about the job.

Trigger Query

Trigger query name: **eview_agent**

Discovery Parameters

Parameter	Description
commandTimeout	Timeout value (in seconds) after which the command issued against the EView/390z Agent will timeout.
maxCommandSize	Maximum size (in bytes) allocated for command output on the z/OS LPAR.
debugMode	Set to true to enable detailed logging in the probe debug log.
discover_CICS_ Regions	Looks for CICS Regions and their detailed properties.
discover_CICS_ programs	True/False flag indicating whether or not to discover CICS programs and transactions. **Default:** False **Note:** If set to True, you should increase the value of the command timeout parameters on the EView/390 client.
exclude_ restricted_ programs	True/False flag indicating whether or not to discover IBM-supplied elements that are labeled 'RESTRICTED'. These elements are the standard operating components for the Vendor software packages. **Default:** True

Note: To see a topology map of this discovery, see "CICS by EView" on page 908.

DB2 by EView Job

This section includes details about the job.

Trigger Query

Trigger query name: **eview_agent**

Discovery Parameters

Parameter	Description
commandTimeout	Timeout value (in seconds) after which the command issued against the EView/390z Agent will timeout
maxCommandSize	Maximum size (in bytes) allocated for command output on the z/OS LPAR
debugMode	Set to true to enable detailed logging in the probe debug log
discover_DDF	Looks for z/OS DB2 Distributed Data Facility
discover_ DataSharingGroups	Looks for z/OS DB2 Distributed Datasharing Group
discover_Databases	Looks for z/OS DB2 Databases
discover_Locations	Looks for z/OS DB2 Locations
discover_ Tablespaces	Looks for z/OS DB2 Tablespaces

Note: To see a topology map of this discovery, see "DB2 by EView" on page 909.

IMS by EView Job

This section includes details about the job.

Trigger Query

Trigger query name: **eview_agent**

Discovery Parameters

Parameter	Description
commandTimeout	Timeout value (in seconds) after which the command issued against the

Parameter	Description
	EView/390z Agent will timeout.
debugMode	True/False flag. Set to true to enable detailed logging in the probe debug log.
maxCommandSize	Maximum size (in bytes) allocated for command output on the z/OS LPAR.
DiscoverIMSDB	True/False flag indicating whether or not to attempt to discover IMS Databases. **Default:** False
discover_ims_ programs	True /False flag indicating whether or not to discover IMS Programs and Transactions. **Default:** False

Note: To see a topology map of this discovery, see "IMS by EView" on page 910.

MQ by EView Job

This section includes details about the job.

Trigger Query

Trigger query name: **eview_agent**

Discovery Parameters

Parameter	Description
commandTimeout	Timeout value (in seconds) after which the command issued against the EView/390z Agent will timeout.
debugMode	True/False flag. Set to True to enable detailed logging in the probe debug log.
maxCommandSize	Maximum size (in bytes) allocated for command output on the z/OS LPAR.
discover_remote_ hosts	True/false flag indicating whether to attempt to discover hosts and queues on connected remote hosts. **Default:** False

Note: To see a topology map of this discovery, see "MQ by EView" on page 911.

Troubleshooting and Limitations – EView Agent Discovery

Troubleshooting Mainframe by EView discovery falls under two broad categories:

- Troubleshooting the UCMDB/DFM Mainframe discovery process:
  - Validating correct triggers for discovery jobs, checking invocation of discovery jobs, checking probe logs for troubleshooting information, and so on
  - Manually invoking commands against the z/OS LPAR using the EView/390z Discovery Client
  - Validating connectivity between the EView/390z Discovery Client and the EView/390z Agent
  - Checking that the commands can be issued successfully and valid responses are returned from the z/OS LPAR
- Troubleshooting the EView/390z Agent.

The discovery troubleshooting process almost always starts when a discovery process fails to correctly discover CIs and relationships. It is important then to determine whether the root-cause of the issue is with the UCMDB/DFM discovery process (jobs, triggers, adapters, scripts, and so on) or with EView/390z Discovery for z/OS. Some steps that can be helpful in this troubleshooting process are:

- Ensure that UCMDB/DFM processes/services are running as normal.
- Ensure that all the Mainframe discovery packages are correctly deployed and that the discovery jobs are properly configured.
- Ensure that the EView/390z Discovery Client (version 6.3 or later) and EView/390z Agent (version 6.3 or later) are installed. If earlier versions are installed, the discovery might fail.
- Ensure that the EView/390z Discovery Client is properly installed on the Data Flow Probe machine and its services are installed correctly and running.
- Ensure that the LPARs to be discovered are correctly configured in the EView/390z Discovery Client.
- Run the discovery job that is having issues and check the discovery logs for messages related to the invocation of jobs and execution of commands.
  - If there appears to be a problem with the invocation of discovery jobs, discovery script syntax errors, or CI reconciliation errors, troubleshoot them as you would any discovery process in

UCMDB.

- If the logs show that the discoveries are failing due to commands not being issued against the EView/390z Agent, identify the failing command from the probe debug log files, and manually try to invoke the relevant commands using the EView/390z Discovery Client. For more information, contact EView Technology Inc.'s customer support.

Problem: Duplicate MainframeDB2Databases may occur because the root container of MainframeDB2Database is changed from **MainframeSubsystems** to **Db2DatasharingGroup**.

Solution: Clean up MainframeDB2Database CIs from UCMDB and rerun the **DB2 by EView** job.

Part 9: Middleware > Java EE Application Servers

Chapter 61: Apache Tomcat Discovery

This chapter includes:

Overview 923

Supported Versions 924

Topology 925

How to Discover Apache Tomcat 926

How to Discover Bugzilla, Wordpress, and MediaWiki 927

Apache Tomcat by Shell Job 928

Adapter Information 928

Overview

To discover Apache Tomcat, DFM parses the following configuration files:

- **server.xml**. This is the main Apache Tomcat configuration file that describes the components of the Tomcat installation, its architecture, and its topology. The file also contains the configuration for global resources.

  The following script fragment appears in the **server.xml** file and is the part used by the **Apache Tomcat by Shell** job to retrieve information for building the CIs:

```
 <Server port="8505" shutdown="SHUTDOWN">
   <GlobalNamingResources>
     <Resource name="jdbc/GlobalDS"
          type="javax.sql.DataSource"
          driverClassName="com.inet.ora.OraDriver"
          url="jdbc:inetora:labm3mam13:1521:UCMDB"
          maxActive="20" />
</GlobalNamingResources>
<Service name="Catalina">
  <Connector port="8580" protocol="HTTP/1.1"/>
  <Engine name="Catalina">
    <Host name="localhost" appBase="webapps">
      <Cluster">
          <Membership mcastAddr="228.0.0.4" mcastPort="45564"/>
      </Cluster>
    </Host>
    <Host name="grabinovic01" appBase="genadiwebapps">
          <Membership mcastAddr="228.0.0.4" mcastPort="45564"/>
        </Cluster>
       </Host>
     </Engine>
   </Service>
 </Server>
```

- **context.xml**. This file defines the application context configuration. Each installed application has a unique URL prefix. This file contains resource configurations for different scopes, depending on the file location.
- **web.xml**. This file defines the application configuration, for example, the application display name and the servlets used to process HTTP requests. Currently, DFM uses this file to retrieve the application display name.

Supported Versions

This discovery supports the following Apache Tomcat versions:

- 5
- 5.5
- 6.x
- 7.x
- 8.x
- 9.0

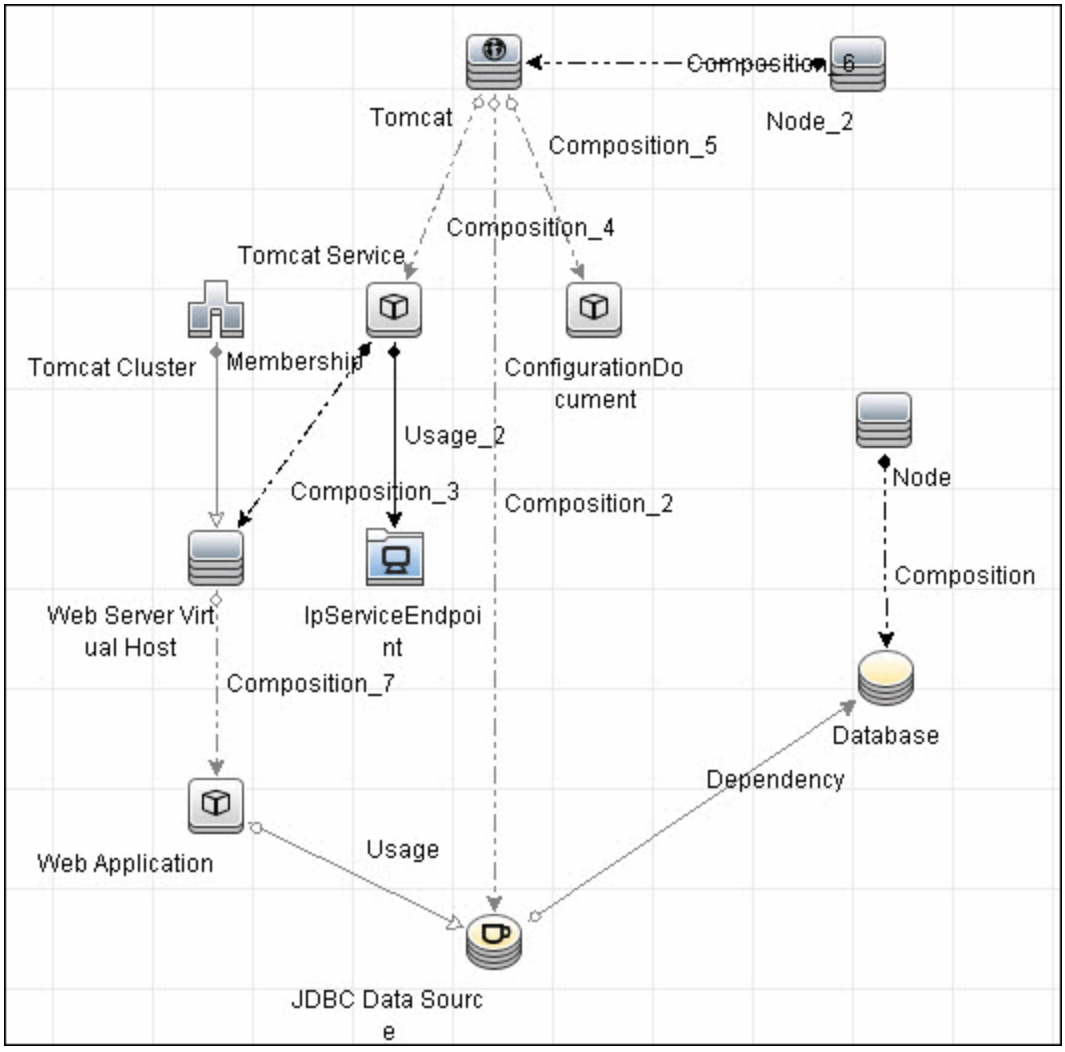
DFM discovers Tomcat running on the following operating systems:

- Windows
- UNIX
- Linux

Topology

The following image displays the topology of the Apache Tomcat discovery.

Note: For a list of discovered CITs, see "Apache Tomcat by Shell Job" on page 928.



How to Discover Apache Tomcat

This task describes how to discover the Apache Tomcat application and includes the following steps:

1. Prerequisite - Set up network and protocol credentials

   This discovery uses the following protocols:

   - NTCMD Protocol
   - SSH Protocol
   - Telnet Protocol

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Run the Discovery

   a. Run the **Range IPs by ICMP** job to discover IPs in the range where Tomcat is running.

   b. Run the **Host Connection by Shell** job to discover Shell agents.

   c. Run the **Host Applications by Shell** job to verify that an Apache Tomcat is running on the system, and to discover Tomcat-specific processes. If these processes are discovered, the job creates Tomcat CIs.

   The job searches for the **java.exe** (or **java**) process name, then searches in the command line for either the **-Dcatalina.home=** or **-Dcatalina.base=** substring. This substring includes the path to the Tomcat home directory. If this substring is not found, the job searches for a process name starting with **tomcat** and, from there, acquires the path to the home directory.

   The job then finds the absolute path to the Tomcat configuration file and adds this path as an attribute (**webserver_configfile**) to the Tomcat CI.

   d. Run the **Apache Tomcat by Shell** job. This job uses the Tomcat CI attribute to locate the configuration files that are discovered by the **Host Applications by Shell** job.

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

How to Discover Bugzilla, Wordpress, and MediaWiki

The following Web-based applications are discovered as part of the Apache and IIS discovery jobs. The following versions are supported:

Application	Supported Version
Bugzilla	3.x
Helpzilla	0.x
MediaWiki	1.15.x
Wordpress	2.5.x

To activate discovery:

1. Run the **Host Connection by Shell** job to create Shell CITs.
2. Run any of the **Host Resources and Applications** jobs to gather information about processes running on the host.
3. Run the **Web Server by Shell** job to retrieve information about Apache and available Web applications deployed on the Apache server.

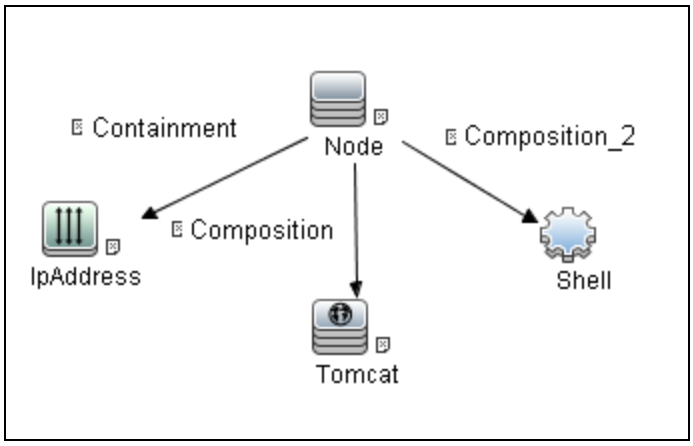
   The Web Application CIT:

   - **ID**. `webapplication`
   - **Parent CIT**. `application`
   - **Usage of the existing attribute**. `name`
   - **New attribute**. `type` (the type of application, for example, blog engine, wiki)

Apache Tomcat by Shell Job

This section includes details about the job.

Trigger Query



Node Name	Condition
IpAddress	NOT IP Probe Name Is null

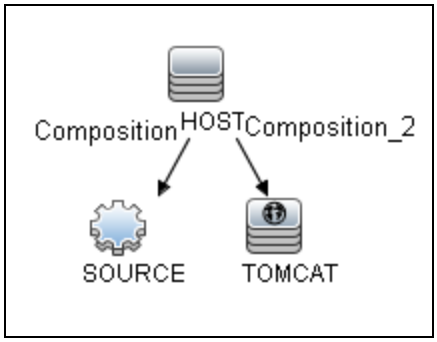
Adapter Information

This job uses the **ApacheTomcat_Topology** adapter.

Input CIT

Shell

Input TQL Query



Triggered CI Data

Name	Value
Protocol	${SOURCE.root_class}
configfile	${TOMCAT.name}
credentialsId	${SOURCE.credentials_id}
connected_os_credentials_id	${SOURCE.connected_os_credentials_id:NA}
hostId	${HOST.root_id}
ip_address	${SOURCE.application_ip}

Used Scripts

- entity.py
- iteratortools.py
- file_ver_lib.py
- file_mon_utils.py
- db.py
- db_platform.py
- db_builder.py
- jdbc_url_parser.py
- jdbc.py

- jee.py
- jee_discoverer.py
- process.py
- process_discoverer.py
- tomcat_by_shell.py

Discovered CITs

- Apache Tomcat
- Apache Tomcat Cluster
- Apache Tomcat Service
- Composition
- ConfigurationDocument
- Containment
- Database
- Dependency
- IpAddress
- IpServiceEndpoint
- JVM
- JdbcDataSource
- Membership
- Node
- Usage
- Web Application
- Web Server Virtual Host

Global Configuration Files

globalSettings.xml

Adapter Parameters

Parameter	Description
configFiles	Full path to Tomcat **server.xml**, separated by commas.
discoverOracle	Specifies whether to discover Oracle CIs. **Default:** true.

Note: To view the topology, see "Topology" on page 925.

Chapter 62: GlassFish Discovery

This chapter includes:

Overview 933

Supported Versions 933

How to Discover GlassFish Topology by Shell 933

JEE Glassfish by Shell Job 934

Glassfish_By_Shell Adapter 935

Troubleshooting and Limitations – GlassFish Discovery 937

Overview

GlassFish is an open source application server based on the source code for Sun Java System Application Server Platform Edition 9 (from Sun Microsystems), and on the source code for TopLink (from Oracle). GlassFish supports all Java platform Enterprise Edition API specifications such as JDBC, RMI, e-mail, JMS, web services and XML, and details how to make them work with one another.

The GlassFish discovery process enables the user to discover a full topology, including J2EE applications, JDBC and JMS resources.

Supported Versions

Version	Supported	J2EE Version	JVM Version
GlassFish 2.1	Yes	J2EE 1.5	JVM 1.5
GlassFish 3.1	Yes	J2EE 1.6	JVM 1.6

How to Discover GlassFish Topology by Shell

This task describes how to discover GlassFish using Shell protocols. The GlassFish discovery process enables the user to discover a complete GlassFish topology including J2EE applications, JDBC and JMS resources. DFM first finds application servers based on the Shell protocol or endpoints (TCP Ports) and then discovers the GlassFish J2EE environment and components by Shell.

1. Prerequisites - Set up protocol credentials

   Discovery is done using the Shell protocol. One of the following credentials should be defined:

   - SSH
   - Telnet
   - NTCMD
2. Run the discovery

a. Run the **Range IPs by ICMP** job in order to discover the target IPs.

b. Run the **Host Connection by Shell** job in order to discover the target host and shell connectivity to it.

c. Run one of the two jobs:

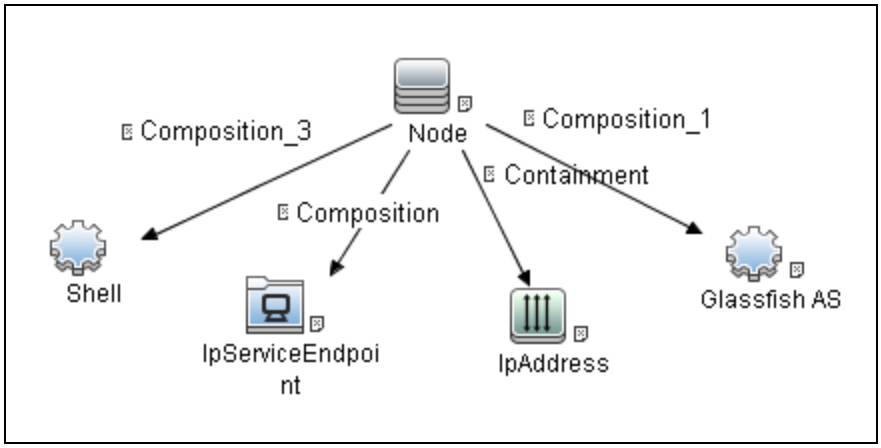
- **Host Applications by Shell** in order to discover applications of the target host, including running processes.
- **JEE TCP Ports** in order to discover service endpoint information.

3. Run the job **JEE Glassfish by Shell**.

JEE Glassfish by Shell Job

This section includes details about the job.

Trigger Query



Node Name	Condition
Glassfish AS	None
IpAddress	NOT IP Probe Name Is null
IpServiceEndPoint	IpServiceName Equal glassfish OR ServiceNames Contains glassfish
Node	None
Shell	NOT Reference to the credentials dictionary entry Is null

Adapter

This job uses the **Glassfish_By_Shell** adapter.

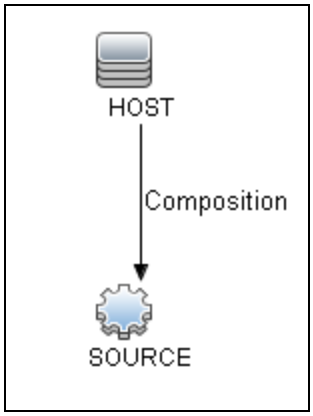
Glassfish_By_Shell Adapter

This section includes details about the adapter.

Input CIT

Shell

Input Query



Triggered CI Data

Name	Value
connected_os_credentials_id	${SOURCE.connected_os_credentials_id:NA}
credentialsId	${SOURCE.credentials_id}
hostId	${HOST.root_id}
ip_address	${SOURCE.application_ip}
protocol	${SOURCE.root_class}

Used Scripts

- connection.py
- db.py
- db_builder.py
- db_platform.py
- entity.py
- file_ver_lib.py
- glassfish.py
- glassfish_by_shell.py
- glassfish_discoverer.py
- iteratortools.py
- jdbc.py
- jdbc_url_parser.py
- jdbcutils.py
- jee.py
- jee_connection.py
- jee_discoverer.py
- jms.py
- jmx.py
- process.py
- process_discoverer.py
- protocol.py

Discovered CITs

- Composition
- ConfigurationDocument

- Containment
- Database
- Dependency
- Deployed
- Glassfish AS
- IpAddress
- IpServiceEndpoint
- J2EE Domain
- J2EE Managed Object
- J2eeCluster
- JVM
- JdbcDataSource
- Membership
- Node
- Usage
- Web Service

Global Configuration Files

globalSettings.xml

Parameters

- **reportAdminApps.** Enables/disables reporting of administrator applications if value is 'true'/'false'

Troubleshooting and Limitations – GlassFish Discovery

This section describes troubleshooting and limitations for GlassFish discovery.

- DFM can discover a J2EE application only when its .ear file is unzipped to a folder.
- Sometimes the command line of the GlassFish process is too large, so it does not fit in to the appropriate field in the probe database while running HRA discovery. In such a case:
  - Stop the probe
  - Open **%DatafFlowProbeHome%/tools/dbscripts/create_netlinks_db_tables.sql**
  - Change the size of **cmdline** for the Processes table from 4000 to 8000, or more if needed
  - Change the size of **cmdline** for the Applications table from 512 to 8000, or more if needed
  - Save the file
  - Run the **clearProbeData.bat** script
  - Start the probe

Chapter 63: JBoss Discovery

This chapter includes:

Overview 940
Supported Versions 940
How to Discover JEE JBoss by JMX 940
How to Discover JEE JBoss by Shell 944
JEE TCP Ports Job 945
Adapter Information 947
JEE JBoss Connections by JMX Job 949
Adapter Information 950
JEE JBoss by JMX Job 952
JEE JBoss by Shell Job 955
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Troubleshooting and Limitations – JBoss Discovery 958

Overview

JBoss Application Server (or JBoss AS) is a free software/open-source Java EE-based application server developed by JBoss, now a division of Red Hat.

An important distinction for this class of software is that it not only implements a server that runs on Java, but it actually implements the Java EE part of Java. Because it is Java-based, the JBoss application server operates cross-platform: usable on any operating system that supports Java.

The JBoss discovery process enables you to discover a full JBoss topology including J2EE applications, JDBC, and JMS resources. DFM first finds JBoss servers based on the JMX protocol, then discovers the JBoss J2EE environment and components.

Supported Versions

- JBoss by JMX discovery: JBoss versions 4.x, 5.x, 6.x, 7.x, 8.x, 9.x, and 10.x.
- JBoss by Shell discovery: JBoss versions 4.x, 5.x, 6.x, 7.x, 8.x, 9.x, and 10.x.

How to Discover JEE JBoss by JMX

This task includes the following steps:

- "Prerequisite - Set up protocol credentials" below
- "Prerequisites - Set up drivers" below
- "Run the discovery" on page 943

1. ## Prerequisite - Set up protocol credentials

   This discovery uses the JBoss protocol.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. ## Prerequisites - Set up drivers

   Default JBoss drivers are included by default with the Probe installation. For details on the required *.jar files, see "JBoss" in the *HPE Universal CMDB Data Flow Management Guide*. The

Probe installation includes JBoss drivers for versions 3.x and 4.x, but you can use your own drivers, if you prefer.

> **Note:** (Only for JBoss 7.x versions) Due to different management modes, you need to add two folders **7.0** and **7.1** under the following directory:
>
> `C:\hp\UCMDB\DataFlowProbe\runtime\probeManager \discoveryResources\j2ee\jboss`
>
> After upgrading CP version to CP 19, replace the folder **7.x** with the real JBoss version. For example, if you have **7.0.x** JBoss Application Server in your environment, change the folder name **7.x** to **7.0**. If you have both **7.0.x** and **7.1.x** in your environment, make sure that there are two folders **7.0** and **7.1** in the preceding directory.

To update .jar files:

a. Copy the drivers to the correct version folder in the following location:

   `C:\hp\UCMDB\DataFlowProbe\runtime\probeManager \discoveryResources\j2ee\jboss\<version_folder>`

   > **Note:** There are errors in the commercial version of the JBoss 5.x client API (EAP). To discover EAP 5.x with authorization enabled, you must take the client drivers from a non-commercial version of 5.x.

b. Restart the Probe before running the DFM jobs.

   For example:

   To discover JBoss 5.x versions, you need to update the driver folder

   `C:\hp\UCMDB\DataFlowProbe\runtime\probeManager \discoveryResources\j2ee\jboss\5.x`

   with the **jbossall-client.jar** file, including all dependencies declared in it.

   Required jars can be found in the **<JBOSS_5_BASE_DIR>/client/** folder.

   The **jbossall-client.jar** file contains a classpath reference to various client .jar files used by jboss client applications. Each of the .jar files in the following list must be available in the same directory as **jbossall-client.jar**. Otherwise they will not be found by the classloader.

   The classpath includes the following files:

   - commons-logging.jar
   - concurrent.jar

- ejb3-persistence.jar
- hibernate-annotations.jar
- jboss-aop-client.jar
- jboss-appclient.jar
- jboss-aspect-jdk50-client.jar
- jboss-client.jar
- jboss-common-core.jar
- jboss-deployers-client-spi.jar
- jboss-deployers-client.jar
- jboss-deployers-core-spi.jar
- jboss-deployers-core.jar
- jboss-deployment.jar
- jboss-ejb3-common-client.jar
- jboss-ejb3-core-client.jar
- jboss-ejb3-ext-api.jar
- jboss-ejb3-proxy-client.jar
- jboss-ejb3-proxy-clustered-client.jar
- jboss-ejb3-security-client.jar
- jboss-ha-client.jar
- jboss-ha-legacy-client.jar
- jboss-iiop-client.jar
- jboss-integration.jar
- jboss-j2se.jar
- jboss-javaee.jar
- jboss-jsr77-client.jar
- jboss-logging-jdk.jar
- jboss-logging-log4j.jar
- jboss-logging-spi.jar
- jboss-main-client.jar

- jboss-mdr.jar
- jboss-messaging-client.jar
- jboss-remoting.jar
- jboss-security-spi.jar
- jboss-serialization.jar
- jboss-srp-client.jar
- jboss-system-client.jar
- jboss-system-jmx-client.jar
- jbosscx-client.jar
- jbosssx-as-client.jar
- jbosssx-client.jar
- jmx-client.jar
- jmx-invoker-adaptor-client.jar
- jnp-client.jar
- slf4j-api.jar
- slf4j-jboss-logging.jar
- xmlsec.jar

3. Run the discovery

Run the following jobs in the following order:

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

- Run the **Range IPs by ICMP** job to discover the target IPs.
- Run the **JEE TCP Ports** job to discover service endpoint information. For job details, see "JEE TCP Ports Job" on page 945.
- Run the **JEE JBoss Connections by JMX** job to perform a shallow discovery of application servers. For job details, see "JEE JBoss Connections by JMX Job" on page 949.
- Run the **JEE JBoss by JMX** job to perform a deep discovery of JBoss application server topology. For job details, see "JEE JBoss by JMX Job" on page 952.

How to Discover JEE JBoss by Shell

Note: This functionality is available as part of Content Pack 2.00 or later.

You can perform deep discovery of JBoss without having to enter JMX credentials for each server, and without having to define additional libraries (*.jar files). Instead, you use the regular Shell credentials.

Deep discovery enables you to discover the topology of J2EE application systems, that is, the components of an application and not just the application itself.

This task includes the following steps:

- "Prerequisite - Set up protocol credentials" below
- "Run the discovery" below

1. Prerequisite - Set up protocol credentials

This discovery uses the Shell protocol. Define credentials for one of the following protocols:

- NTCMD protocol
- SSH protocol
- Telnet protocol

For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

Users do not need root permissions, but do need the appropriate credentials to enable connecting to the remote machines and running the relevant commands, such as **dir\ls** and **type\cat**.

2. Run the discovery

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

a. Run the **Range IPs by ICMP** job to discover the target IPs.

b. Run the **Host Connection by Shell** job to discover the target host and Shell connectivity to it.

c. Run one of the two jobs:

- **Host Applications by Shell** to discover applications of the target host, including running processes.

- **JEE TCP Ports** to discover service endpoint information. For job details, see "JEE TCP Ports Job" below.

d. Run the **JEE JBoss by Shell** job. For job details, see "JEE JBoss by Shell Job" on page 955.

JEE TCP Ports Job

This section includes details about the job.

Adapter

This job uses the **TCP Ports Discovery** adapter.

Trigger Query

Node Conditions

Node Name	Condition
IpAddress	`NOT IP Probe Name Is null`

Job Parameters

Name	Default Value	Description
checkIfIpIsReachable	true	This flag indicates whether the job should check if the discovered IP is reachable before the job starts to check availability of the host's ports.
checkOnlyKnownPorts	true	This flag indicates whether the job should discover only known ports. This flag does not cancel the **ports** or **UDPports** parameters. Setting this flag to **false** is applicable only with a real port range in the **ports** or

Name	Default Value	Description
		UDPports parameter.
connectTimeOut	5000	The timeout (in milliseconds) when connecting to an IP and port.
nmapPath		The full path to the nmap executable file (for example: **C:\Program Files (x86)\Nmap\nmap.exe**).
pingTimeOut	2000	The ICMP ping timeout (in milliseconds).
ports	**For JEE TCP Ports job:** • weblogic, weblogicSSL, websphere_jmx, rmi **For Databases TCP Ports job:** • oracle, db2, sybase, sql, mysql **For SAP TCP Ports job:** • sap, sap_jmx, sap_http, sap_https **For SAP TCP Ports job:** no default value	This parameter contains a list of TCP ports on which discovery is performed. This list can include ranges, separate port numbers, and known protocol names (such as http, ftp, etc.) and must be comma separated. If this list is empty or contains the value *****, discovery is performed only on all known TCP ports. If a port range is entered (such as 1000-1100), discovery is performed only on all known ports in that range if **checkOnlyKnownPorts=true**.
scanUDP	false	This flag indicates whether or not to scan UDP ports. **Note:** UDP scanning is supported only if **useNMap=true** (see below).
UDPports		This parameter contains a list of UDP ports on which discovery is performed. This list can include ranges, separate port numbers, and known protocol names (such as http, ftp, etc.) and must be comma separated. If this list is empty or contains the value *****, discovery is performed only on all known UDP ports.

Name	Default Value	Description
		If a port range is entered (such as 1000-1100), discovery is performed only on all known ports in that range if **checkOnlyKnownPorts=true**.
useNMap	**For Databases TCP Ports and JEE TCP Ports jobs:** false **For SAP TCP Ports and TCP Ports jobs:** true	This flag indicates whether or not to use nmap during port scanning. **Note:** If no path is specified for **nmapPath** (see above), the nmap from the system path is used.

Note: Only ports on which a port name has been assigned to it in the **ports** or **UDPports** parameters and which are marked as 'discoverable' (**isDiscovered=1**) in the **portNumberToPortName.xml** configuration file are discovered.

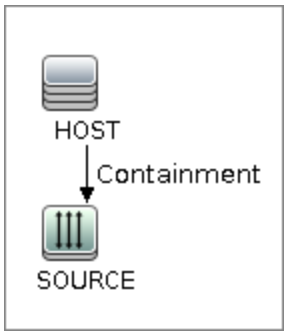
Adapter Information

This adapter discovers TCP ports.

Input CIT

IpAddress

Input Query



Triggered CI Data

Name	Value
ip_address	${SOURCE.name}
ip_domain	${SOURCE.routing_domain}

Used Scripts

- TcpPortScanner.py
- nmap.py

Global Configuration File

portNumberToPortName.xml

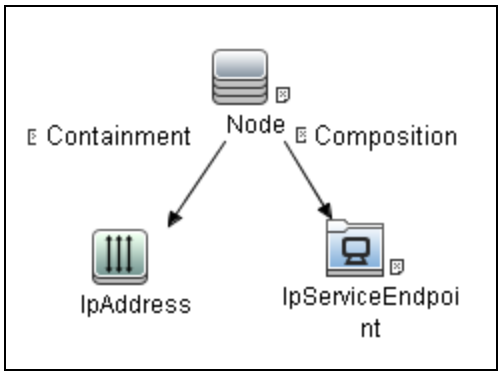
Discovered CITs

- Composition
- Containment
- IpAddress
- IpServiceEndpoint
- Node

JEE JBoss Connections by JMX Job

This section includes details about the job.

Trigger Query



Node Name	Condition
Node	None
IpServiceEndPoint	IpServiceName Equal rmi OR IpServiceName Equal jboss-port OR ServiceNames Contains rmi OR ServiceNames Contains jboss-port
IpAddress	NOT IP Probe Name Is null

Parameters

Name	Value	Description
disableUDPDiscovery	false	Indicates whether to disable UDP discovery of the JMX port.
remoteJVMArgs	-Xms64m -Xmx256m -XX:PermSize=256m -XX:MaxPermSize=256m	The JVM parameters that should be passed to the remote process.
runInSeparateProcess	true	Indicates whether the

Name	Value	Description
		pattern runs in a separate thread.

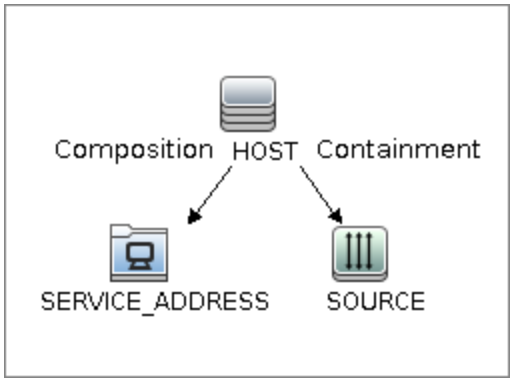
Adapter Information

This job uses the **JMX_J2EE_JBoss_Connection** adapter. This adapter discovers JBoss server instances based on the JMX protocol.

Input CIT

IpAddress

Input Query



Triggered CI Data

Name	Value
ip_address	${SOURCE.name}
ip_domain	${SOURCE.routing_domain}
ports	${SERVICE_ADDRESS.network_port_number:NA}

Used Scripts

- connection.py
- db.py

- db_builder.py
- db_platform.py
- entity.py
- iteratortools.py
- jboss.py
- jboss_discoverer.py
- jdbc.py
- jdbc_url_parser.py
- jee.py
- jee_connection.py
- jee_discoverer.py
- jmx.py
- JMX_J2EE_JBoss_Connection.py
- protocol.py

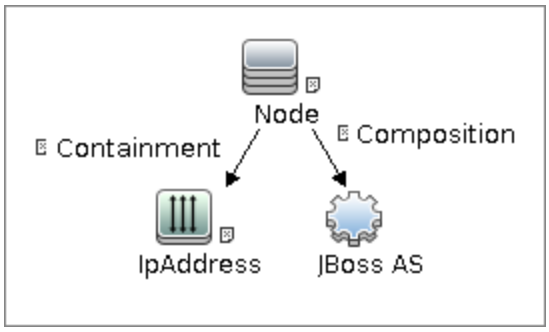
Discovered CITs

- Composition
- Containment
- IpAddress
- IpServiceEndpoint
- J2EE Domain
- JBoss AS
- JEE Node
- JVM
- Membership
- Node
- Usage

JEE JBoss by JMX Job

This section includes details about the job.

Trigger Query



- Node Conditions

Node Name	Condition
Node	None
JBoss AS	`NOT Reference to the credentials dictionary entry Is null`
IpAddress	`NOT IP Probe Name Is null`

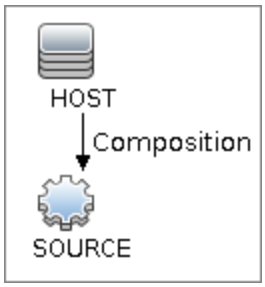
Job Parameters

Parameters are not overridden by default and use values from the adapter.

Adapter - JMX_J2EE_JBoss

This adapter discovers JBoss servers instances based on the JMX protocol.

- Input CIT: JBoss AS
- Input Query



- Triggered CI Data

Name	Value
credentialsId	${SOURCE.credentials_id}
ip_address	${SOURCE.application_ip:}
port	${SOURCE.application_port:}
servername	${SOURCE.name}
userName	${SOURCE.application_username:}
version	${SOURCE.application_version:}

- Used Scripts
  - connection.py
  - db.py
  - db_builder.py
  - db_platform.py
  - entity.py
  - iteratortools.py
  - jboss.py
  - jboss_discoverer.py
  - jdbc.py
  - jdbc_url_parser.py
  - jee.py
  - jee_connection.py
  - jee_discoverer.py

- jms.py
- jmx.py
- JMX_J2EE_JBoss.py
- protocol.py

- Global Configuration File: globalSettings.xml
- Parameters:

Name	Value	Description
discoverAppResources	true	Discover modules, ejbs and servlets if set to true.
discoverJMSResources	true	Discover JMS providers and JMS servers if set to true.
remoteJVMArgs	-Xms64m -Xmx256m -XX:PermSize=256m -XX:MaxPermSize=256m	JVM parameters that should be passed to the remote process.
runInSeparateProcess	true	Whether the pattern runs in a separate thread.

Discovered CITs

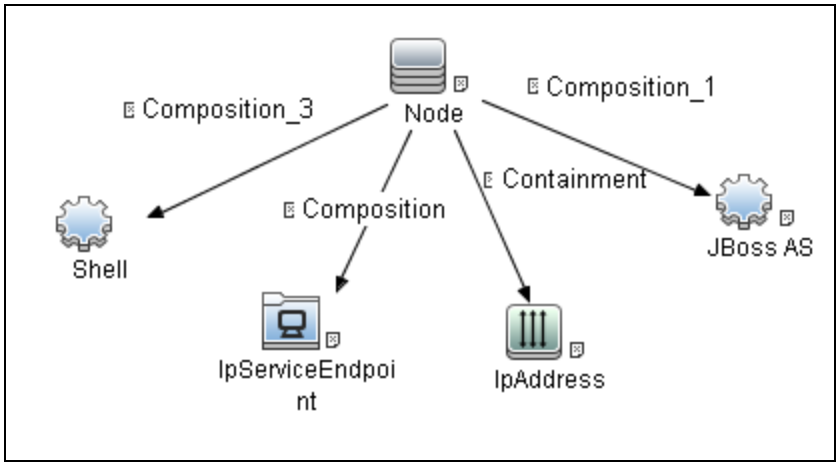
- Composition
- ConfigurationDocument
- Containment
- Database
- Dependency
- Deployed
- IpAddress
- IpServiceEndpoint
- J2EE Domain
- J2EE Managed Object
- J2eeCluster

- JBoss AS
- JVM
- JdbcDataSource
- JEE Node
- Membership
- Node
- Usage
- Web Service

JEE JBoss by Shell Job

This section includes details about the job.

Trigger Query



Node Name	Condition
Node	None
Shell	NOT Reference to the credentials dictionary entry Is null
JBoss AS	None
IpAddress	NOT IP Probe Name Is null

Node Name	Condition
IpServiceEndPoint	IpServiceName Equal rmi OR IpServiceName Equal jboss-port OR ServiceNames Contains rmi OR ServiceNames Contains jboss-port

Parameters

Parameters are not overridden by default and use values from the adapter.

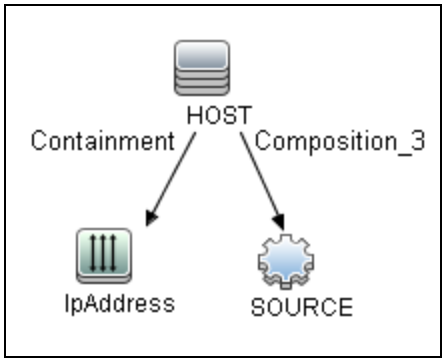
Adapter Information

This job uses the **JBoss_By_Shell** adapter.

Input CIT

Shell

Input Query



Triggered CI Data

Name	Value
connected_os_credentials_id	${SOURCE.connected_os_credentials_id:NA}
credentialsId	${SOURCE.credentials_id}
hostId	${HOST.root_id}

Name	Value
ip_address	${SOURCE.application_ip}
ip_address_list	${IpAddress.name}
Protocol	${SOURCE.root_class}

Used Scripts

- connection.py
- db.py
- db_builder.py
- db_platform.py
- entity.py
- file_ver_lib.py
- iteratortools.py
- jboss.py
- jboss_by_shell.py
- jboss_discoverer.py
- jdbc.py
- jdbc_url_parser.py
- jee.py
- jee_connection.py
- jee_discoverer.py
- jms.py
- jmx.py
- process.py
- process_discoverer.py
- protocol.py

Global Configuration File

- globalSettings.xml

Parameters

None

Discovered CITs

- Composition
- ConfigurationDocument
- Containment
- Database
- Dependency
- Deployed
- IpAddress
- IpServiceEndpoint
- J2EE Domain
- J2EE Managed Object
- J2eeCluster
- JBoss AS
- JEE Node
- JVM
- JdbcDataSource
- Membership
- Node
- Usage
- Web Service

Troubleshooting and Limitations – JBoss Discovery

This section describes troubleshooting and limitations for JBoss discovery.

- **Limitation:** DFM can discover a J2EE application only when its .ear file is unzipped to a folder.
- **Limitation:** When using JBoss 7.x, this discovery only supports local Host Controller configuration, because JMX MBeans of such a managed JBoss server has no information about the remote Domain Controller.

Chapter 64: Oracle iAS Discovery

This chapter includes:

Overview 961

Supported Versions 961

Topology 962

How to Discover Oracle Application Server by Shell 962

Oracle Application Server by Shell Job 963

Adapter Information 964

Overview

Oracle's Internet Application Server (iAS) provides a single integrated packaged solution of for middleware infrastructure including Oracle Containers for J2EE (OC4J), Oracle Web Cache, Oracle HTTP Server, Oracle Forms, Oracle Reports, Oracle Portal and Oracle Discoverer.

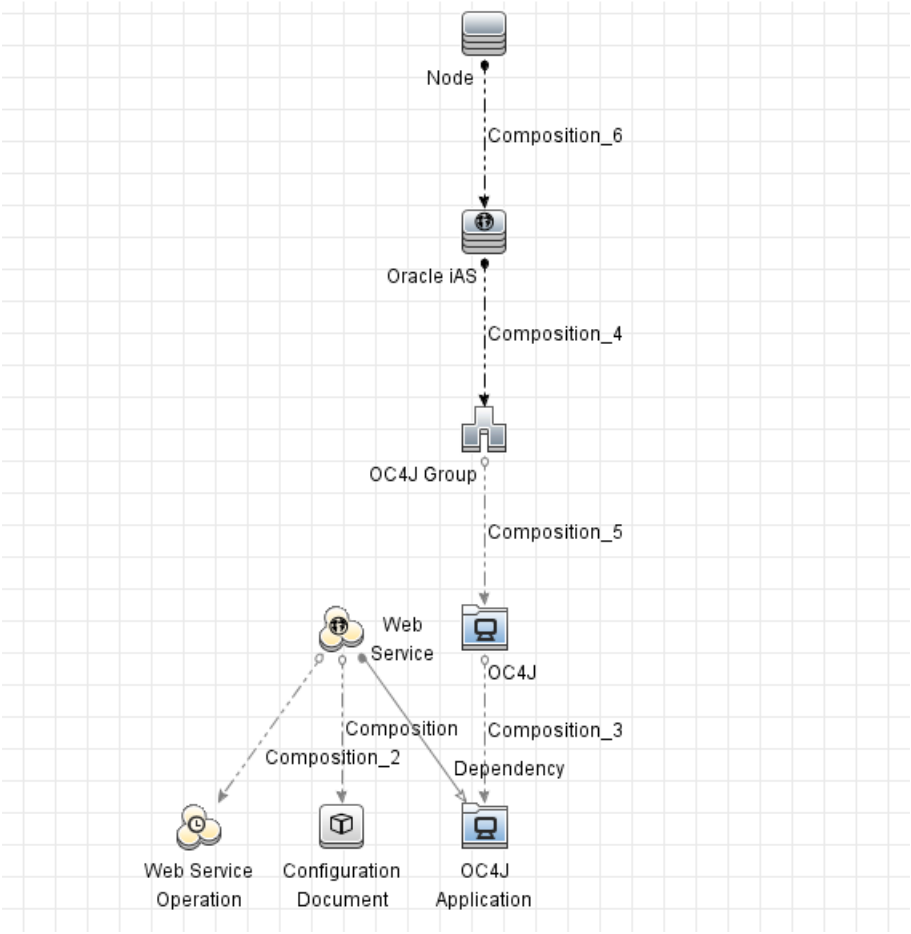
This section describes how to discover the Oracle iAS by the Shell protocol.

Supported Versions

This discovery supports Oracle Internet Application Server 9i and 10g.

Topology

The following image displays the topology of the Oracle iAS discovery.



How to Discover Oracle Application Server by Shell

This task includes the following steps:

1. Prerequisite - Set up protocol credentials

   This discovery uses the Shell protocol. Define credentials for one of the following protocols:

   - NTCMD protocol
   - SSH protocol

- Telnet protocol
- Universal Discovery protocol

For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Run the discovery

Run the following jobs in the following order:

a. **Range IPs by ICMP**

b. **Host Connection by Shell**

c. **Host Applications by Shell**

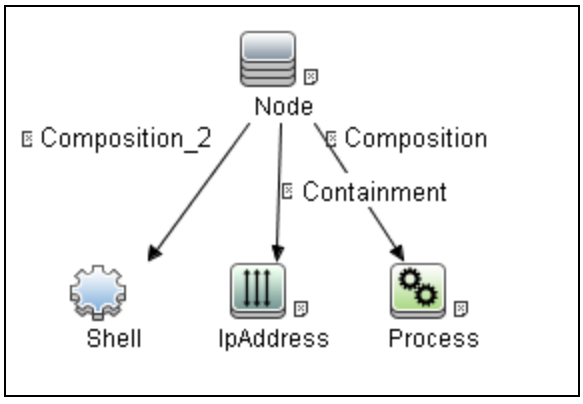
d. **Oracle Application Server by Shell**

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

Oracle Application Server by Shell Job

This section includes details about the job.

Trigger Query



CI	Attribute Value
Shell	NOT Reference to the credentials dictionary entry Is null

CI	Attribute Value
IpAddress	NOT IP Probe Name Is null
Process	Process CMD Line Like ignore case %opmn%

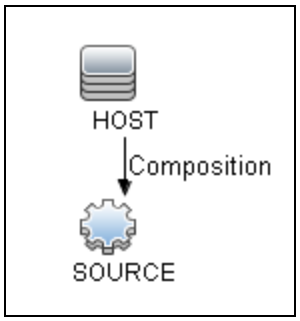
Adapter Information

This job uses the **Oracle Application Server** adapter.

Input CIT

Jython

Input Query



Triggered CI Data

Name	Value
Protocol	${SOURCE.root_class}
connected_os_credentials_id	${SOURCE.connected_os_credentials_id:NA}
credentialsId	${SOURCE.credentials_id}
ip_address	${SOURCE.application_ip}

Used Scripts

- oracle_shell_utils.py
- file_ver_lib.py

- file_mon_utils.py
- OracleApplicationServer.py

Discovered CITs

- Composition
- Containment
- Dependency
- IpAddress
- Node
- OC4J
- OC4J Group
- Oracle iAS
- RunningSoftware
- UriEndpoint

Adapter Parameters

Parameter	Default Value	Description
port	8888	The port number forOracle Application Server.
OracleHomePath		The Oracle home path(s), separated by semicolons.

Chapter 65: WebLogic Discovery

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Overview

WebLogic discovery enables you to discover a full topology including J2EE applications, and JDBC and JMS resources.

Supported Versions

The following versions are supported:

WebLogic 9.x, 10.x, 11g, 11gR1 PS1, 11gR1 PS2, 11gR1 PS3 and 12c.

How to Discover WebLogic Topology by JMX

This task describes how to discover WebLogic. The WebLogic discovery process enables you to discover a complete WebLogic topology including J2EE applications, JDBC, and JMS resources.

DFM first finds WebLogic servers based on the JMX protocol, then discovers the WebLogic J2EE environment and components.

This task includes the following steps:

- "Prerequisite - Set up protocol credentials" below
- "Prerequisite - Set up drivers" below
- "Run the discovery" on the next page

1. ## Prerequisite - Set up protocol credentials

   This discovery is based on the JMX protocol using credentials from the Weblogic protocol. Weblogic protocol credentials must be defined.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. ## Prerequisite - Set up drivers

   Set up the drivers needed to discover WebLogic. Default WebLogic drivers are not included and should be copied to the Probe.

a. To discover WebLogic on SSL, obtain the following drivers:

Driver	Description
wlcipher.jar	If WebLogic is running on SSL **Note:** For all supported WebLogic versions
client trust store JKS file	If WebLogic is running on SSL. For example, **DemoTrust.jks**
jsafeFIPS.jar	If WebLogic is running on SSL **Note:** For WebLogic 8.1 SP5 and later
wlfullclient.jar	If WebLogic is running on SSL. **wlfullclient.jar** should be generated first using JarBuilder tool i. Change directory to %weblogic.home%/server/lib2. ii. Run java -jar wljarbuilder.jar **Note:** For WebLogic 9.x and 10.x
wlclient.jar	For WebLogic 9.x and 10.x only
wljmxclient.jar	For WebLogic 9.x and 10.x only

b. Place the drivers under the correct version folder in the following location:

```
C:\hp\UCMDB\DataFlowProbe\runtime\probeManager
\discoveryResources\j2ee\weblogic\<version_folder>
```

For example,

```
C:\hp\UCMDB\DataFlowProbe\runtime\probeManager
\discoveryResources\j2ee\weblogic\10.x
```

c. Restart the Probe before running the DFM jobs.

3. Run the discovery

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

a. Run the **Range IPs by ICMP** job to discover the target IPs.

b. Run the **JEE TCP Ports** job to discover service endpoint information. For job details, see "JEE TCP Ports Job" on page 970.

c. Run the **JEE Weblogic Connections by JMX** job to perform a shallow discovery of

application servers. For job details, see "JEE Weblogic Connections by JMX Job" on page 973.

d. Run the **JEE Weblogic by JMX** job to perform a deep discovery of application server topology. For job details, see "JEE Weblogic by JMX Job" on page 976.

How to Discover WebLogic Topology by Shell

The WebLogic discovery process enables you to discover a complete WebLogic topology including J2EE applications, JDBC, and JMS resources. DFM first finds application servers based on the Shell protocol or endpoints (TCP Ports) and then discovers the WebLogic J2EE environment and components by shell.

This task includes the following steps:

1. Prerequisite - Set up protocol credentials

   This discovery uses the Shell protocol. Define credentials for one of the following protocols:

   - NTCMD protocol
   - SSH protocol
   - Telnet protocol

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Discovery Workflow

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

   a. Run the **Range IPs by ICMP** job to discover the target IPs.

   b. Run the **Host Connection by Shell** job to discover the target host and shell connectivity to it.

   c. Run one of the two jobs:

      - **Host Applications by Shell** to discover resources of the target host, including running processes.
      - **JEE TCP Ports** to discover service endpoint information. For job details, see "JEE TCP Ports Job" on the next page.

d. Run the job **JEE Weblogic by Shell**. For job details, see "JEE Weblogic by Shell Job" on page 981.

JEE TCP Ports Job

This section includes details about the job.

Adapter

This job uses the **TCP Ports Discovery** adapter.

Trigger Query

Node Conditions

Node Name	Condition
IpAddress	`NOT IP Probe Name Is null`

Job Parameters

Name	Default Value	Description
checkIfIpIsReachable	true	This flag indicates whether the job should check if the discovered IP is reachable before the job starts to check availability of the host's ports.
checkOnlyKnownPorts	true	This flag indicates whether the job should discover only known ports. This flag does not cancel the **ports** or **UDPports** parameters. Setting this flag to **false** is applicable only with a real port range in the **ports** or **UDPports** parameter.

Name	Default Value	Description
connectTimeOut	5000	The timeout (in milliseconds) when connecting to an IP and port.
nmapPath		The full path to the nmap executable file (for example: **C:\Program Files (x86)\Nmap\nmap.exe**).
pingTimeOut	2000	The ICMP ping timeout (in milliseconds).
ports	**For JEE TCP Ports job:** • weblogic, weblogicSSL, websphere_jmx, rmi **For Databases TCP Ports job:** • oracle, db2, sybase, sql, mysql **For SAP TCP Ports job:** • sap, sap_jmx, sap_http, sap_https **For SAP TCP Ports job:** no default value	This parameter contains a list of TCP ports on which discovery is performed. This list can include ranges, separate port numbers, and known protocol names (such as http, ftp, etc.) and must be comma separated. If this list is empty or contains the value *, discovery is performed only on all known TCP ports. If a port range is entered (such as 1000-1100), discovery is performed only on all known ports in that range if **checkOnlyKnownPorts=true**.
scanUDP	false	This flag indicates whether or not to scan UDP ports. **Note:** UDP scanning is supported only if **useNMap=true** (see below).
UDPports		This parameter contains a list of UDP ports on which discovery is performed. This list can include ranges, separate port numbers, and known protocol names (such as http, ftp, etc.) and must be comma separated. If this list is empty or contains the value *, discovery is performed only on all known UDP ports. If a port range is entered (such as 1000-1100), discovery is performed only on all known ports in that

Name	Default Value	Description
		range if **checkOnlyKnownPorts=true**.
useNMap	**For Databases TCP Ports and JEE TCP Ports jobs:** false **For SAP TCP Ports and TCP Ports jobs:** true	This flag indicates whether or not to use nmap during port scanning. **Note:** If no path is specified for **nmapPath** (see above), the nmap from the system path is used.

Note: Only ports on which a port name has been assigned to it in the **ports** or **UDPports** parameters and which are marked as 'discoverable' (**isDiscovered=1**) in the **portNumberToPortName.xml** configuration file are discovered.

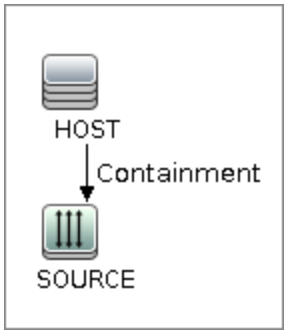
Adapter Information

This adapter discovers TCP ports.

Input CIT

IpAddress

Input Query



Triggered CI Data

Name	Value
ip_address	${SOURCE.name}
ip_domain	${SOURCE.routing_domain}

Used Scripts

- TcpPortScanner.py
- nmap.py

Global Configuration File

portNumberToPortName.xml

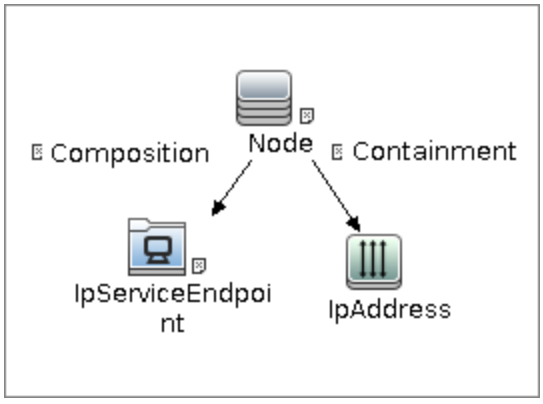
Discovered CITs

- Composition
- Containment
- IpAddress
- IpServiceEndpoint
- Node

JEE Weblogic Connections by JMX Job

This section includes details about the job.

Trigger Query



- Node Conditions

Node Name	Condition
Node	None
IpServiceEndPoint	IpServiceName Equal weblogic OR IpServiceName Equal weblogicSSL OR ServiceNames Contains weblogic OR ServiceNames Contains weblogicSSL
IpAddress	NOT IP Probe Name Is null

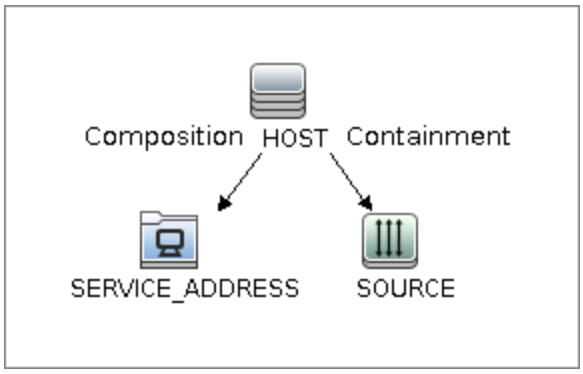
Job Parameters

Parameters are not overridden by default and use values from the adapter.

Adapter - JMX_J2EE_WebLogic_Connection

This adapter is used for Weblogic Server discovery.

- Input CIT: IpAddress
- Input Query:



- Triggered CI Data

Name	Value
ip_address	${SOURCE.name}
ip_domain	${SOURCE.routing_domain}
ports	${SERVICE_ADDRESS.network_port_number:NA}
hostId	${HOST.root_id}

- Used Scripts
  - connection.py
  - db.py
  - db_builder.py
  - db_platform.py
  - entity.py
  - iteratortools.py
  - jdbc.py
  - jdbc_ulr_parser.py
  - jee.py
  - jee_connection.py
  - jee_discoverer.py
  - jms.py
  - jmx.py

- JMX_J2EE_WebLogic_Connection.py
- protocol.py
- weblogic.py
- weblogic_discoverer.py

- Global Configuration File: None
- Adapter Parameters

Name	Value	Description
remoteJVMArgs	-Xms64m -Xmx256m -XX:PermSize=256m -XX:MaxPermSize=256m	JVM parameters that should be passed to the remote process.
runInSeparateProcess	true	Should pattern run in separate thread.

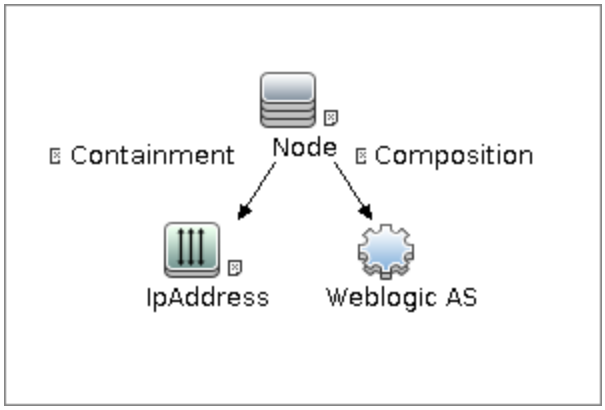
Discovered CITs

- Composition
- Containment
- IpAddress
- IpServiceEndpoint
- J2EE Domain
- JEE Node
- JVM
- Membership
- Node
- Usage
- WebLogic AS

JEE Weblogic by JMX Job

This section includes details about the job:

Trigger Query



- Node Conditions

Node Name	Condition
Node	None
IpAddress	NOT IP Probe Name Is null
Weblogic AS	NOT Reference to the credentials dictionary entry Is null

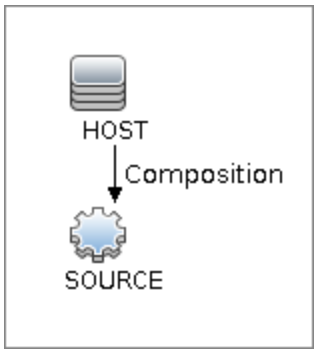
Job Parameters

Parameters are not overridden by default and use values from the adapter.

Adapter - JMX_J2EE_WebLogic

This adapter is used for Weblogic J2EE Topology Discovery by JMX.

- Input CIT: Weblogic AS
- Input Query:



- Triggered CI Data

Name	Value
credentialsId	${SOURCE.credentials_id}
ip_address	${SOURCE.application_ip}
port	${SOURCE.application_port}
servername	${SOURCE.name}
version	${SOURCE.application_version}
protocol	${SOURCE.j2eeserver_protocol}

- Used Scripts
  - connection.py
  - db.py
  - db_builder.py
  - db_platform.py
  - entity.py
  - iteratortools.py
  - jdbc.py
  - jdbc_url_parser.py
  - jee.py
  - jee_connection.py
  - jee_discoverer.py
  - jms.py

- jmx.py
- JMX_J2EE_WebLogic.py
- protocol.py
- weblogic.py
- weblogic_discoverer.py

- Global Configuration File: globalSettings.xml
- Adapter Parameters

Name	Value	Description
deploymentDescriptors	true	Set to **true** to fetch deployment descriptors of J2EE Application, EJB Modules and Web Modules (value: true/false).
discoverAppResources	true	Discover modules, ejbs and servlets if set to true.
discoverJMSResources	true	Discover jms providers and jms servers if set to true.
remoteJVMArgs	-Xms64m -Xmx256m -XX:PermSize=256m -XX:MaxPermSize=256m	JVM parameters that should be passed to the remote process.
runInSeparateProcess	true	Should pattern run in separate thread.
discoverDeployedOnly Applications	true	Discover applications that are deployed and are in running status

Discovered CITs

- Composition
- ConfigurationDocument
- Containment
- Database
- Dependency
- Deployed

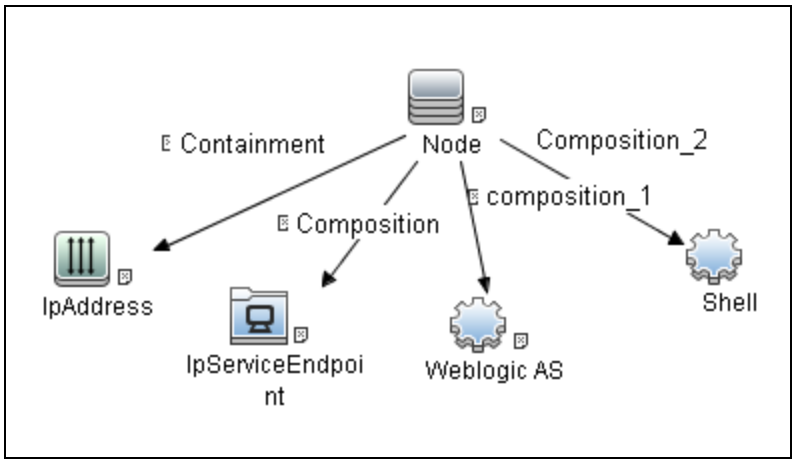
- IpAddress
- IpServiceEndpoint
- J2EE Domain
- J2EE Managed Object
- J2eeCluster
- JEE Node
- JVM
- JdbcDataSource
- Membership
- Node
- Usage
- Web Service
- Weblogic AS

> **Note:** JDBC Datasources cannot be discovered if they were not activated in the Weblogic Admin Console prior to discovery.

JEE Weblogic by Shell Job

This section includes details about the job.

Trigger Query



Node Name	Condition
Node	None
Shell	None
Weblogic AS	None
IpAddress	NOT IP Probe Name Is null
IpServiceEndPoint	IpServiceName Equal weblogic OR IpServiceName Equal weblogicSSL OR ServiceNames Contains weblogic OR ServiceNames Contains weblogicSSL

Parameters

Parameters are not overridden by default and use values from the adapter.

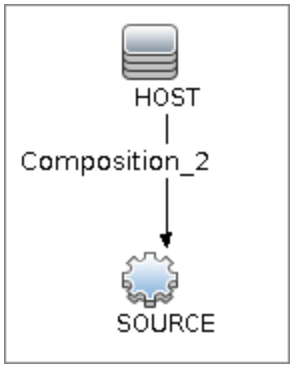
Adapter Information

This job uses the **WebLogic_By_Shell** adapter.

Input CIT

Shell

Input Query



Triggered CI Data

Name	Value
connected_os_credentials_id	${SOURCE.connected_os_credentials_id:NA}
credentialsId	${SOURCE.credentials_id}
hostId	${HOST.root_id}
ip_address	${SOURCE.application_ip}
Protocol	${SOURCE.root_class}

Used Scripts

- connection.py
- db.py
- db_builder.py
- db_platform.py
- entity.py
- file_ver_lib.py
- fptools.py

- iteratortools.py
- jdbc.py
- jdbc_url_parser.py
- jee.py
- jee_connection.py
- jee_discoverer.py
- jms.py
- jmx.py
- process.py
- process_discoverer.py
- protocol.py
- weblogic.py
- weblogic_by_shell.py
- weblogic_discoverer.py
- asm_weblogic_discoverer.py

Global Configuration File

globalSettings.xml

Adapter Parameters

None

Discovered CITs

- Composition
- ConfigurationDocument
- Containment
- Database
- Database Schema

- Dependency
- Deployed
- IpAddress
- IpServiceEndpoint
- J2eeCluster
- J2EE Domain
- J2EE Managed Object
- JdbcDataSource
- JEE Node
- Membership
- Node
- Usage
- Web Service
- Weblogic AS

Troubleshooting and Limitations – WebLogic Discovery

Troubleshooting

- **Problem:** When running the WebLogic by JMX job, using the SSL protocol, and the UCMDB server and Data Flow Probe are connected using the SSL protocol, the job is unable to connect to the target node.

  The following are alternative solutions:

  Solution 1: Configure an HTTP connection between UCMDB server and the Data Flow Probe.

  Solution 2: Allow a non SSL connection to the WebLogic server and configure UCMDB JMX credentials; do not use an SSL connection

  Solution 3: Update the parameter **remoteJVMArgs** of the jobs (JEE WebLogic Connections by JMX job and JEE WebLogic by JMX job) by adding the following argument:

  ```
  Djavax.net.ssl.trustStore=..\runtime\probeManager\discoveryResources
  \j2ee\websphere\UCMDB_store.jks
  ```

Limitations

- For Weblogic versions 8.x and earlier, DFM discovers only those domains created by the WebLogic Configuration Wizard.
- For versions earlier than WebLogic 9, the JEE WebLogic by Shell job can run only on admin server hosts. For WebLogic version 9 or later, the job can run also on hosts that contain managed nodes only.
- DFM can discover a J2EE application only when its .ear file is unzipped to a folder.
- The WebLogic installation includes an example that is filtered out by default. You can remove the filter in the **weblogic_by_shell.py** Jython script. Look for **WL_EXAMPLE_DOMAINS = 'medrec'**.

Chapter 66: WebSphere Discovery

This chapter includes:

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Troubleshooting and Limitations – WebSphere Discovery 1010

Overview

This section describes how to discover WebSphere application center. The WebSphere discovery process enables you to discover the complete WebSphere topology including J2EE applications, JDBC, and JMS resources.

Supported Versions

WAS Version	J2EE Version	JVM Version
5.0	J2EE 1.3	JVM 1.3
5.1	J2EE 1.3	JVM 1.4
6.0	J2EE 1.4	JVM 1.4
6.1	J2EE 1.4	JVM 1.5
7.0	Java EE 5	JVM 1.6
8.x	Java EE 7	JVM 1.7

How to Discover WebSphere Topology by JMX

DFM first finds WebSphere servers based on either SOAP or RMI authentication and then discovers the WebSphere J2EE environment and components.

This task describes how to discover WebSphere connections by JMX, and includes the following steps:

1. Prerequisite - Set up protocol credentials

   This discovery is based on the JMX protocol using credentials from the WebSphere protocol. WebSphere protocol credentials must be defined.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Prerequisite - Set up drivers

Set up the drivers needed to discover WebSphere. Default WebSphere drivers are included by default with the Probe installation.

The Probe installation includes WebSphere drivers for versions 5 and 6, but you can use your own drivers, if you prefer. However, you can use only drivers that work with a supported version. For details on supported versions, see Discovered Applications.

To update the .jar files:

a. Copy the drivers to the correct version folder in the following location:

```
C:\hp\UCMDB\DataFlowProbe\runtime\probeManager
\discoveryResources\j2ee\websphere\<version_folder>
```

For example,

```
C:\hp\UCMDB\DataFlowProbe\runtime\probeManager
\discoveryResources\j2ee\websphere\5.x
```

b. Restart the Probe before running the DFM jobs.

3. Update the .jar files

a. Copy the following files from a WebSphere 8.x application server:

- **<WebSphere root folder>**\AppServer\runtimes\com.ibm.ws.orb_8.x.0.jar
- **<WebSphere root folder>**\AppServer\runtimes\com.ibm.ws.ejb.thinclient_8.x.0.jar
- **<WebSphere root folder>**\AppServer\runtimes\com.ibm.ws.admin.client_8.x.0.jar
- **<WebSphere root folder>**\AppServer\deploytool\itp\plugins\ <com.ibm.websphere.v8_....>\wasJars\ibmpkcs.jar
- **<WebSphere root folder>**\AppServer\deploytool\itp\plugins\ <com.ibm.websphere.v8_....>\wasJars\ibmkeycert.jar
- **<WebSphere root folder**\AppServer\deploytool\itp\plugins\ <com.ibm.websphere.v8_....>\wasJars\ibmjceprovider.jar

  where **<WebSphere root folder>** is the folder where you installed WebSphere.

b. Stop the Data Flow Probe.

c. Back up all of the files in **<DataFlowProbe root folder>**\runtime\probeManager\discoveryResources\j2ee\websphere\ except **UCMDB_ store.jks**.

where **<DataFlowProbe root folder>** is the folder where you installed the Data Flow Probe.

d. Delete all files from **<DataFlowProbe root folder>**\runtime\probeManager\discoveryResources\j2ee\websphere\ except UCMDB_store.jks.

e. Put all of the files you copied in step a in the following location on the Data Flow Probe: **<DataFlowProbe root folder>**\runtime\probeManager\discoveryResources\j2ee\websphere

f. Restart the Data Flow Probe.

4. Run the discovery

Run the following jobs in the following order:

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

a. Run the **Range IPs by ICMP** job to discover the target IPs.

b. Run the **JEE TCP Ports** job to discover service endpoint information. For job details, see "JEE TCP Ports Job" on page 994.

c. Run the **JEE WebSphere Connections by JMX** job to perform a shallow discovery of application servers. For job details, see "JEE WebSphere Connections by JMX Job" on page 998.

d. Run the **JEE WebSphere by Shell or JMX** job to perform a deep discovery of application server topology. For job details, see "JEE WebSphere by Shell or JMX Job" on page 1000.

How to Discover WebSphere Topology by Shell

This task describes how to discover a complete WebSphere topology using Shell protocols. The WebSphere discovery process discovers Web services that are deployed on an IBM WebSphere server. The discovered Web services are represented by the `webservice` CIT in the CMDB.

DFM first finds application servers based on the Shell protocol or endpoints (TCP Ports) and then discovers the WebSphere J2EE environment and components by Shell.

This task includes the following steps:

- "Prerequisite - Set up protocol credentials" on the next page
- "Prerequisite - Set up key stores" on the next page
- "Run the discovery" on the next page

1. Prerequisite - Set up protocol credentials

   This discovery uses the Shell protocol. You must define one of the following protocols:

   - SSH Protocol
   - Telnet Protocol
   - NTCMD Protocol

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Prerequisite - Set up key stores

   The following procedure is relevant if you are running a client machine that includes two key stores, each one needed for identification on a specific WebSphere server. If the client attempts to connect to one of the WebSphere servers with the wrong key store, the attempt fails. If the client then uses the second, correct key store to connect to the WebSphere server, that attempt also fails.

   - **Solution 1**: Set up one key store on the client for all WebSphere servers.
   - **Solution 2**: Set up one key store per IP address range for all WebSphere servers that use the same user name and password. For a server that uses a different user name and password, set up a key store in another IP range.

3. Run the discovery

   Run the following jobs in the following order:

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

   a. Run the **Range IPs by ICMP** job to discover the target IPs.

   b. Run the **Host Connection by Shell** job to discovers the target host and Shell connectivity to the host.

   c. Run one of the following jobs:

      - Run the **Host Applications by Shell** job to discover applications of the target host, including running processes.
      - Run the **JEE TCP Ports** job to discover service endpoint information. For job details, see "JEE TCP Ports Job" on page 994.

d. Run the **JEE WebSphere by Shell** job. For job details, see "JEE WebSphere by Shell Job" on page 1004.

How to Discover WebSphere Inactive Instances by Shell

This task describes how to discover WebSphere inactive (cold standby) instances using Shell protocols.

This task includes the following steps:

1. Prerequisite - Set up protocol credentials

   This discovery uses the Shell protocol. You must define one of the following protocols:

   - SSH Protocol
   - NTCMD Protocol
   - Universal Discovery Protocol
   - Telnet Protocol

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Run the discovery

   a. Run the **Range IPs by ICMP** job to discover the target IPs.

   b. Run the **Host Connection by Shell** job to discovers the target host and Shell connectivity to the host.

   c. Click **Add CI** in the Discovery Progress pane to add the Shell CI that belongs to the WebSphere application server, and then run the **JEE Inactive WebSphere by Shell** job to discover WebSphere inactive (cold standby) instances. For job details, see "JEE Inactive WebSphere by Shell Job" on the next page.

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

JEE Inactive WebSphere by Shell Job

This section includes details about the job.

Job Parameters

Parameters are not overridden by default and use values from the adapter.

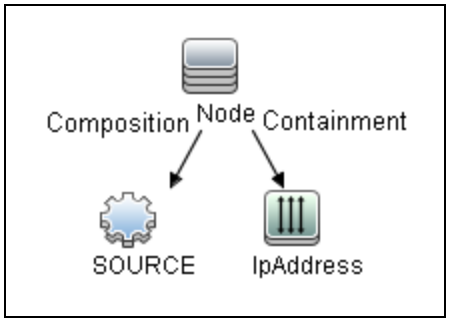
Adapter Information

This job uses the **Inactive_WebSphere_By_Shell** adapter.

Input CIT

Shell

Input Query



Node Name	Condition
SOURCE	NOT Reference to the credentials dictionary entry Is null

Triggered CI Data

Name	Value
Protocol	${SOURCE.root_class}
connected_os_credentials_id	${SOURCE.connected_os_credentials_id:NA}

Name	Value
credentialsId	${SOURCE.credentials_id}
hostId	${HOST.root_id}
ip_address	${SOURCE.application_ip}

Used Scripts

- websphere_discoverer.py
- inactive_websphere_by_shell.py

Discovered CITs

- Composition
- ConfigurationDocument
- Containment
- Database
- Database Schema
- Dependency
- Deployed
- IpAddress
- IpServiceEndpoint
- J2EE Domain
- J2EE Managed Object
- J2eeCluster
- JEE Node
- JVM
- JdbcDataSource
- Membership
- Node

- Usage
- Web Service
- Websphere AS

Adapter Parameters

Parameter	Description
unixInstallPath	The root path of WebSphere application server on UNIX, for example, **/opt/IBM/WebSphere**. **Note:** You can add multiple root paths separated by commas.
winInstallPath	The root path of WebSphere application server on Windows, for example, **C:\Program Files\IBM\WebSphere,C:\Program> Files (x86)\IBM\WebSphere** **Note:** You can add multiple root paths separated by commas.

JEE TCP Ports Job

This section includes details about the job.

Adapter

This job uses the **TCP Ports Discovery** adapter.

Trigger Query

Node Conditions

Node Name	Condition
IpAddress	`NOT IP Probe Name Is null`

Job Parameters

Name	Default Value	Description
checkIfIpIsReachable	true	This flag indicates whether the job should check if the discovered IP is reachable before the job starts to check availability of the host's ports.
checkOnlyKnownPorts	true	This flag indicates whether the job should discover only known ports. This flag does not cancel the **ports** or **UDPports** parameters. Setting this flag to **false** is applicable only with a real port range in the **ports** or **UDPports** parameter.
connectTimeOut	5000	The timeout (in milliseconds) when connecting to an IP and port.
nmapPath		The full path to the nmap executable file (for example: **C:\Program Files (x86)\Nmap\nmap.exe**).
pingTimeOut	2000	The ICMP ping timeout (in milliseconds).
ports	**For JEE TCP Ports job:** • weblogic, weblogicSSL, websphere_jmx, rmi **For Databases TCP Ports job:** • oracle, db2, sybase, sql, mysql **For SAP TCP Ports job:** • sap, sap_jmx, sap_http, sap_https	This parameter contains a list of TCP ports on which discovery is performed. This list can include ranges, separate port numbers, and known protocol names (such as http, ftp, etc.) and must be comma separated. If this list is empty or contains the value *, discovery is performed only on all known TCP ports. If a port range is entered (such as 1000-1100), discovery is performed only on all known ports in that range if **checkOnlyKnownPorts=true**.

Name	Default Value	Description
	For SAP TCP Ports job: no default value	
scanUDP	false	This flag indicates whether or not to scan UDP ports. **Note:** UDP scanning is supported only if **useNMap=true** (see below).
UDPports		This parameter contains a list of UDP ports on which discovery is performed. This list can include ranges, separate port numbers, and known protocol names (such as http, ftp, etc.) and must be comma separated. If this list is empty or contains the value *****, discovery is performed only on all known UDP ports. If a port range is entered (such as 1000-1100), discovery is performed only on all known ports in that range if **checkOnlyKnownPorts=true**.
useNMap	**For Databases TCP Ports and JEE TCP Ports jobs:** false **For SAP TCP Ports and TCP Ports jobs:** true	This flag indicates whether or not to use nmap during port scanning. **Note:** If no path is specified for **nmapPath** (see above), the nmap from the system path is used.

Note: Only ports on which a port name has been assigned to it in the **ports** or **UDPports** parameters and which are marked as 'discoverable' (**isDiscovered=1**) in the **portNumberToPortName.xml** configuration file are discovered.

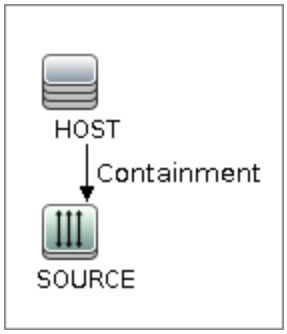
Adapter Information

This adapter discovers TCP ports.

Input CIT

IpAddress

Input Query



Triggered CI Data

Name	Value
ip_address	${SOURCE.name}
ip_domain	${SOURCE.routing_domain}

Used Scripts

- TcpPortScanner.py
- nmap.py

Global Configuration File

portNumberToPortName.xml

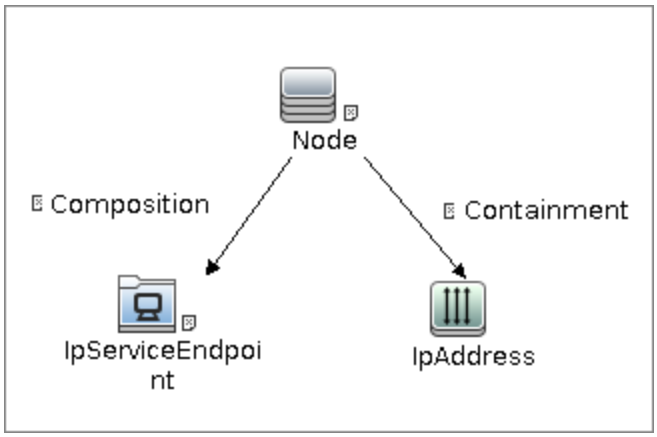
Discovered CITs

- Composition
- Containment
- IpAddress
- IpServiceEndpoint
- Node

JEE WebSphere Connections by JMX Job

This section includes details about the job.

Trigger Query



Node Conditions

Node Name	Condition
IpServiceEndpoint	IpServiceName Equal websphere_jmx OR ServiceNames Contains websphere_jmx
IpAddress	NOT IP Probe Name Is null

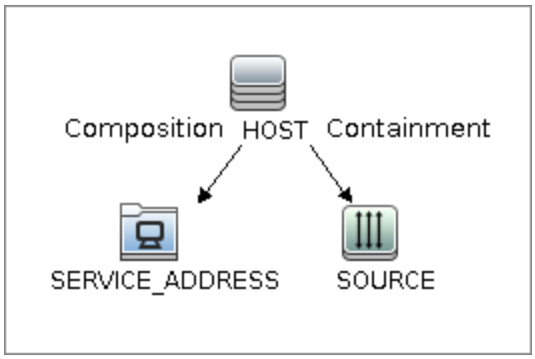
Job Parameters

Parameters are not overridden by default and use values from the adapter.

Adapter - JMX_J2EE_WebSphere_Connection

This adapter is used for WebSphere Server discovery.

- Input CIT: IpAddress
- Input Query:



- Triggered CI Data

Name	Value
ip_address	${SOURCE.name}
ip_domain	${SOURCE.routing_domain}
ports	${SERVICE_ADDRESS.network_port_number:NA}
hostId	${HOST.root_id}
ip_dnsname	${SOURCE.authoritative_dns_name:NA}

- Used Scripts
  - connection.py
  - db.py
  - db_builder.py
  - db_platform.py
  - entity.py
  - iteratortools.py
  - jdbc.py
  - jdbc_url_parser.py
  - jee.py
  - jee_connection.py
  - jee_discoverer.py
  - jms.py
  - jmx.py

- JMX_J2EE_WebSphere_Connection.py
- protocol.py
- websphere.py

- Global Configuration File: None
- Parameters

Name	Value	Description
remoteJVMArgs	-Xms64m -Xmx256m -XX:PermSize=256m -XX:MaxPermSize=256m	JVM parameters that should be passed to the remote process.
runInSeparateProcess	true	Should pattern run in separate thread.

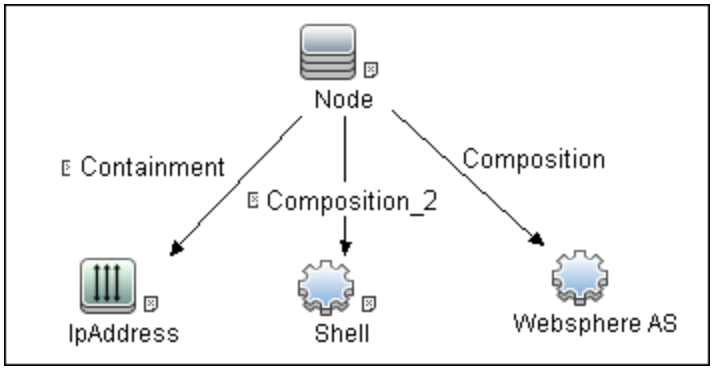
Discovered CITs

- Composition
- IpAddress
- IpServiceEndpoint
- J2EE Domain
- JEE Node
- JVM
- Node
- Usage
- Websphere AS

JEE WebSphere by Shell or JMX Job

This section includes details about the job.

Trigger Query



Node Name	Condition
IpAddress	NOT IP Probe Name Is null
Websphere AS	NOT Reference to the credentials dictionary entry Is null
Shell	NOT Reference to the credentials dictionary entry Is null

Job Parameters

Parameters are not overridden by default and use values from the adapter.

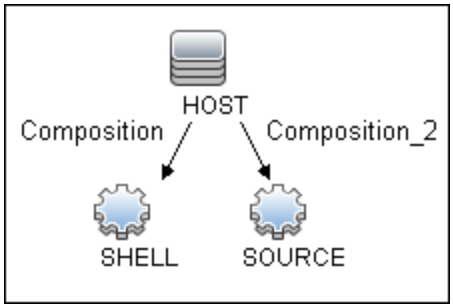
Adapter Information

This job uses the **JMX_J2EE_WebSphere** adapter.

Input CIT

WebSphere AS

Input Query



Triggered CI Data

Name	Value
credentialsId	${SOURCE.credentials_id}
hostId	${HOST.root_id}
ip	${SHELL.application_ip:NA}
ip_address	${SHELL.application_ip}
port	${SHELL.application_port:NA}
protocol	${SHELL.root_class:NA}
shellCredentialsId	${SHELL.credentials_id:NA}
version	${SOURCE.application_version}

Used Scripts

- connection.py
- db.py
- db_builder.py
- db_platform.py
- entity.py
- iteratortools.py
- jdbc.py

- jdbc_url_parser.py
- jee.py
- jee_connection.py
- jee_discoverer.py
- jms.py
- jmx.py
- JMX_J2EE_WebSphere.py
- protocol.py
- websphere.py
- websphere_discoverer.py

Global Configuration File

globalSettings.xml

Adapter Parameters

Name	Value	Description
applications	None	List of applications to discover (comma separated).
discoverAppResources	true	Discover modules, ejbs and servlets if set to true.
discoverConfigFile	true	Discover additional configuration files for cell, server, and application, if set to true.
discoverEAR	true	Discover J2EE application EAR files if set to true.
discoverJDBCResources	true	Discover jdbc providers and datasources if set to true.
discoverJMSResources	true	Discover jms providers and jms servers if set to true.
remoteJVMArgs	-Xms64m -Xmx256m -XX:PermSize=256m -XX:MaxPermSize=256m	JVM parameters that should be passed to the remote process.

Name	Value	Description
runInSeparateProcess	true	Determines if the pattern should be run in a separate thread.
servers	None	List of servers to discover (comma separated).

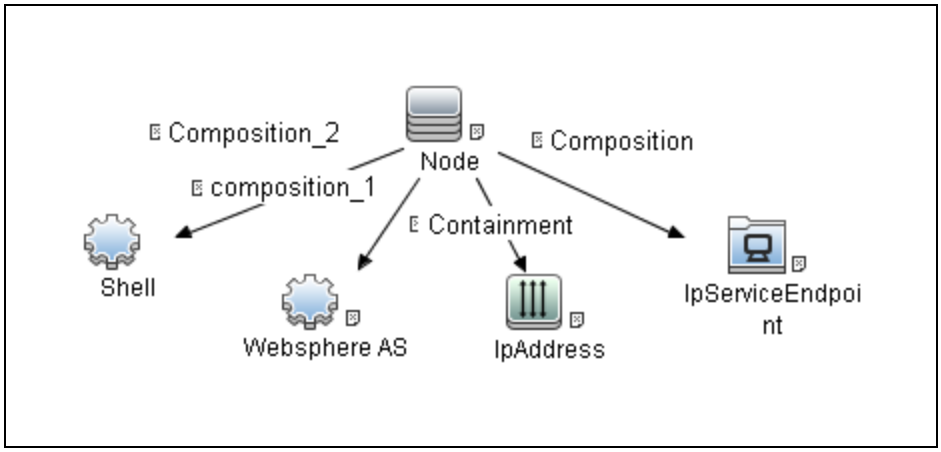
Discovered CITs

- Composition
- ConfigurationDocument
- Database
- Dependency
- Deployed
- IpAddress
- IpServiceEndpoint
- J2EE Domain
- J2EE Managed Object
- J2eeCluster
- JEE Node
- JVM
- JdbcDataSource
- Membership
- Node
- Usage
- Web Service
- Websphere AS

JEE WebSphere by Shell Job

This section includes details about the job.

Trigger Query



Node Name	Condition
IpAddress	NOT IP Probe Name Is null
Shell	NOT Reference to the credentials dictionary entry Is null
IpServiceEndPoint	IpServiceName Equal websphere_jmx OR ServiceNames Contains websphere_jmx

Job Parameters

Parameters are not overridden by default and use values from the adapter.

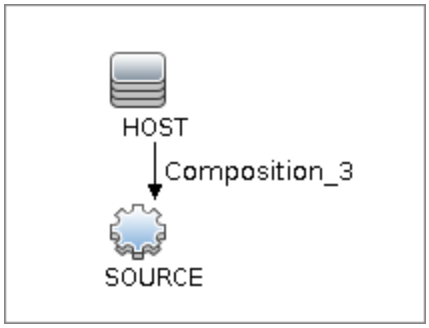
Adapter Information

This job uses the **WebSphere_By_Shell** adapter.

Input CIT

Shell

Input Query



Triggered CI Data

Name	Value
Protocol	${SOURCE.root_class}
credentialsId	${SOURCE.credentials_id}
hostId	${HOST.root_id}
ip_address	${SOURCE.application_ip}
connected_os_credentials_id	${SOURCE.connected_os_credentials_id:NA}

Used Scripts

- asm_websphere_discoverer.py
- connection.py
- db.py
- db_builder.py
- db_platform.py
- entity.py
- file_ver_lib.py
- fptools.py
- iteratortools.py
- jdbc.py
- jdbc_url_parser.py
- jee.py
- jee_connection.py

- jee_constants.py
- jee_discoverer.py
- jms.py
- jmx.py
- process.py
- process_discoverer.py
- protocol.py
- websphere.py
- websphere_by_shell.py
- websphere_discoverer.py

Global Configuration File

globalSettings.xml

Adapter Parameters

None

Discovered Elements

DFM discovers the following elements:

- The Version Number

  DFM discovers the version number of the WebSphere application server from the **WAS.product** or **BASE.product** file (depending on the WebSphere version) in the **<WebSphere base directory>\properties\version** folder.

- The Server Listening Port and Address

  DFM retrieves information about WebSphere servers by searching for the **serverindex.xml** file, found either in the **<WebSphere base directory>\profiles\<PROFILE>\config\cells\<CELL>\nodes\<NODE>** folder, or the **<WebSphere base directory>\config\cells\<CELL>\nodes\<NODE>** folder.

- J2EE Applications

DFM searches for the **deployment.xml** file in each **<WebSphere base directory>\profiles\<PROFILE>\config\cells\<CELL>\applications** folder (or in the **<WebSphere base directory>\config\cells\<CELL>\nodes\<NODE>\applications** folder). The **deployment.xml** file is located in every installed application folder, and contains information about application targets.

- Configuration Files

  DFM creates CIs for the **resources.xml** resources configuration file. A CI is created for each cell, node, and server (with the relevant prefix); each CI is attached to the WebSphere server CI.

- JMS Resources

  WebSphere JMS resources are configured as JMS providers. Resources are of two main kinds: **connection factories** and **destinations** (topic, queue). These may be further categorized as follows:

  - Connection Factories
    - resources.jms.mqseries:MQConnectionFactory
  - Queue Connection Factories
    - resources.jms.mqseries:MQQueueConnectionFactory
    - resources.jms.internalmessaging:WASQueueConnectionFactory
  - Topic Connection Factories
    - resources.jms.mqseries:MQTopicConnectionFactory
    - resources.jms.internalmessaging:WASTopicConnectionFactory
  - Queues or Topics
    - resources.jms:GenericJMSDestination
    - resources.jms.mqseries:MQTopic
    - resources.jms.mqseries:MQQueue
    - resources.jms.internalmessaging:WASTopic
    - resources.jms.internalmessaging:WASQueue

  DFM strives to use all the types mentioned to acquire information about used resources. Discovery looks for the configuration file **resources.xml** on different deployment scopes. The following table shows the deployment scopes and relative path to the configuration file.

Scope	Relative File Path
Cell	<PROFILE>\config\cells\<CELL>\resources.xml
Cluster	<PROFILE>\config\cells\<CELL>\clusters\<CLUSTER>\resources.xml
Node	<PROFILE>\config\cells\<CELL>\nodes\<NODE>\resources.xml
Server	<PROFILE>\config\cells\<CELL>\nodes\<NODE>\servers\<SERVER>\resources.xml

Note: The file path is relative to the <PROFILE> home directory.

Discovered CITs

- Composition
- ConfigurationDocument
- Containment
- Database
- Database Schema
- Dependency
- Deployed
- IpAddress
- IpServiceEndpoint
- J2EE Domain
- J2EE Managed Object
- J2eeCluster
- JEE Node
- JVM
- JdbcDataSource
- Membership
- Node

- Usage
- Web Service
- Websphere AS

Troubleshooting and Limitations – WebSphere Discovery

This section describes troubleshooting and limitations for WebSphere discovery.

Troubleshooting

- **Problem:** When running the Websphere by JMX job, using the SSL protocol, and the UCMDB server and Data Flow Probe are connected using the SSL protocol, the job is unable to connect to the target node.

  The following are alternative solutions:

  Solution 1: Configure an HTTP connection between UCMDB server and the Data Flow Probe.

  Solution 2: Allow a non SSL connection to the Websphere server and configure UCMDB JMX credentials; do not use an SSL connection

  Solution 3: Update the parameter **remoteJVMArgs** of the jobs (JEE WebSphere Connections by JMX job and JEE WebSphere by Shell or JMX job) by adding the following argument:

  ```
  Djavax.net.ssl.trustStore=..\runtime\probeManager\discoveryResources
  \j2ee\websphere\UCMDB_store.jks
  ```

Limitations

- If DFM finds two cells with the same name on the same host, only one cell configuration (**j2eedomain** topology) is reported.
- EJB and Web Service CIs are not discovered.
- DFM can discover a J2EE application only when its **.ear** file is unzipped to a folder.
- A job (script) works with a certificate in jks* key format only.

Chapter 67: WebSphere Liberty Core Server Discovery

This chapter includes:

Overview 1012

Supported Versions 1012

How to Discover WebSphere Liberty Core by Shell 1012

JEE WebSphere Liberty Core by Shell Job 1013

Adapter Information 1013

Overview

This section describes how to discover the WebSphere Liberty Core edition by the Shell protocol. The WebSphere Liberty Core Server discovery process enables you to discover the WebSphere Liberty Core topology including J2EE applications and JDBC.

Supported Versions

This discovery supports IBM WebSphere Liberty Core Server 8.x.

How to Discover WebSphere Liberty Core by Shell

This task includes the following steps:

1. Prerequisite - Set up protocol credentials

   This discovery uses the Shell protocol. Define credentials for one of the following protocols:

   - NTCMD protocol
   - SSH protocol
   - Telnet protocol
   - Universal Discovery protocol

   You do not need root permissions, but do need the appropriate credentials to enable connecting to the remote machines and running the relevant commands, such as **dir\ls** and **type\cat**.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Run the discovery

   Run the following jobs in the following order:

   a. Run the **Range IPs by ICMP** job to discover the target IPs.

   b. Run the **Host Connection by Shell** job to connect to the target OS.

   c. Run the **Host Applications by Shell** job to discover applications of the target host including running processes.

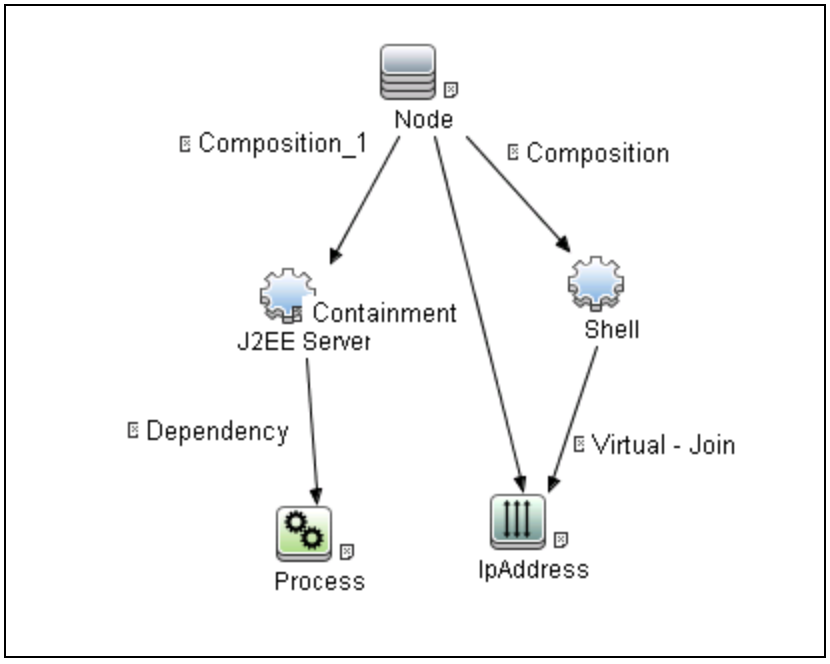
d. Run the **JEE WebSphere Liberty Core by Shell** job to discover the full topology of WebSphere Liberty Core.

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

JEE WebSphere Liberty Core by Shell Job

This section includes details about the job.

Trigger Query



Node Name	Condition
J2EE Server	DiscoveredProductName Equal WebSphere Liberty Core Server
Shell	NOT Reference to the credentials dictionary entry Is null
IpAddress	NOT IP Probe Name Is null

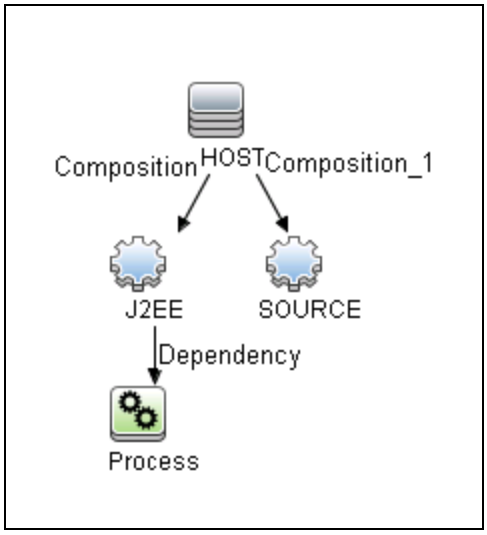
Adapter Information

This job uses the **WebSphere_Liberty_Core_By_Shell** adapter.

Input CIT

Shell

Input Query



Triggered CI Data

Name	Value
Protocol	${SOURCE.root_class}
credentialsId	${SOURCE.credentials_id}
ip_address	${SOURCE.application_ip}
j2eeserver_names	${J2EE.name:}
websphere_process_cmdline	${Process.process_cmdline:}

Used Scripts

websphere_liberty_core_by_shell.py

Global Configuration File

globalSettings.xml

Adapter Parameters

Name	Value	Description
max_include_depth	5	Defines the maximum recursion depth of the included file discovery.

Discovered CITs

- Node
- J2EE Server
- J2EE Domain
- J2eeApplication
- JdbcDataSource
- JVM
- ConfigurationDocument
- Composition
- Deployed
- Membership

Part 10: Middleware > Messaging Servers

Chapter 68: Microsoft MQ (Message Queue) Discovery

This chapter includes:

- Supported Versions 1018
- How to Discover Microsoft MQ 1018
- Microsoft Message Queue Topology by NTCMD or UDA Job 1020
- Microsoft Message Queue Topology by LDAP Job 1023
- Microsoft MQ Discovery Scripts 1024
- Microsoft MQ Topology Discovery Methodology 1025
  - Host Applications by Shell Job 1025
  - Microsoft Message Queue Topology by NTCMD or UDA Job 1028
  - Microsoft Message Queue Topology by LDAP Job 1033

Supported Versions

MS-MQ discovery supports MS MQ version 3.0, 4.0, and 5.2.

How to Discover Microsoft MQ

The Microsoft Message Queue (MS MQ) discovery process enables you to discover MS MQ topology running with Active Directory, as well as the end configuration of all MS MQ servers.

There are two discovery flows, detailed as follows:

1. **Run the discovery by LDAP**
    a. Run the **Range IPs by ICMP** job, or the **Range IPs by nmap** job, to discover the MS MQ system IP addresses.
    b. Run the **TCP Ports** job to discover the LDAP ports on the MS MQ system.
    c. Run the **Active Directory Connection by LDAP** job to detect which LDAP credentials are needed for discovery for the **Microsoft Message Queue Topology by LDAP** job.
    d. Run the **Microsoft Message Queue Topology by LDAP** job to discover the Active Directory topology (forest, site-link).
2. **Run the discovery by NTCMD or UDA**
    a. Run the **Range IPs by ICMP** job, or the **Range IPs by nmap** job to to discover the MS MQ system IP addresses.
    b. Run the **Host Connection by Shell** job to detect which Shell credentials are needed for discovery for the **Host Applications by Shell** job.
    c. Run the **Host Applications by Shell** job. At this stage, UCMDB contains information about the MS MQ Manager and machine with the domain controller, on condition that the server (the physical machine on which the MS MQ is installed) is a member of the domain.
    d. Run the **Microsoft Message Queue Topology by NTCMD or UDA** job to discover the server side topology (queues, triggers, rules).

> **Note:** Because information is retrieved from configuration files in three short registry branches only, and each file is less than 2 KB, system performance should not be affected.

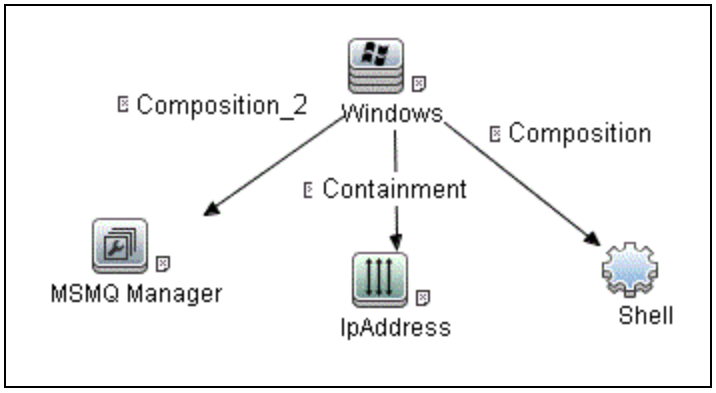
For details on how DFM discovers MQ topology, see "Microsoft MQ Topology Discovery Methodology" on page 1025.

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

Microsoft Message Queue Topology by NTCMD or UDA Job

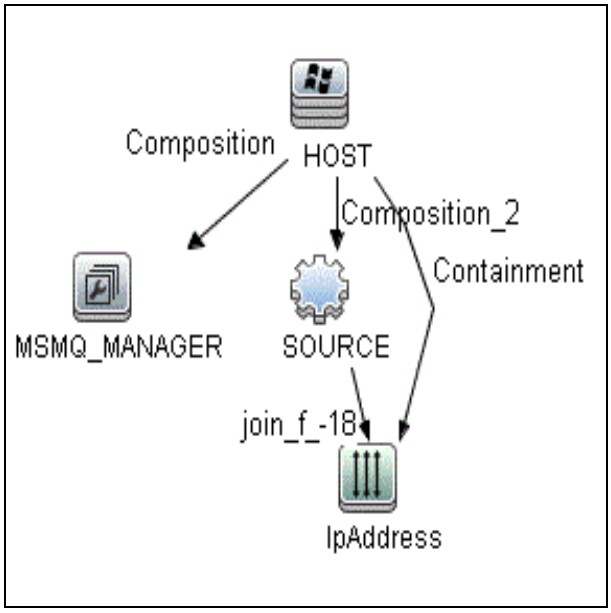
This section includes details about the job.

Trigger Query



Node Name	Condition
Windows	None
MSMQ Manager	None
IpAddress	NOT IP Probe Name Is Null
Shell	NOT Reference to the credentials dictionary entry Is null AND NOT Application IP Is null AND (CI Type Equal ntcmd OR CI Type Equal uda)

Input Query



Node Name	Condition
SOURCE	CI Type Equal ntcmd OR CI Type Equal uda
HOST	None
MSMQ_MANAGER	None
IpAddress	NOT IP Probe Name Is Null

Discovered CITs

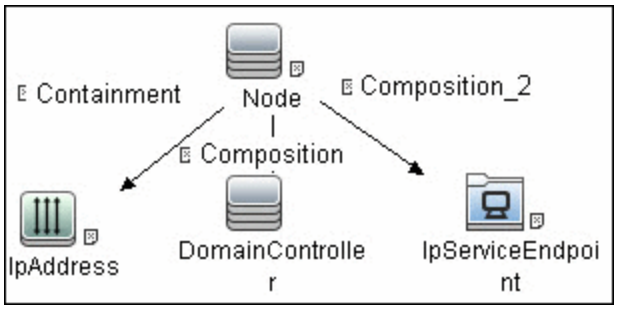
- Composition
- Containment
- IpAddress
- MSMQ Manager
- MSMQ Queue
- MSMQ Rule
- MSMQ Trigger

- Node
- Usage

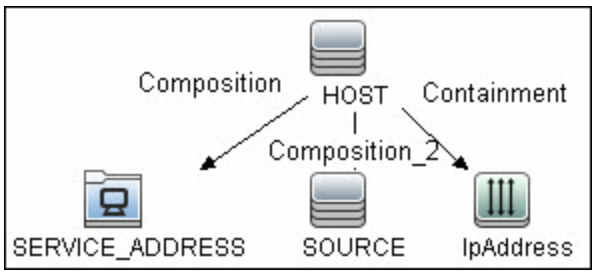
Microsoft Message Queue Topology by LDAP Job

This section includes details about the job.

Trigger Query



Input Query



Discovered CITs

- Active Directory Forest
- ActiveDirectorySite
- ActiveDirectorySystem
- Composition
- Containment
- IpAddress
- MSMQ Manager
- Membership

- Node
- Usage

Adapter Parameters

- **baseDn.** This value determines the DN under which records about domain controller servers are stored. The default value is **OU=Domain Controllers**.

Microsoft MQ Discovery Scripts

To view the scripts, go to **Adapter Management > Resources** pane **> Packages > Microsoft_MQ > Scripts**.

Script	Description
ntcmd_msmq.py	Main script for the **Microsoft Message Queue Topology by NTCMD or UDA** job
ldap_msmq.py	Main script for the **Microsoft Message Queue Topology by LDAP** job
plugin_microsoft_mq.py	Shallow plug-in for MS MQ Manager discovery (**Adapter Management > Resources** pane **> Packages > Host_Resources_Basic > Scripts**)
host_resolve_utils.py	DNS resolving utilities **(Adapter Management > Resources** pane **> Packages > Host_Resources_Basic > Scripts**)

Microsoft MQ Topology Discovery Methodology

This section describes how DFM discovers the MS MQ topology.

This section includes the following topics:

- "Host Applications by Shell Job" below
- "Microsoft Message Queue Topology by NTCMD or UDA Job" on page 1028
- "Microsoft Message Queue Topology by LDAP Job" on page 1033

Host Applications by Shell Job

This job uses the **plugin_microsoft_mq.py** script.

Information is parsed from the following registry branches:

Registry Branch (1)

```
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSMQ\Parameters\MachineCache\
```

- **Command Output**

```
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSMQ\Parameters\MachineCache
EnterpriseId    REG_BINARY    C209A2FE9203F64CB543441CC92A40DC
    SiteId    REG_BINARY    FB7BA54DFF5F40429ECA64752D0130A0
    MQS_DepClients    REG_DWORD    0x0
    MQS    REG_DWORD    0x1
    MQS_DsServer    REG_DWORD    0x0
    MQS_Routing    REG_DWORD    0x1
    QMId    REG_BINARY    1D19B008D7BF654B84050FC7353F993C
    MachineQuota    REG_DWORD    0x100000
    MachineJournalQuota    REG_DWORD    0xffffffff
    LongLiveTime    REG_DWORD    0x54600
```

- **Regular Expression Patterns**

  Message routing enabled:

  ```
  "\s*MQS_Routing\s+REG_DWORD\s+0x[0]*(\d)\s*"
  ```

  Message storage limit:

```
"\s*MachineQuota\s+REG_DWORD\s+(\w+)\s*"
```

Message journal limit:

```
"\s*MachineJournalQuota\s+REG_DWORD\s+(\w+)\s*"
```

Registry Branch (2)

```
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSMQ\Parameters\setup\
```

- **Command Output**

```
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSMQ\Parameters\setup
MachineDomain    REG_SZ    UCMDB-EX
MachineDomainFQDN    REG_SZ    ucmdb-ex.dot
OSType    REG_DWORD    0x500
CreateMsmqObj    REG_DWORD    0x0
UserSid    REG_BINARY 1050000000000051500000576A62162631895
C45612C98F4010000
MachineDN    REG_SZ    CN=MSMQ-VM01,CN=Computers,DC=ucmdb-ex,DC=dot
JoinStatus    REG_DWORD    0x2
MSMQAddedToICFExceptionList    REG_DWORD    0x1
MQDSSvcInstalled    REG_DWORD    0x1
InetpubWebDir    REG_DWORD    0x1
```

- **Regular Expression Patterns**

Machine domain name:

```
"\s*MachineDomainFQDN\s+REG_SZ\s+([\w\-\.]+)\s*"
```

Registry Branch (3)

HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSMQ\Setup\

- **Command Output**

```
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSMQ\Setup
    msmq_Core    REG_DWORD    0x1
    msmq_LocalStorage    REG_DWORD    0x1
    msmq_ADIntegrated    REG_DWORD    0x1
    InstalledComponents    REG_DWORD    0xf8000000
    msmq_MQDSService    REG_DWORD    0x1
    msmq_TriggersService    REG_DWORD    0x1
    msmq_HTTPSupport    REG_DWORD    0x1
    msmq_RoutingSupport    REG_DWORD    0x1
```

- **Regular Expression Patterns**

  MsMQ is a domain member:

  ```
  "\s*msmq_ADIntegrated\s+REG_DWORD\s+0x[0]*(\d)\s*"
  ```

  Triggers enabled:

  ```
  "\s*msmq_TriggersService\s+REG_DWORD\s+0x[0]*(\d)\s*"
  ```

Microsoft Message Queue Topology by NTCMD or UDA Job

This job discovers the settings and relationships of triggers, rules, and queues.

MS MQ Queue Discovery

- **Registry Branch**

```
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSMQ\Parameters /v StoreReliablePath
```

- **Command Output**

```
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSMQ\Parameters
    StoreReliablePath    REG_SZ    C:\WINDOWS\system32\msmq\storage
```

- **Regular Expression Patterns**

  Base parent folder for message storage

```
"\s*StoreReliablePath\s+REG_SZ\s+(.+)"
```

- **Command**

```
dir /B /A:-D <ms mq queue settings folder>
```

- **Command Output**

```
dir /B /A:-D C:\WINDOWS\system32\msmq\storage\lqs
00000002.990736e8
00000003.6ab7c4b8
00000004.4c1eb11b
00000006.e2f46f06
00000010.d1c14377
00000012.e6d243aa
9b0b035bf61b429d845bbd61740403b7.0d0d6ec1
```

- **Result**

  The file names of MS MQ queue configurations are retrieved. DFM then iterates against this list of files, reads them, and parses the queue settings.

- **Command**

```
type <full_path_to_the_file>
```

- **Command Output**

```
type C:\WINDOWS\system32\msmq\storage\lqs\00000002.990736e8
[Properties]
Label=private$\admin_queue$
Type=00000000-0000-0000-0000-000000000000
QueueName=\private$\admin_queue$
Journal=00
Quota=4294967295
Security=010007805c000000680000000000000140000000200
480003000000000018003f000e000102000000000052000000020
020000000014002400020001010000000000010000000000140
004000000010100000000000507000000010100000000000051200
000001010000000000512000000
JournalQuota=4294967295
CreateTime=1259681363
BasePriority=32767
ModifyTime=1259681363
Authenticate=00
PrivLevel=1
Transaction=00
SystemQueue=01
Signature=DoronJ
```

- **Parse Rules**

  Queue name:

  ```
  ".*QueueName\s*=\s*(.+?)\n.*"
  ```

  Is transactional:

  ```
  ".*Transaction\s*=\s*(\d+).*"
  ```

  Queue type (public/private):

  ```
  "^[\\]*(private).*$" against Queue name
  ```

  Message limit:

  ```
  ".*\s+Quota\s*=\s*(\d+).*"
  ```

  Is journal enabled:

  ```
  ".*Journal\s*=\s*(\d+).*"
  ```

  Journal limit:

  ```
  ".*JournalQuota\s*=\s*(\d+).*"
  ```

MS MQ Trigger Discovery

- **Registry Branch**

```
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSMQ\Triggers\Data\Triggers\
```

- **Command Output**

```
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSMQ\Triggers
\Data\Triggers\31b8e2c4-f412-431e-9b2c-517f7e5031d7
    Name    REG_SZ    Test Trigger
    Queue    REG_SZ    msmq-vm2\Test Queue
    Enabled    REG_DWORD    0x1
    Serialized    REG_DWORD    0x0
    MsgProcessingType    REG_DWORD    0x1
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSMQ\
Triggers\Data\Triggers\31b8e2c4-f412-431e-9b2c-517f7e5031d7\AttachedRules
    Rule0    REG_SZ    9c172d69-c832-453e-826b-4415b7d0dfef
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSMQ\
Triggers\Data\Triggers\728b0d45-531d-4887-9762-3191b0069bb1
    Name    REG_SZ    remote Trigger
    Queue    REG_SZ    msmq-vm01\Test Queue
    Enabled    REG_DWORD    0x1
    Serialized    REG_DWORD    0x0
    MsgProcessingType    REG_DWORD    0x0
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSMQ\
Triggers\Data\Triggers\728b0d45-531d-4887-9762-3191b0069bb1\AttachedRules
    Rule0    REG_SZ    9c172d69-c832-453e-826b-4415b7d0dfef
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSMQ\
Triggers\Data\Triggers\b900d598-e3c2-4958-bf21-c8c99ed264e2
    Name    REG_SZ    qqqqqqq
    Queue    REG_SZ    msmq-vm2\private$\Private Test Queue
    Enabled    REG_DWORD    0x1
    Serialized    REG_DWORD    0x0
    MsgProcessingType    REG_DWORD    0x1
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSMQ\
Triggers\Data\Triggers\b900d598-e3c2-4958-bf21-c8c99ed264e2\AttachedRules
    Rule0    REG_SZ    9c172d69-c832-453e-826b-4415b7d0dfef
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSMQ\
Triggers\Data\Triggers\dc4302f0-d28c-40e4-a19a-492dcee231fe
    Name    REG_SZ    Test2
    Queue    REG_SZ    msmq-vm2\private$\Test Transactional
    Enabled    REG_DWORD    0x1
    Serialized    REG_DWORD    0x1
    MsgProcessingType    REG_DWORD    0x2
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSMQ\
Triggers\Data\Triggers\dc4302f0-d28c-40e4-a19a-492dcee231fe\AttachedRules
```

```
Rule0    REG_SZ    9c172d69-c832-453e-826b-4415b7d0dfef
Rule1    REG_SZ    2874c4c1-57f1-4672-bbdd-0c16f17788cf
```

MS MQ Rule Discovery

- **Regular Expression Patterns**

  The output buffer is split by the following regular expression:

  ```
  "(HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSMQ\
  Triggers\Data\Triggers\[0-9a-fA-F]{8}\-[0-9a-fA-F]{4}\
  -[0-9a-fA-F]{4}\-[0-9a-fA-F]{4}\-[0-9a-fA-F]{12})\s*\n"
  ```

  After each string buffer is split, the following patterns are applied:

  Trigger name:

  ```
  ".*Name\s+REG_SZ\s+(.*?)\n.*"
  ```

  Trigger GUID:

  ```
  " HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSMQ\Triggers\
  Data\Triggers\([0-9a-fA-F]{8}\-[0-9a-fA-F]{4}\-[0-9a-fA-F]{4}\
  -[0-9a-fA-F]{4}\-[0-9a-fA-F]{12})\s*\n"
  ```

  Assigned queue:

  ```
  ".*Queue\s+REG_SZ\s+(.*?)\n.*"
  ```

  Trigger is serialized:

  ```
  ".*Serialized\s+REG_DWORD\s+0x(\d+).*"
  ```

  Trigger is enabled:

  ```
  ".*Enabled\s+REG_DWORD\s+(0x\d+).*"
  ```

  Trigger message processing type:

  ```
  ".*MsgProcessingType\s+REG_DWORD\s+(0x\d+).*"
  ```

  Trigger assigned rule GUID:

  ```
  ".*Rule\d+\s+REG_SZ\s+([0-9a-fA-F]{8}\-[0-9a-fA-F]{4}\
  -[0-9a-fA-F]{4}\-[0-9a-fA-F]{4}\-[0-9a-fA-F]{12}).*"
  ```

- **Registry Branch**

  ```
  HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSMQ\Triggers\Data\Rules\
  ```

- **Command Output**

```
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSMQ\Triggers\Data\Rules\
2874c4c1-57f1-4672-bbdd-0c16f17788cf
    Name    REG_SZ    Test Rule2
    Description    REG_SZ    bla bla
    ImplementationProgID    REG_SZ    MSQMTriggerObjects.MSMQRuleHandler
    Condition    REG_SZ    $MSG_PRIORITY_EQUALS=1
        $MSG_LABEL_DOES_NOT_CONTAIN=bla
    Action    REG_SZ    EXE     C:\WINDOWS\system32\calc.exe
    ShowWindow    REG_DWORD    0x1
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSMQ\Triggers\Data\Rules\
9c172d69-c832-453e-826b-4415b7d0dfef
    Name    REG_SZ    Test Rule
    Description    REG_SZ
    ImplementationProgID    REG_SZ    MSQMTriggerObjects.MSMQRuleHandler
    Condition    REG_SZ    $MSG_LABEL_CONTAINS=Test
    Action    REG_SZ    EXE     C:\WINDOWS\NOTEPAD.EXE
    ShowWindow    REG_DWORD    0x1
```

- **Regular Expression Patterns**

  The output buffer is split by the following constant:

  ```
  "HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSMQ\Triggers\Data\Rules\"
  ```

  After each string buffer is split, the following patterns are applied:

  Rule name:

  ```
  ".*Name\s+REG_SZ\s+(.*?)\n.*"
  ```

  Rule condition:

  ```
  ".*Condition\s+REG_SZ\s+(.*?)\n.*"
  ```

  Rule action:

  ```
  ".*Action\s+REG_SZ\s+(.*?)\n.*"
  ```

  Rule GUID:

  ```
  "\s*([0-9a-fA-F]{8}\-[0-9a-fA-F]{4}\-[0-9a-fA-F]{4}\
  -[0-9a-fA-F]{4}\-[0-9a-fA-F]{12}).*"
  ```

Microsoft Message Queue Topology by LDAP Job

This job reports the Active Directory-related part of MS MQ deployment: AD Forest, AD Site, MS MQ Manager, and MS MQ Routing Link.

Schema parameters:

`CN=Configuration,DC=<domain_name>,DC=<domain_suffix>`

Site discovery (derived from AD discovery):

`CN=Sites,CN=Configuration,<domain_name>,DC=<domain_suffix>`

Server Discovery with MS MQ Manager

- **Branch**

  `CN=Servers,CN=<site_name>,CN=Sites,CN=Configuration,DC=<domain_name>,DC=<domain_suffix>`

- **Values**

  Server name property:

  `'name'`

  Server full DN:

  `'distinguishedName'`

  If an underlying branch exists (for `objectClass=mSMQSettings`), the server is considered to include an MS MQ Manager.

Chapter 69: TIBCO BusinessWorks and EMS Discovery

This chapter includes:

Overview 1035

Discovery Mechanism 1035

Supported Versions 1035

Topology 1036

How to Discover TIBCO BusinessWorks and EMS 1037

TIBCO BusinessWorks by Shell Job 1038

TIBCO EMS by Shell Job 1040

Overview

TIBCO Enterprise Message Service (**EMS**) is a messaging platform which combines different IT resources on a common enterprise backbone to manage real-time information flow.

TIBCO ActiveMatrix BusinessWorks (**BusinessWorks**) is a service creation, orchestration, and integration product, entirely created using open standards.

The TIBCO discovery process allows you to discover a full topology.

Discovery Mechanism

Because TIBCO does not have any system configuration files about applications, the TIBCO discovery mechanism starts by using TIBCO's **AppManage** utility to export a list of xml files to a temporary folder on the BusinessWorks server and by using TIBCO's **TibcoEmsAdmin** utility to get information about EMS and JMS topology.

The discovery mechanism continues with the **TIBCO BusinessWorks by Shell** and **TIBCO EMS by Shell** jobs.

Supported Versions

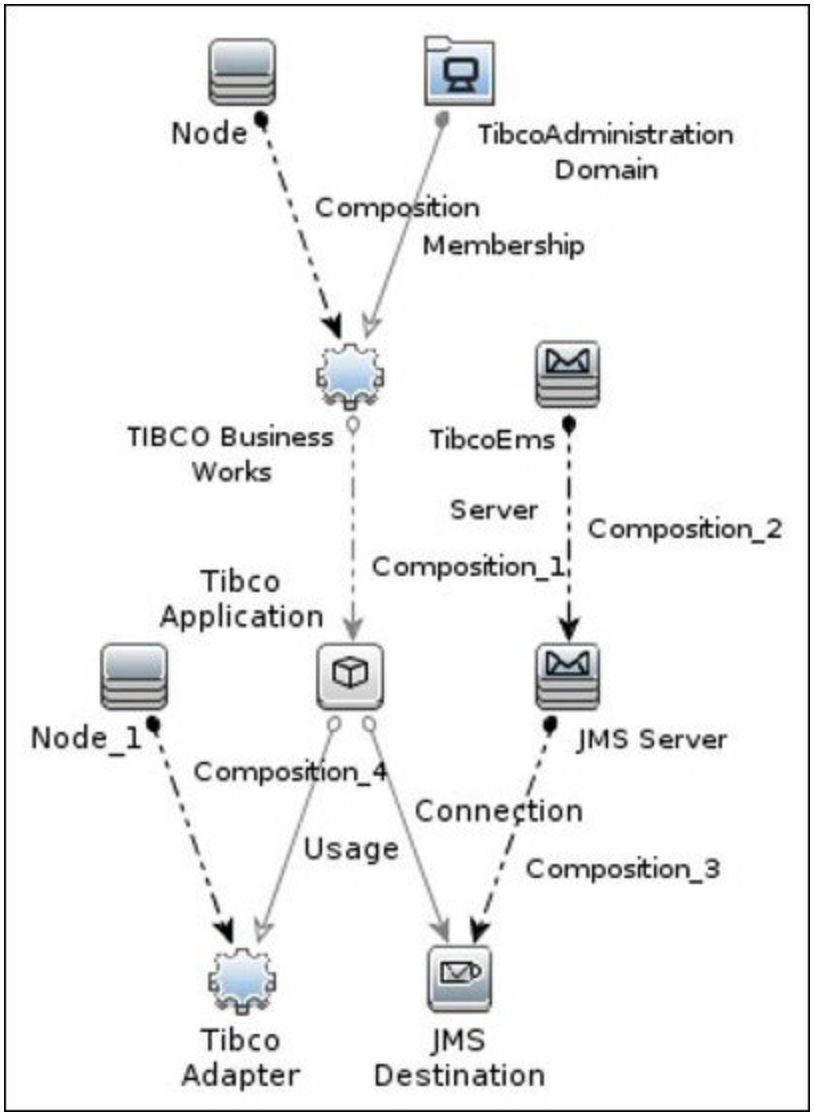
TIBCO discovery supports the following versions of software running in a UNIX environment:

- Version 6.0 of EMS
- Versions 5.7 and 5.8 of BusinessWorks.

Topology

The following image displays BusinessWorks topology.

Note: For a list of discovered CITs, see "TIBCO BusinessWorks by Shell Job" on page 1038.



How to Discover TIBCO BusinessWorks and EMS

This task includes the following steps:

1. Prerequisites - Set up protocol credentials

   You must set up the Shell (SSH or Telnet) and TIBCO protocols.

   - Shell Protocols: SSH, Telnet.

     Prepare the following information: **user name**, **password** and **domain name**.

   - TIBCO Protocol

     Prepare the following information: **user name**, and **password**.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Prerequisites - Other

   a. Run the **Range IPs by ICMP** job in order to discover the target IPs.

   b. Run the **Host Connection by Shell** job in order to discover the target host and shell connectivity to it.

   c. Run the **Host Applications by Shell** job in order to discover applications of the target host, including TIBCO BusinessWorks software and agent processes.

   > **Note:** You must enable the **discoverProcesses** attribute; this finds the **Process** CI on which the **TIBCO EMS by Shell** job triggers.

   d. Ensure you have **both** of the following:

      i. Read and write access to the temporary folder on the TIBCO BusinessWorks server. The default folder is **/tmp**.

      ii. Access to run the **TIBCO runtime assistant (TRA) AppManage** utility.

3. Run the Discovery

   a. Run the **TIBCO BusinessWorks by Shell** job in order to discover the topology of the target BusinessWorks server.

   b. Run the **TIBCO EMS by Shell** job in order to discover the topology of the target EMS server.

TIBCO BusinessWorks by Shell Job

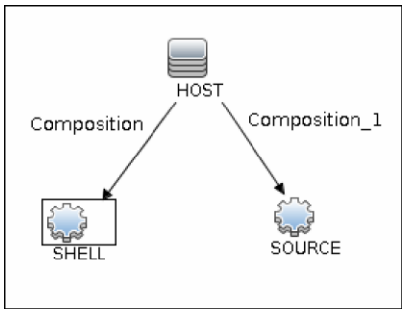
This section includes details about the job.

Input CIT

TibcoBusinessWorks

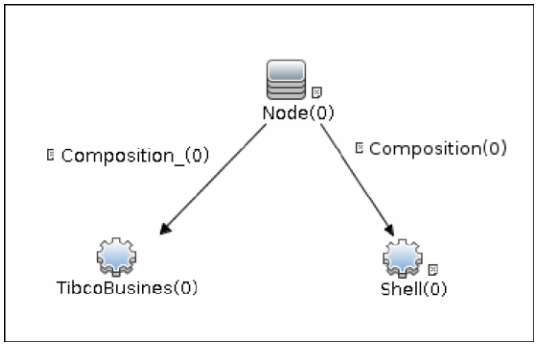
Input TQL Query

The following graphic shows an input TQL query for this job.



Trigger TQL Query

The following graphic shows a trigger TQL query for this job.



Triggered CI Data

Name	Value
Protocol	${SHELL.root_class}
bwId	${SOURCE.root_id}
bwPath	${SOURCE.application_path}
credentialsId	${SHELL.credentials_id}
hostId	${HOST.root_id}
ip_address	${SHELL.application_ip}

Used Scripts

- db.py
- db_builder.py
- db_platform.py
- entity.py
- iteratortools.py
- jdb_url_parser.py
- jdbc.py
- jee.py
- jms.py
- jmx.py
- tibco.py
- tibco_businessworks_by_shell.py
- tibco_discoverer.py

Discovered CITs

- Composition

- Connection
- Containment
- IpAddress
- IpServiceEndpoint
- JMS Desination
- JMS Server
- Membership
- Node
- TibcoAdapter
- TibcoAdministrationDomain
- TibcoApplication
- TibcoBusinessWorks
- TibcoEmsServer
- Usage

Adapter Parameters

Parameter	Description
temp_directory	This is the temporary directory on the TIBCO BusinessWorks server where files created in the discovery process are stored.
discover_jms_topology	Whether to discover JMS topology. **Default:** false.

TIBCO EMS by Shell Job

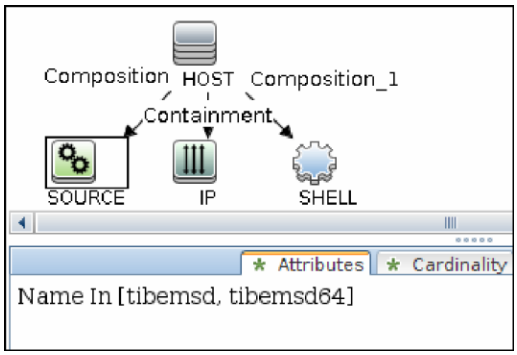
This section includes details about the job.

Input CIT

Process

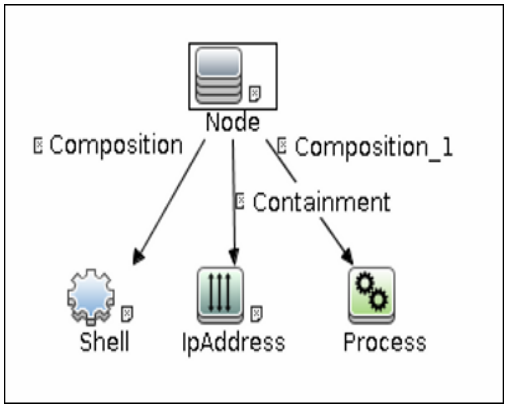
Input TQL Query

The following graphic shows an input TQL query for this job.



Trigger TQL Query

The following graphic shows a trigger TQL query for this job.



Triggered CI Data

Name	Value
Protocol	${SHELL.root_class}
credentialsId	${SHELL.credentials_id}
hostId	${HOST.root_id}
ip_address	${SHELL.application_ip}

Name	Value
processCmdLine	${SOURCE.process_cmdline}
processPath	${SOURCE.process_path}
processRootId	${SOURCE.root_id}

Used Scripts

- db.py
- db_builder.py
- db_platform.py
- entity.py
- iteratortools.py
- jdbc_url_parser.py
- jdbc.py
- jee.py
- jms.py
- jmx.py
- tibco.py
- tibco_discoverer.py
- tibco_ems_by_shell.py

Discovered CITs

- Composition
- Containment
- IpAddress
- IpServiceEndpoint
- JMS Destination
- JMS Server

- Node
- Process
- TibcoEmsServer
- Usage

Adapter Parameters

Parameter	Description
discover_queues	Whether to discover information about queues. **Default:** false.
discover_topics	Whether to discover information about topics. **Default:** false.
emsadmin_tool_absolute_paths	List of emasadmin tool absolute paths in case the path that is retrieved from process is a relative path. Separate the paths by commas.

Chapter 70: WebSphere MQ Discovery

This chapter includes:

- Overview 1045
- Supported Versions 1045
- Topology 1045
  - MQ Queue Dependency 1046
  - MQ Q Manager Resources on Non-Local Cluster 1047
  - MQ Namelist Membership 1048
  - MQ Cluster Membership 1048
  - MQ Channel Communication 1049
  - MQ Alias Queue Managers 1049
  - MQ Topology 1050
- How to Discover WebSphere MQ 1052
- Discovery Mechanism 1053
- Adapter 1054
  - Adapter Parameters 1054
- Discovered CITs 1055
- Relationships 1057
- Troubleshooting and Limitations – WebSphere MQ Discovery 1059

Overview

The WebSphere MQ package enables mapping the various components of WebSphere MQ infrastructure in an organization. The end goal is to model its interdependence with other applications or services within the organization and enable end to end impact analysis across the messaging silo.

Message Queuing is a middle-ware technology that enables disparate software services to communicate in a way that does not require any knowledge of the target service. Reliable communication can be achieved regardless of current availability of the target system or complexity of the infrastructure connecting the two systems.

A Message may contain simple character data, numeric data, complex binary data, a request for information, a command, or a mixture of all of these. The messaging infrastructure is responsible for reliable and transparent transportation of a message from the source to the target and is not required to understand or be aware of its content.

Supported Versions

- **Target Platform.** IBM WebSphere MQ
- **Target Platform Versions.** 5.x, 6.x, 7.0.1, 7.1, 7.5, 8.0, and 9.0
- **Target Platform OS.** Microsoft Windows, Solaris, Linux, AIX

Topology

The WebSphere MQ package includes the following views that model details of the MQ infrastructure. Each view has a corresponding report with the same query configuration.

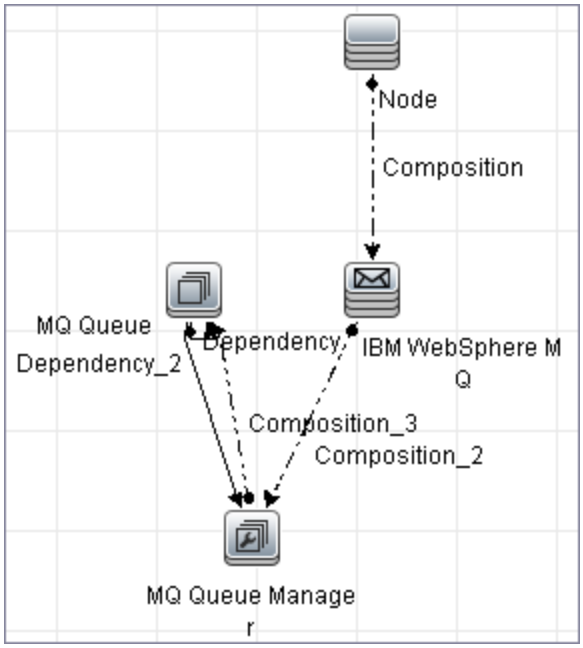
> **Note:**
>
> - These out-of-the-box views are provided as examples only. You may prefer to define your own views.
> - For a list of discovered CITs, see "Discovered CITs" on page 1055.

This section describes the following views:

- "MQ Queue Dependency" below
- "MQ Q Manager Resources on Non-Local Cluster" on the next page
- "MQ Namelist Membership" on page 1048
- "MQ Cluster Membership" on page 1048
- "MQ Channel Communication" on page 1049
- "MQ Alias Queue Managers" on page 1049
- "MQ Topology" on page 1050

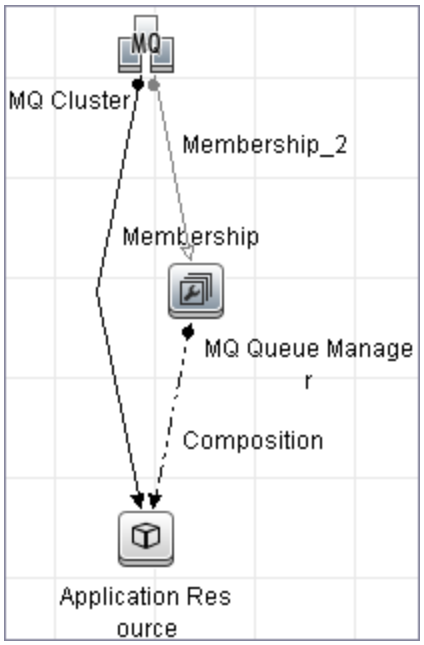
MQ Queue Dependency

This view displays queues that are dependent on other MQ objects and typically include Remote Queues, Alias Queues, and Remote Queue Managers:



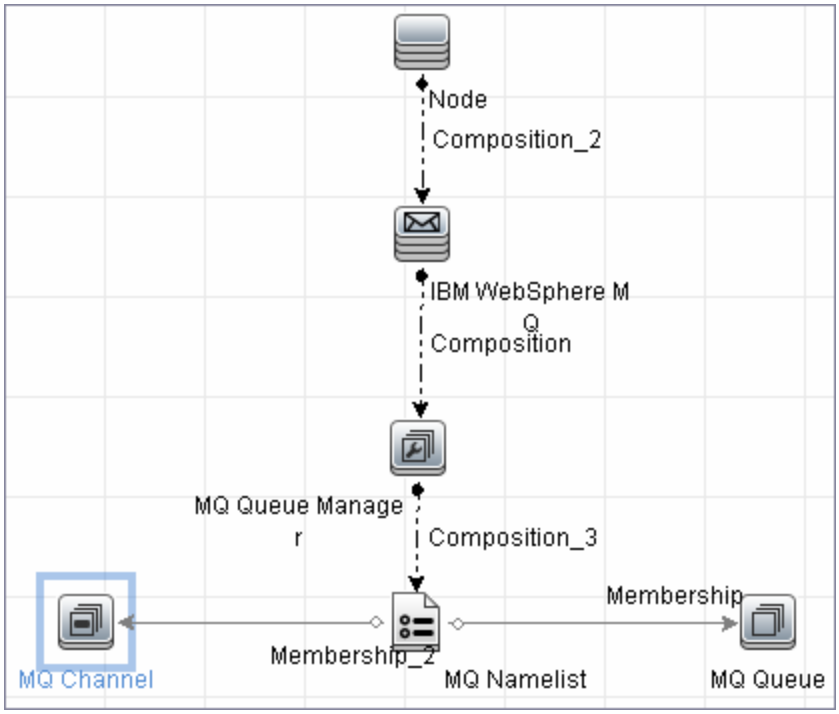
MQ Q Manager Resources on Non-Local Cluster

This view displays MQ objects managed by a Queue Manager and belonging to an MQ Cluster that the Queue Manager is not a member of. Any MQ objects in this view may be misconfigured and the purpose of this view is to identify such misconfigured objects.



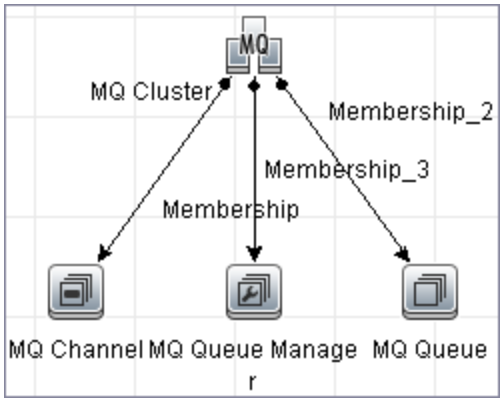
MQ Namelist Membership

This view displays namelists and their members:



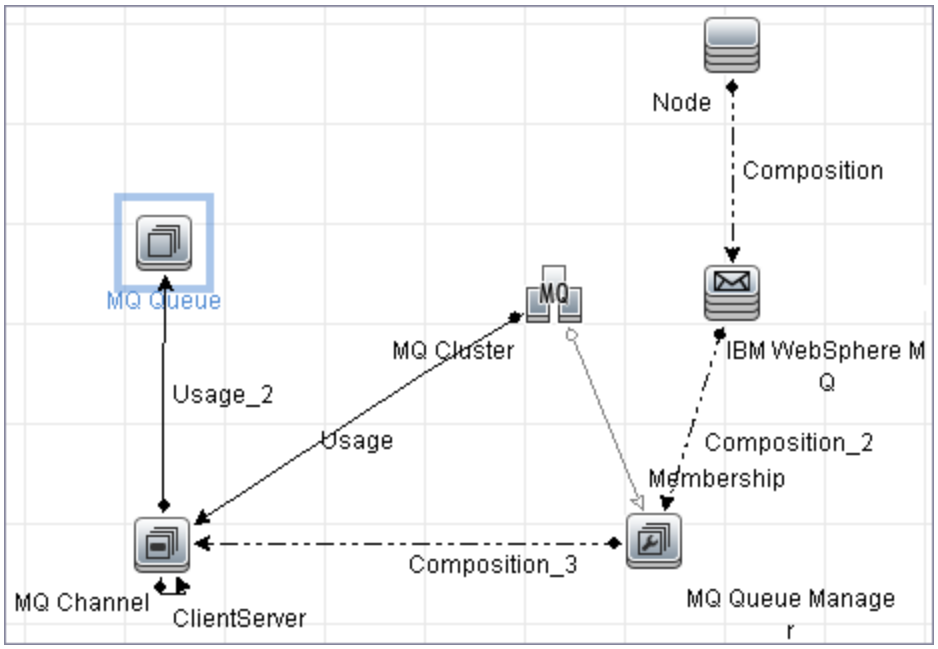
MQ Cluster Membership

This view displays clusters and their members:



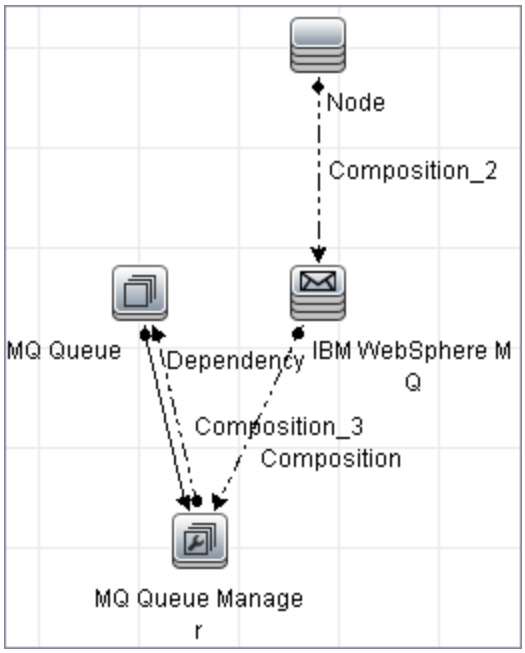
MQ Channel Communication

This view displays client-server communication between MQ Channels and queues used by the channels:



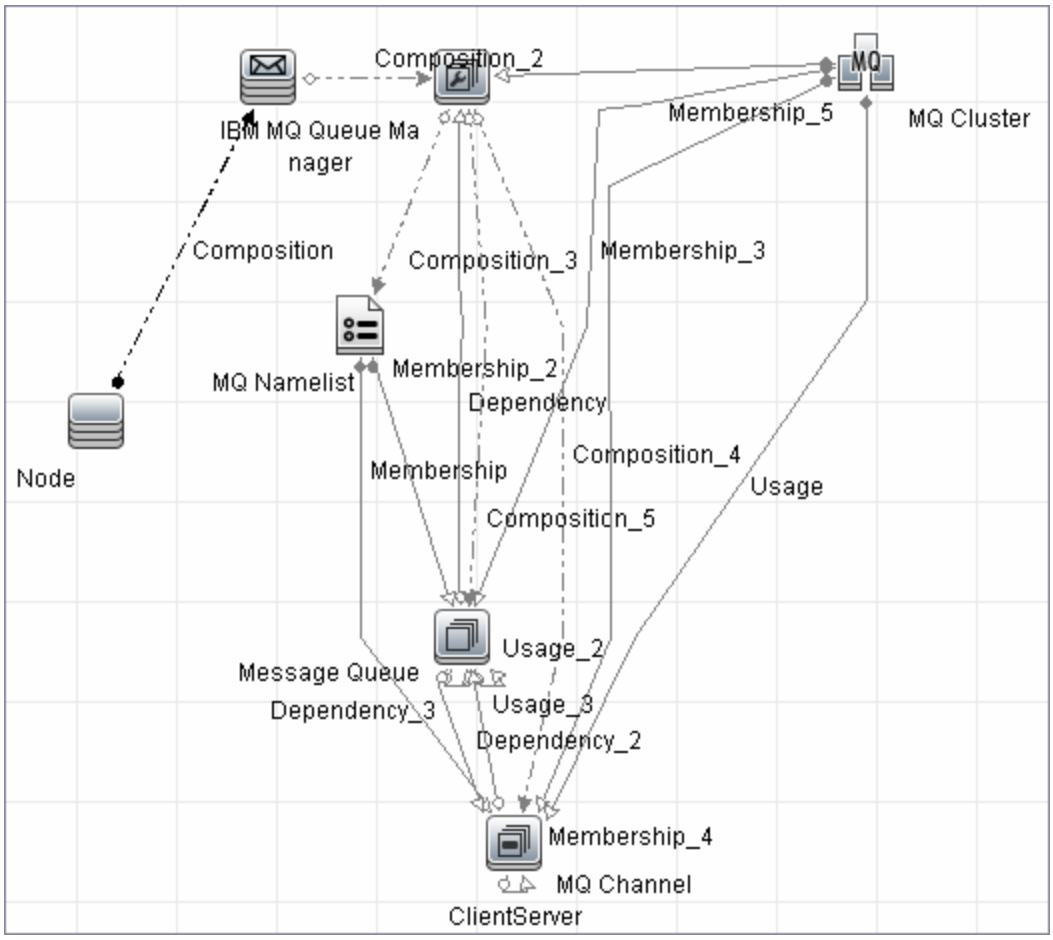
MQ Alias Queue Managers

This view displays Queues that are serving as remote Queue Managers:



MQ Topology

This view displays all MQ objects in the MQ infrastructure including relationships and interdependencies:


Composition_2
MQ
IBM MQ Queue Manager
Membership_5
MQ Cluster
Composition
Composition_3
Membership_3
MQ Namelist
Membership_2
Dependency
Node
Membership
Composition_4
Usage
Composition_5
Usage_2
Message Queue
Dependency_3
Usage_3
Dependency_2
Membership_4
MQ Channel
ClientServer

How to Discover WebSphere MQ

The WebSphere MQ job discovers WebSphere MQ components and includes the following steps:

1. Prerequisite - Set up protocol credentials

   This discovery uses the SSH, Telnet, or NTCMD protocols.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

   The Shell commands are (**sudo** is optional):

   - **dspmqver** or **mqver**
   - **dsmpq**
   - **runmqsc** or **runmqadm -r**

2. Prerequisite - IP Addresses

   Verify that all WebSphere MQ server IP addresses are within the scope of the Data Flow Probe. For details, see the section describing how to add Probe range in the *HPE Universal CMDB Data Flow Management Guide*.

3. Run the discovery

   a. Configure parameters for the **MQ by Shell** job as necessary. For details, see "Data Flow Probe Setup" in the *HPE Universal CMDB Data Flow Management Guide*.

   b. Run the following jobs to collect information required to trigger WebSphere MQ discovery:

      - **Range IPs by ICMP**. Discovers the WebSphere MQ server IP addresses.
      - **Host Connection by Shell**. Discovers operating system information on the WebSphere MQ servers.
      - **Host Applications by Shell**. Discovers instances of WebSphere MQ on the servers.
      - **MQ by Shell**. Discovers the WebSphere MQ infrastructure.

Discovery Mechanism

WebSphere MQ can be installed on several UNIX platforms and Microsoft Windows, and is managed using a command line interface standardized across platforms. The command line interface is accessible through programs, **runqsc** or **runmqadm,** that are included in a WebSphere MQ installation.

The **MQ by Shell** job uses the **Shell** CI associated with a server as its trigger. Because every server in the CMDB may have an associated **Shell** CI, the trigger query results contain the **Shell** CI only for servers on which WebSphere MQ software is installed.

The **MQ by Shell** job uses the WebSphere MQ command line interface to query for MQ objects and their details. Since the **runmqsc** command requires administrator or root privileges and the **runmqadm** command is not always available, the job attempts the **runmqadm -r** command first. If **runmqadm** fails, the job tries the **runmqsc** command.

After logging in to the MQ server using the **Shell** CI (created by the **Host Connections by Shell** job), DFM:

1. Identifies the version of WebSphere MQ installed on the server. This is done using the **dspmqver** command. (If **dspmqver** fails, the **mqver** command is attempted.)
2. Retrieves a list of WebSphere MQ Queue Managers using the **dspmq** command.
3. Retrieves details on each Queue Manager using the MQ CLI (command line interface) command:

   ```
   DISPLAY QMGR DESCR DEADQ DEFXMITQ REPOS CCSID
   ```

4. Retrieves a list of queues on each Queue Manager using the MQ CLI command:

   ```
   DISPLAY QUEUE(*) TYPE DESCR CLUSTER CLUSNL USAGE RNAME RQMNAME XMITQ TARGQ
   DEFTYPE
   ```

   Relationships between queues and other MQ objects such as other queues, Queue Managers, and so on, are built on the fly.

5. Retrieves (for each `TRANSMIT Queue` found) the remote server name and IP and port using the sender channel associated with the transmit queue. This is done using the MQ CLI command:

   ```
   DISPLAY CHANNEL(*) WHERE(xmitq EQ <transmitQueueName>) TYPE(SDR) CONNAME
   ```

6. Retrieves a list of channels on each Queue Manager using the MQ CLI command:

   ```
   DISPLAY CHANNEL(*) CHLTYPE TRPTYPE DESCR CLUSTER CLUSNL CONNAME XMITQ
   ```

Relationships between channels and other MQ objects such as other queues, channels, and so on, are built on the fly.

7. Retrieves a list of clusters that each Queue Manager is a member of, or knows about, using the MQ CLI command:

   ```
   DISPLAY CLUSQMGR(*) CONNAME QMTYPE
   ```

   Relationships between clusters and other clusters are built on the fly.

8. Retrieves the `namelists` that each Queue Manager is a member of, or knows about, using the MQ CLI command:

   ```
   DISPLAY NAMELIST(*) NAMES NAMCOUNT DESCR
   ```

Adapter

This discovery uses the **WebSphere MQ Topology by shell** adapter.

Adapter Parameters

Parameter	Description
discover_dynamic_queues	Enables discovery of dynamic queues (Queues created and destroyed on the fly by applications).
discover_remote_hosts	Enables resolution and discovery of remote servers and MQ objects referenced by the MQ server being discovered. If set to **false**, relationships between MQ objects on different servers are not discovered.
mq_cmd_timeout	Sets the command time-out for MQ CLI commands.
mqver_path	Path to **mqver** or **dspmqver** executable files. Separate multiple entries by a comma (**;**).
sudo_command	Must be set if the **use_sudo** parameter is set to **true**. Any entry here is prefixed to the MQ command line interface program. This parameter is typically used to set the MQ username. For example, if this parameter is set to **sudo -u mqm** the **runmqsc** command is invoked as **sudo -u mqm runmqsc**.
use_sudo	Set to **true** to enable sudo usage.

Discovered CITs

The WebSphere MQ discovery discovers the following CI Types.

Note: To view the topology, see "Topology" on page 1045.

CI Type	Key Attributes	Description
Composition		
Containment		
Dependency		
IBM MQ Channel (mqchannel) Parent: Message Queue Resource	• Name • Container: IBM MQ Queue Manager	This abstract CI Type represents MQ Channels. MQ Channels are required by Queue Managers to communicate with other Queue Managers. Channels have uni-directional and bi-directional communication (such as a request-response system) and require a second channel to return data. A channel sends or receives data on a specific port on a TCP/IP network.
IBM MQ Cluster (mqcluster) Parent: Failover Cluster	Name	Represents an MQ Queue Manager Cluster An MQ Cluster provides a flexible approach to join multiple Queue Managers with minimal configuration. This enables multiple instances of the same service to be hosted through multiple Queue Managers, resulting in higher performance, capacity, and resiliency. Queue managers can dynamically join or leave clusters.
IBM MQ Namelist (mqnamelist) Parent: Message Queue Resource	• Name • Container: IBM MQ Queue Manager	Represents an MQ Namelist. An MQ namelist contains a list of names and is typically used to contain a list of MQ Queue Manager Clusters. These namelists are then specified in the cluster namelist property and may be used by all Queue Managers in that cluster for look up.
IBM MQ Queue (mqqueue) Parent: MQ Queue	• Name • Container: IBM MQ Queue Manager	A Queue is a container of messages in the MQ infrastructure and controls how messages are routed between Queue Managers in the MQ infrastructure. Queues may be set up in several configurations to control message ordering and delivery (F/LIFO, message priority, sequential delivery, guaranteed delivery, and so on) and are optimized to carry small amounts of information.
IBM MQ Queue Manager (mqqueue) Parent: Message	• Name • Container: IBM	Represents an MQ Queue Manager. A WebSphere MQ instance may have one or more Queue Managers. The Queue Manager is responsible for functions not directly

CI Type	Key Attributes	Description
Queue Resource	WebSphere MQ CI	related to data movement such as storage, timing, triggering, and so on. Queue managers use a proprietary IBM technology known as a **bindings** connection to communicate with the MQ objects it manages and with remote clients via a network.
IBM MQ Receiver Channel (mqreceiverchannel) Parent: IBM MQ Channel	• Name • Container: IBM MQ Queue Manager	A receiving channel receives messages from remote Queue Managers through a sending channel with the same name.
IBM MQ Sender Channel (mqsenderchannel) Parent: IBM MQ Channel	• Name • Container: IBM MQ Queue Manager	A sending channel is associated with a specific Transmission queue within the same parent Queue Manager and has a well-defined destination.
IBMWebSphereMQ (webspheremq) Parent: Message Queuing Software	• Name: Always **IBM WebSphere MQ** • Container: Node	Represents an instance of WebSphere MQ software installed on a server.
IpAddress		
IpServiceEndpoint		
Membership		
Node		
Usage		

Relationships

WebSphere MQ discovery contains the following relationships:

Link	End1	End2	Cardinality	Description
Client Server	IBM MQ Send Channel	IBM MQ Receive Channel	1..*	Represents the direction of message flow between MQ Channels
Realization	IBM MQ Remote Queue	IBM MQ Queue	1..*	Indicates a strong dependency between an MQ Remote Queue and another Queue for which it is a remote. This is used in situations when the type of Queue is unknown.
Realization	IBM MQ Remote Queue	IBM MQ Local Queue	1..*	Indicates a strong dependency between an MQ Remote Queue and a Local Queue for which it is a remote.
Realization	IBM MQ Remote Queue	IBM MQ Alias Queue	1..*	Indicates a strong dependency between an MQ Remote Queue and an Alias Queue for which it is a remote.
Realization	IBM MQ Remote Queue	IBM MQ Remote Queue	1..*	Indicates a strong dependency between an MQ Remote Queue and a Remote Queue for which it is a remote.
Realization	IBM MQ Alias Queue	IBM MQ Queue	1..*	Indicates a strong dependency between an MQ Alias Queue and another Queue for which it is an alias. This is used in situations when the type of Queue is unknown.
Realization	IBM MQ Alias Queue	IBM MQ Local Queue	1..*	Indicates a strong dependency between an MQ Alias Queue and a Local Queue for which it is an alias.
Realization	IBM MQ Alias Queue	IBM MQ Remote Queue	1..*	Indicates a strong dependency between an MQ Alias Queue and a Remote Queue for which it is an alias.
Realization	IBM MQ Alias Queue	IBM MQ Alias Queue	1..*	Indicates a strong dependency between an MQ Alias Queue and an Alias Queue for which it is an alias.
Realization	IBM MQ Remote Queue	IBM MQ Queue Manager	1..*	Relates a queue of type remote queue (Remote Queue Manager) and the Queue Manager it is representing. This is a special purpose Remote Queue that is a remote for Queue Manager

Link	End1	End2	Cardinality	Description
				(instead of a remote queue). For Queue Managers QM1 and QM2, it is possible to set up a Remote Queue on QM1 named RQM2 which is a remote of QM2. Any MQ command issued to RQM2 is passed on to QM2 for execution.
Membership	IBM MQ Cluster	IBM MQ Queue Manager	1..*	Indicates that the MQ Queue Manager is a member of the MQ Queue Manager Cluster. If an MQ Queue Manager is a `full repository` for a cluster, the name of this relationship is set to **Repository**.
Membership	IBM MQ Cluster	IBM MQ Channel	1..*	Indicates that the MQ Channel is a member of the MQ Queue Manager Cluster. When a queue or channel is defined in any Queue Manager, it is possible (but not necessary) to specify of which MQ cluster this queue is a member. This is useful when very specific configurations are required, for example, when a queue is a member of a cluster but the Queue Manager is not a member of that cluster. This link is used to identify these special configurations.
Membership	IBM MQ Cluster	IBM MQ Queue	1..*	Indicates that the MQ Queue is a member of the MQ Queue Manager Cluster. This link is added for the same reason as in the previous row.
Membership	IBM MQ Namelist	IBM MQ Channel	1..*	Indicates that the MQ Channel contains the name of the MQ Namelist in its `CLUSNL` parameter.
Membership	IBM MQ Namelist	IBM MQ Queue	1..*	Indicates that the MQ Queue contains the name of the MQ Namelist in its `CLUSNL` parameter.
Usage	IBM MQ Cluster	IBM MQ Channel	1..*	Indicates the MQ Channel (of types Cluster Sender Channel or Cluster Receiver Channel) used by the MQ Queue Manager Cluster for communication with another cluster. This relationship is specific to MQ Channels of type `Cluster Sender Channel` and `Cluster Receiver Channel`. These channels are dedicated to inter-cluster communication and are not used by queues or other MQ objects.
Usage	IBM MQ Remote Queue	IBM MQ Transmit Queue	1..*	Indicates a remote queue using a transmission queue for communication.
Usage	IBM MQ	IBM MQ	1..*	Indicates a sender Transmission Queue using a

Link	End1	End2	Cardinality	Description
	Transmit Queue	Sender Channel		Sender channel for communication.

Troubleshooting and Limitations – WebSphere MQ Discovery

- If there are DNS resolution errors in the log files, and discovery takes abnormally long to complete, try setting the **discovery_remote_hosts** parameter to **false**. For details, see "Adapter Parameters" on page 1054.
- If the discovery results appear incomplete, try increasing the value of the **mq_cmd_timeout** parameter. For details, see "Adapter Parameters" on page 1054.

Part 11: Middleware > Web Servers

Chapter 71: Basic Web Server Discovery

This chapter includes:

- Overview 1062
- Supported Versions 1062
- How to Discover Basic Web Servers 1062
- Web Server by Shell Job 1063
  - Introduction 1063
  - Topology Map 1064
  - Supported Policy 1064
  - Adapter Information 1064
- Web Server Detection using TCP Ports Job 1067
  - Introduction 1067
  - Topology Map 1068
  - Supported Policy 1068
  - Adapter Information 1069
- WebSphere to Web Server Dependency Job 1070
  - Introduction 1070
  - Topology Map 1072
  - Supported Policy 1072
  - Adapter Information 1072

Overview

Basic Web Server Discovery allows the discovery of web servers except Apache Tomcat and allows the discovery of dependencies between web servers and WebSphere application servers.

Supported Versions

This discovery supports the following versions:

Vendor	Product	Supported Versions
IBM	IBM HTTP Server	5, 6.1, 7, 8.0, 8.5, 8.5.5, 9.0
Apache	Apache HTTP Server	1.3, 2.0, 2.2, 2.4
Microsoft	IIS	5, 6, 7, 7.5, 8, 8.5, 10
IBM	WebSphere Application Server	5, 6.1, 7, 8.0, 8.5, 8.5.5, 9.0

How to Discover Basic Web Servers

This section describes how to discover the basic web servers.

Prerequisites

- Set up the following protocols:
  - **SSH Protocol**
  - **NTCMD Protocol**
  - **Telnet Protocol**

  For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

Run the discovery

Run the basic web server discovery by executing the following jobs:

1. **Web Server by Shell**
2. **Web Server Detection using TCP Ports**
3. **WebSphere to Web Server Dependency**

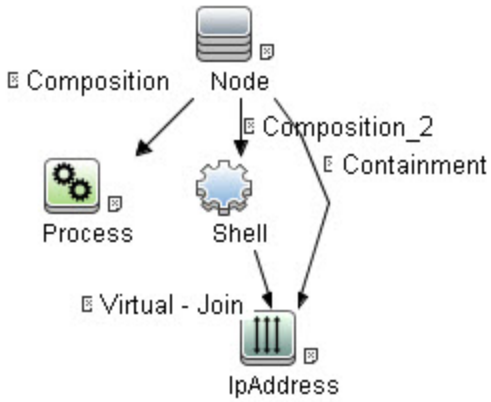
Web Server by Shell Job

This section includes details about the job.

Introduction

This job discovers Apache web servers using the Shell protocols.

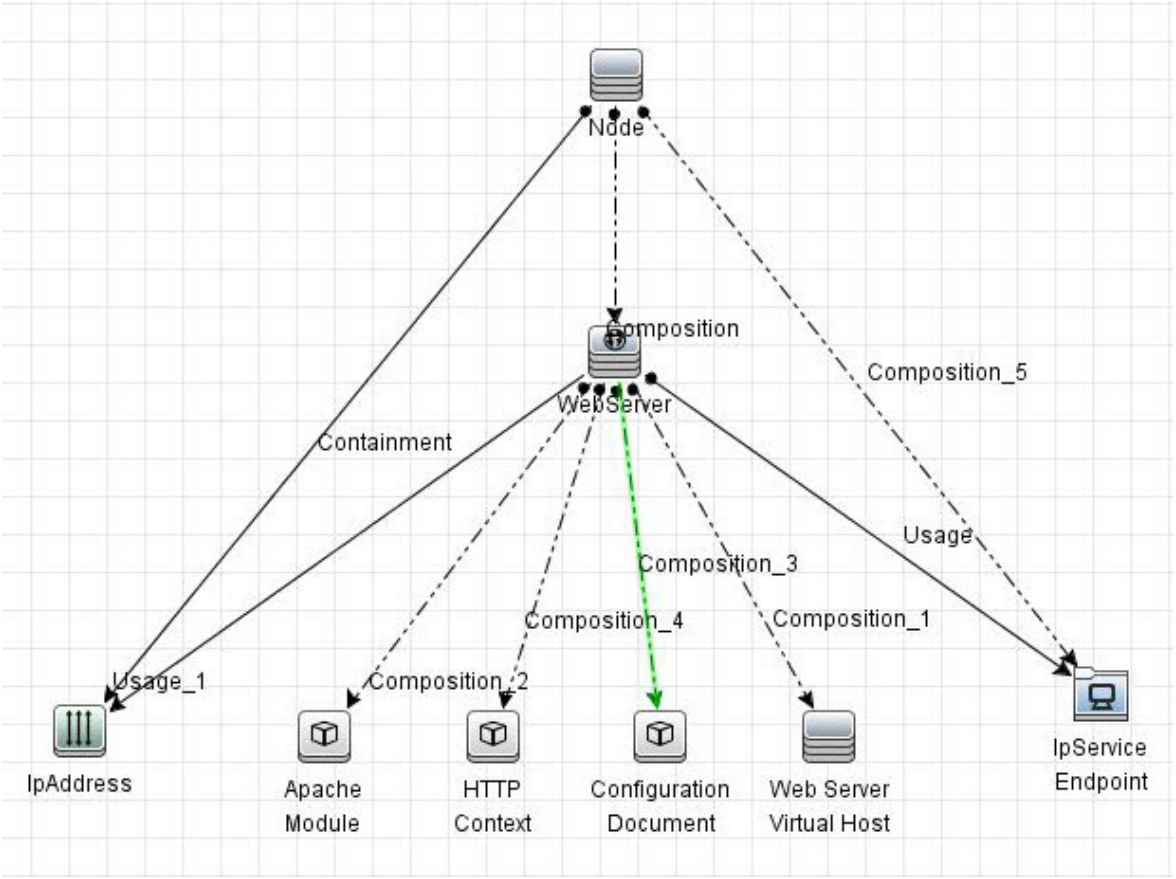
Trigger TQL



Node Name	Condition
Node	None
Process	(Process Path Like ignore case %httpd% OR Process Path Like ignore case %apache%) AND NOT Process Path Like ignore case %tomcat%
Shell	NOT Reference to the credentials dictionary entry Is null
IpAddress	NOT IP Probe Name Is null

Topology Map

The **Web Servers by Shell** topology is shown below.



Supported Policy

This job supports the following versions:

Vendor	Product	Supported Versions
IBM	IBM HTTP Server	5, 6.1, 7, 8.0, 8.5, 8.5.5, 9.0
Apache	Apache HTTP Server	1.3, 2.0, 2.2, 2.4

Adapter Information

This job uses the **Apache Web Servers by Shell** adapter.

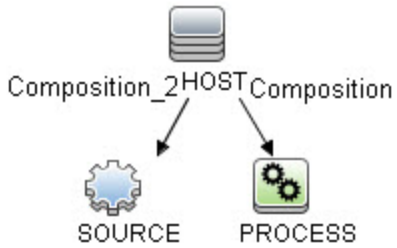
Adapter Type

Jython

Input CIT

Shell

Input TQL



Triggered CI Data

Name	Value
Protocol	${SOURCE.root_class}
connected_os_credentials_id	${SOURCE.connected_os_credentials_id:NA}
credentialsId	${SOURCE.credentials_id}
ip_address	${SOURCE.application_ip}
serverProcCmdLine	${PROCESS.process_cmdline:NA}
serverProcPath	${PROCESS.process_path:NA}

Used Scripts

- file_ver_lib.py
- websphere_plugin_config.py
- websphere_plugin_config_reporter.py
- tcp_discovery_oam.py

- Apache.py

Discovered CITs

- Apache
- Apache Module
- Composition
- ConfigurationDocument
- Containment
- Dependency
- Deployed
- HTTP Context
- IBM HTTP Server
- IpAddress
- IpServiceEndpoint
- Node
- RunningSoftware
- Usage
- Web Server Virtual Host
- WebServer

Global Configuration Files

globalSettings.xml

Adapter Parameters

Parameter	Description
configFiles	Full path to Apache configuration files, including file names. **Note:** Multiple files must be separated by semicolons (;).

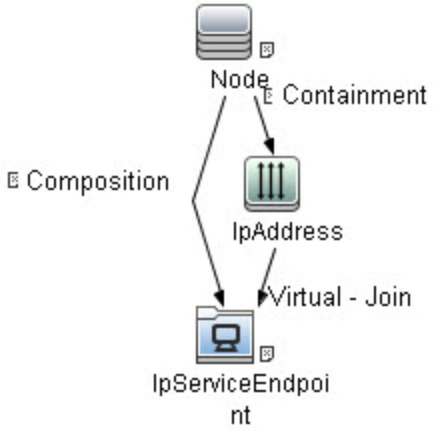
Web Server Detection using TCP Ports Job

This section includes details about the job.

Introduction

This job discovers web servers using TCP ports.

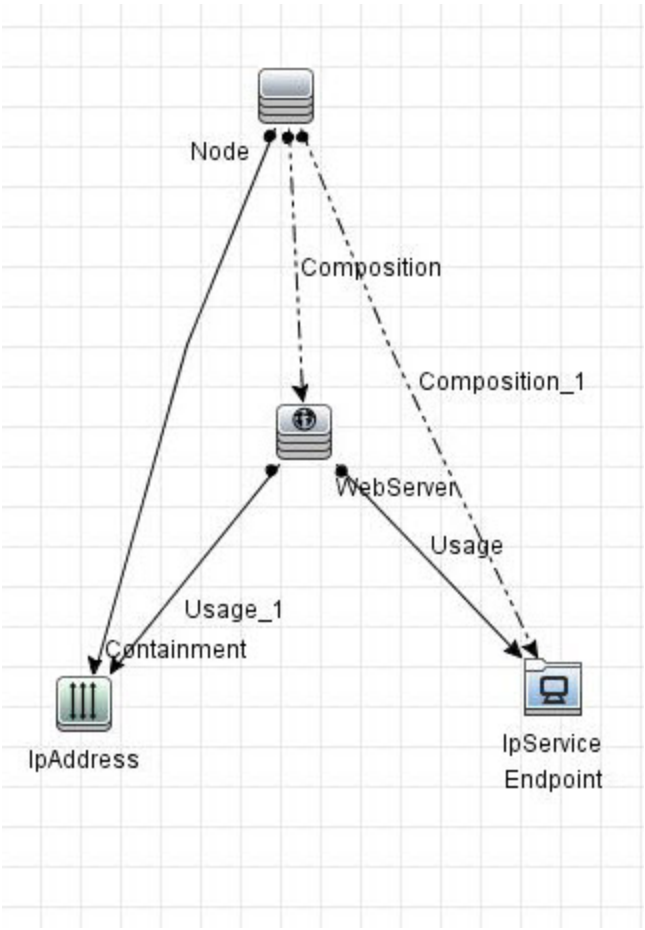
Trigger TQL



Node Name	Condition
Node	None
IpAddress	NOT IP Probe Name Is null
IpServiceEndpoint	IpServiceName Equal http OR ServiceNames Contains http

Topology Map

The **Web Server Detection using TCP Ports** topology is shown below.



Supported Policy

This job supports the following versions:

Vendor	Product	Supported Versions
IBM	IBM HTTP Server	5, 6.1, 7, 8.0, 8.5, 8.5.5, 9.0
Apache	Apache HTTP Server	1.3, 2.0, 2.2, 2.4
Microsoft	IIS	5, 6, 7, 7.5, 8, 8.5, 10

Adapter Information

This job uses the **TCP Web Server Detection** adapter.

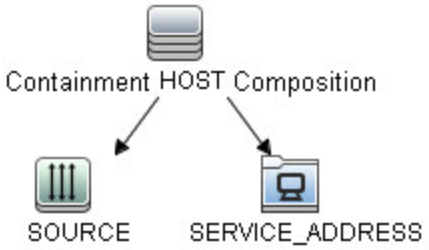
Adapter Type

Jython

Input CIT

IpAddress

Input TQL



Triggered CI Data

Name	Value
http_port	${SERVICE_ADDRESS.network_port_number}
ip_address	${SOURCE.name}
ip_domain	${SOURCE.routing_domain}

Used Scripts

WebserverConnection.py

Discovered CITs

- Composition
- Containment
- IIS Web Server
- IpAddress
- IpServiceEndpoint
- Node
- RunningSoftware
- SunOne
- Usage
- WebServer

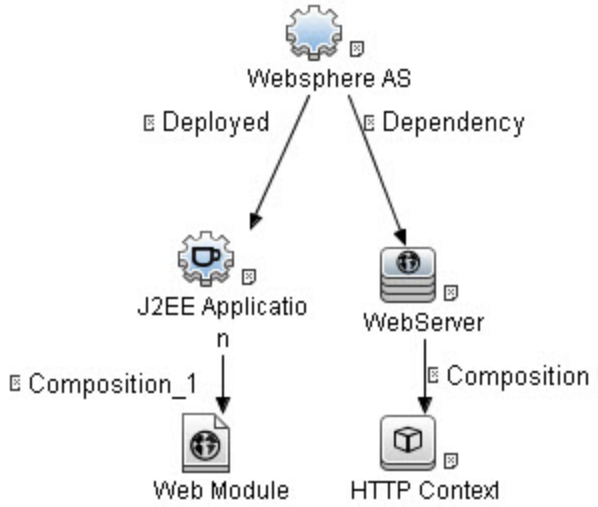
WebSphere to Web Server Dependency Job

This section includes details about the job.

Introduction

This job discovers dependencies between web servers and WebSphere application servers.

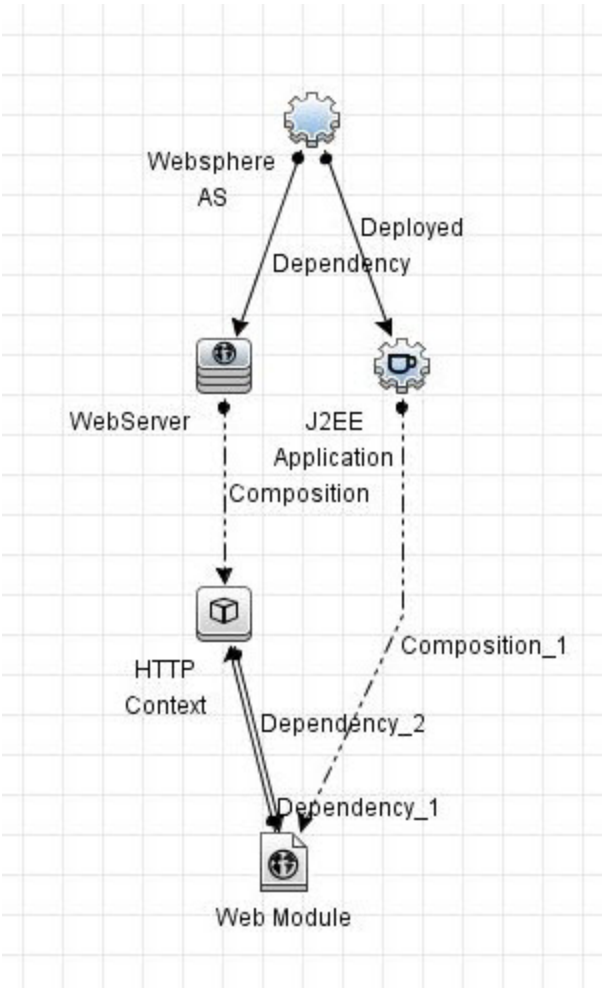
Trigger TQL



Node Name	Condition
Websphere AS	NOT J2EE Server Full Name Is null
J2EE Application	None
Web Module	NOT J2EE Managed Object Context Root Is null
WebServer	None
HTTP Context	NOT Web Application Context Is null AND NOT Web Application Server Name Is null

Topology Map

The **WebSphere to Web Server Dependency** topology is shown below.



Supported Policy

This job supports the following versions:

IBM WebSphere Application Server 5, 6.1, 7, 8.0, 8.5, 8.5.5, and 9.0.

Adapter Information

This job uses the **Web server to WebSphere Dependency** adapter.

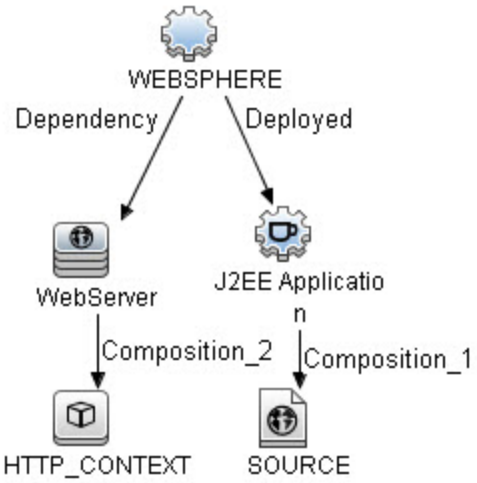
Adapter Type

Jython

Input CIT

Web Module

Input TQL



Triggered CI Data

Name	Value
http_context_context_root	${HTTP_CONTEXT.httpcontext_webapplicationcontext}
http_context_id	${HTTP_CONTEXT.root_id}
http_context_root_container	${HTTP_CONTEXT.root_container}
http_context_server	${HTTP_CONTEXT.httpcontext_webapplicationserver}
web_module_context_root	${SOURCE.j2eemanagedobject_contextroot}
web_module_id	${SOURCE.root_id}
websphere_full_name	${WEBSPHERE.j2eeserver_fullname}

Used Scripts

websphere_webserver_dependency.py

Discovered CITs

- Dependency
- HTTP Context
- J2EE Deployed Object
- RunningSoftware

Chapter 72: Microsoft Internet Information Services (IIS) Discovery

This chapter includes:

Supported Versions 1076

Microsoft Internet Information Services (IIS) Discovery Topology 1076

How to Discover Microsoft Internet Information Services (IIS) Topology 1078

IIS Applications by NTCMD or UDA Job 1079

Bugzilla, Wordpress, and MediaWiki Discovery 1082

Troubleshooting and Limitations – Microsoft IIS Discovery 1083

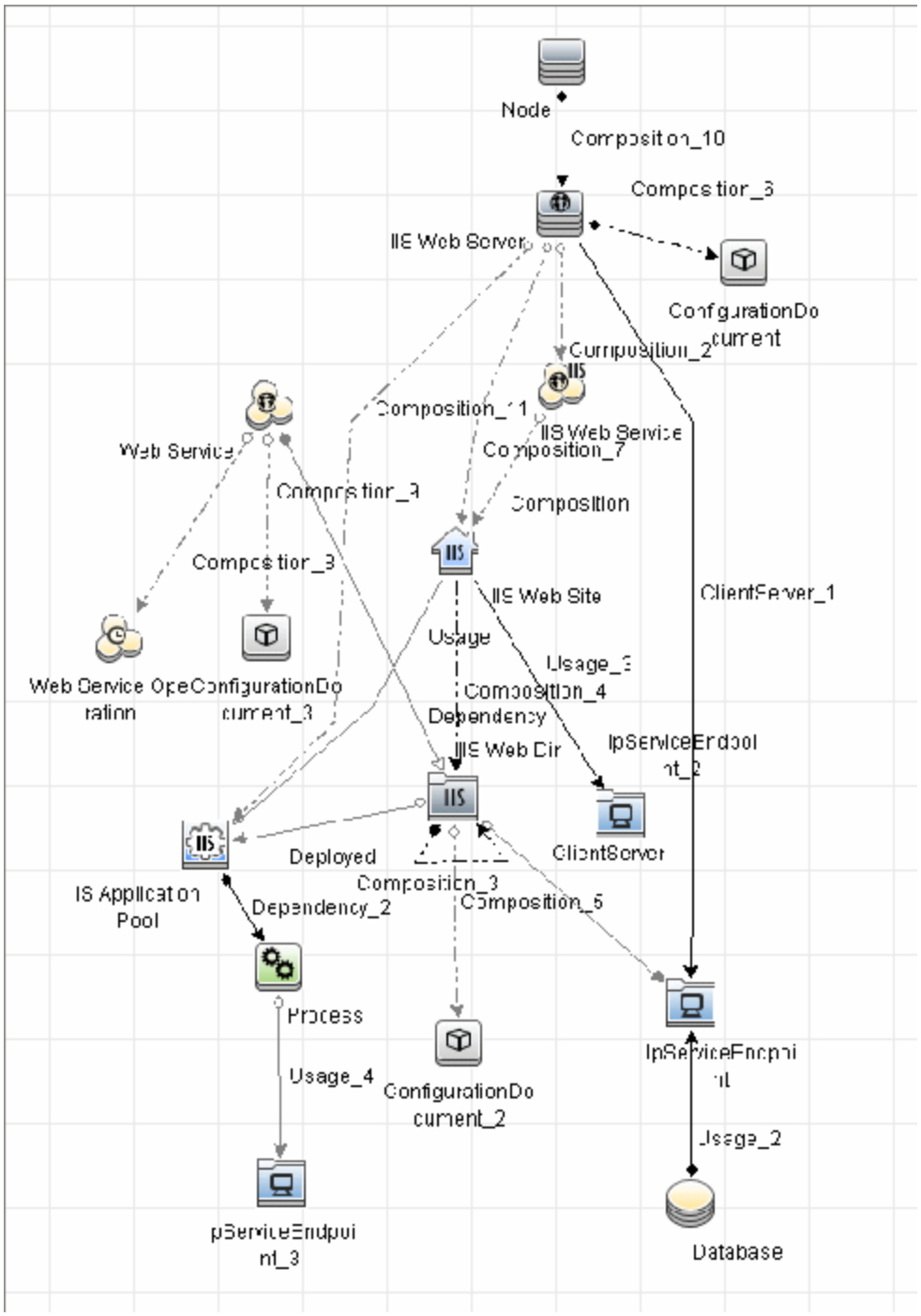
Supported Versions

This discovery supports Microsoft Internet Information Services (IIS) versions: 5, 6, 7, 7.5, 8, 8.5, and 10.

> **Note:**
>
> - Discovery of IIS 7 is supported through the IIS 6 Management Compatibility tool.
> - Starting from IIS 7, IIS provides a new command line tool, **AppCmd.exe**, to configure and query objects on your web server, and to return output in text or XML format. Therefore, you can use **AppCmd.exe** to discover IIS 7 and later versions.

Microsoft Internet Information Services (IIS) Discovery Topology

> **Note:** For a list of discovered CITs, see "IIS Applications by NTCMD or UDA Job" on page 1079.


Node
Composition_10
Composition_3
IIS Web Server
ConfigurationDocument
Composition_2
Composition_1
IIS Web Service
Composition_7
Web Service
Composition_4
Composition
Composition_3
IIS Web Site
ClientServer_1
Usage
Usage_3
Web Service Operation
ConfigurationDocument_3
Composition_4
Dependency
IIS Web Dir
IpServiceEndpoint_2
ClientServer
Deployed
Composition_3
Composition_5
IIS Application Pool
Dependency_2
Process
IpServiceEndpoint
Usage_4
ConfigurationDocument_2
Usage_2
IpServiceEndpoint_3
Database

How to Discover Microsoft Internet Information Services (IIS) Topology

This task describes how to discover Microsoft Internet Information Services (IIS) and includes the following steps:

1. Prerequisite - Set up protocol credentials

   This discovery uses the **NTCMD** protocol.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Prerequisites - Other

   - To retrieve all relevant information, DFM should be able to execute Visual Basic scripts and have write permission to the **%SystemRoot%/system32/drivers/etc** folder.
   - Verify that the target machine running IIS lies in the Data Flow Probe range.

3. Run the discovery

   In the Universal Discovery window, activate the jobs in the following order:

   a. Run the **Host Connection by Shell** job to create Shell CITs.

   b. Run the **Host Applications by Shell** job to discover IIS Web Server CIs and IIS Application Pool CIs with corresponding **Depend** links to the managing process.

   c. Run the **IIS Applications by NTCMD or UDA** job to discover the detailed topology of IIS.

      After the connection is made, DFM copies the **adsutil.vbs** script on the remote machine. DFM retrieves IIS topology information from the output of this tool.

      Microsoft IIS version 7.0 enables you to create an IIS application from a Web directory, as well as from a virtual directory (as in prior versions). Therefore, when DFM discovers such an application, DFM creates an IIS Web Directory CI.

      To view required permissions: **Universal Discovery > Discovery Modules/Jobs > Middleware > Web Servers > IIS > IIS Applications by NTCMD or UDA** job. **Details** tab > **Discovery Job Details** pane. Click the **View Permissions** button. For details, see "IIS Applications by NTCMD or UDA Job" on the next page.

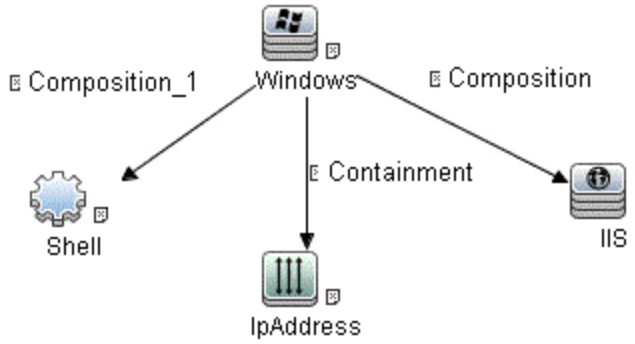
> **Note:** The IIS Web Dir CI is created only if there is an `IIS Virtual Dir` CI or a `web.config` file underneath in the topology, otherwise it is not reported.

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

IIS Applications by NTCMD or UDA Job

This section includes:

Trigger Query



Node Name	Condition
Windows	None
Shell	NOT Reference to the credentials dictionary entry Is null AND (CI Type Equal ntcmd OR CI Type Equal uda)
IpAddress	NOT IP Probe Name Is null
IIS	NOT Version Is null

Adapter

This job uses the NTCMD_APP_Dis_IIS adapter.

- Triggered CI Data

Name	Value
Protocol	${SHELL.root_class}
credentialsId	${SHELL.credentials_id}
host_ips	${IpAddress.name}
iis_name	${SOURCE.discovered_product_name}
iis_version	${SOURCE.version}
ip_address	${SHELL.application_ip}

- Permissions

Permission	Operation	Usage Description	Objects and Parameters
Shell	exec	Basic login	uname ver wmic OS Get CodeSet wmic OS Get OSLanguage
Shell	copy	Copy file to remote machine	adsutil.vbs - Visual Basic script for IIS discovery
Shell	exec	Discover IIS Topology	cscript.exe adsutil.vbs ENUM "MSFTPSVC/{SITENUM}root" cscript.exe adsutil.vbs ENUM "W3SVC" cscript.exe adsutil.vbs ENUM "W3SVC/AppPools" cscript.exe adsutil.vbs ENUM "W3SVC/AppPools/{POOLNAME}" cscript.exe adsutil.vbs ENUM "W3SVC/{SITENUM}" cscript.exe adsutil.vbs ENUM "W3SVC/{SITENUM}/root" cscript.exe adsutil.vbs ENUM /p "W3SVC/{SITENUM}/Root" cscript.exe adsutil.vbs ENUM /p "W3SVC/{SITENUM}/Root/{IIS_DIR}" cscript.exe adsutil.vbs ENUM /p MSFTPSVC cscript.exe adsutil.vbs ENUM /p MSFTPSVC/{SITENUM}/Root cscript.exe adsutil.vbs ENUM /p W3SVC cscript.exe adsutil.vbs ENUM /p W3SVC/AppPools cscript.exe adsutil.vbs ENUM MSFTPSVC cscript.exe adsutil.vbs ENUM MSFTPSVC/{SITENUM} cscript.exe adsutil.vbs ENUM SMTPSVC cscript.exe adsutil.vbs ENUM W3SVC/{SITENUM}/Root/{IIS_DIR} cscript.exe adsutil.vbs GET "{PATH}/KeyType" cscript.exe adsutil.vbs GET KeyType cscript.exe adsutil.vbs GET MSFTPSVC/{SITENUM}/Root/{PATH}/Key... cscript.exe adsutil.vbs GET MaxBandwidth dir /B hostname nslookup <hostname> type <file_path>

- Adapter Parameters

Parameter	Description
acceptedStatusCodes	Contains status code which should be treated as **OK** during the verification of URL.
adsutil_path	Enter the path and name to the **adsutil.vbs** script. The **adsutil.vbs** script is a free script provided by Microsoft for IIS management tasks.

Parameter	Description
checkConnectionToUrl	When set to **true**, any reported URL is verified on the availability by HTTP(s) head method from the probe machine. In case of an unsuccessful connection, the URL is skipped.
do_web_service	**True.** The IIS Web Service CI is reported. **Note: report_legacy_topology** must also be set to **true** for DFM to report this CI.
prefer_appcmd	Enables **AppCmd.exe** to discover IIS. By default, this parameter is set to **true**.
report_legacy_ topology	For backwards compatibility, DFM continues, by default, to report the legacy IIS topology.
web_service_file_ extensions	List of file extensions which will detect as web services. **Note:** Wildcards are not supported.

Discovered CITs

- ClientServer
- Composition
- ConfigurationDocument
- Containment
- Database
- Database Resource
- Depedency
- Deployed
- IIS FTP Server
- IIS Resource
- IIS SMTP Server
- IIS Web Server
- IpAddress

- IpServiceEndpoint
- Node
- UriEndpoint
- Usage
- Web Server Virtual Host

Bugzilla, Wordpress, and MediaWiki Discovery

For details, see "How to Discover Bugzilla, Wordpress, and MediaWiki" on page 927.

Troubleshooting and Limitations – Microsoft IIS Discovery

This section describes troubleshooting and limitations for Microsoft Internet Information Services (IIS) discovery.

- An IIS Web server CI is created even if no Web service is running on the machine but the IIS FTP and IIS SMTP services are present.
- If the discovered web.config file's ConnectionStrings property contains a password, when the configuration file CI is created the password is replaced with asterisk characters.

Part 12: Middleware > Web Services

Chapter 73: UDDI Registry Discovery

This chapter includes:

Overview 1086

Supported Versions 1086

Topology 1086

How to Discover UDDI Processes 1087

Overview

The UDDI discovery process enables you to discover Web services from a UDDI registry.

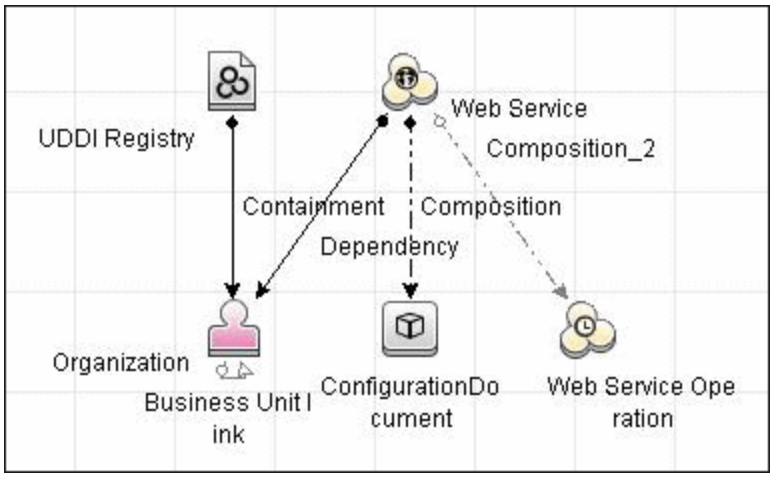
DFM queries the UDDI registry for its Web services, including non-SOAP services, or for a specific publisher service (if defined in the UDDI Registry protocol). The Web services found in the UDDI registry are represented by a **WebService Resource** CI in the CMDB and the registry is created as a **UDDI Registry** CI.

Supported Versions

This discovery supports UDDI versions 2 and 3.

Topology

The following depicts the topology of the **SOA_UDDI_View**:



How to Discover UDDI Processes

This task includes the following steps:

1. Prerequisites - Install ruddi jar file

   a. Download the ruddi-1.0-bin.jar file from the following location:

   http://sourceforge.net/projects/s-feng/files/S-FENG/lib/ruddi1.0/ruddi-1.0-bin.jar/download?use_mirror=iweb

   b. Rename the file **ruddi.jar** and copy it to the following directory on the probe machine:

   <hp>\UCMDB\DataFlowProbe\runtime\probeManager\discoveryResources\uddi

2. Prerequisites - Set up protocol credentials

   Set up the UDDI protocol.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

3. Run the discovery

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

   Activate the following jobs:

   - **Web Services by URL**
   - **Web Service Connections by UDDI Registry**
   - **Web Services by UDDI Registry**

4. Provide service publisher details – Optional

   Update the UDDI Registry adapter's **organization** parameter with the name of the service publisher and a description of the organization.

   For more details about editing adapter parameters, see "Adapter Definition Tab" in the *HPE Universal CMDB Data Flow Management Guide*.

Part 13: Middleware > Proxy Servers

Chapter 74: IBM Security Access Manager Discovery

This chapter includes:

Overview 1090
Supported Versions 1090
Webseal Connection by Shell Job 1090
Introduction 1091
Adapter Information 1091
Webseal Connection by Web Services Job 1093
Introduction 1093
Adapter Information 1094
Webseal Policy Server Connection by Shell Job 1096
Introduction 1096
Adapter Information 1097
Webseal Policy Server Topology by Shell Job 1099
Introduction 1099
Adapter Information 1099
Webseal Topology by Shell Job 1101
Introduction 1101
Adapter Information 1102
Webseal Topology by Web Services Job 1103
Introduction 1103
Adapter Information 1104
How to Discover IBM Security Access Manager Using HTTP 1106
How to Discover IBM Security Access Manager Using Shell 1107

Overview

This package discovers IBM Security Access Manager (previously called IBM Tivoli Access Manager), which is an integrated access appliance that provides web access security protection. This package includes adapters that discover this application using the following protocols:

- HTTP/Web
- Shell

> **Note:**
>
> The **Webseal Policy Server Connection by Shell** and **Webseal Policy Server Topology by Shell** jobs are supposed to be used as the complete replacement for the **Webseal Connection by Shell** and **Webseal Topology by Shell** jobs. That is, if the **Webseal Policy Server Connection by Shell** and **Webseal Policy Server Topology by Shell** jobs are run, no need to run the **Webseal Connection by Shell** and **Webseal Topology by Shell** jobs.
>
> The reasons to use the **Webseal Policy Server Connection by Shell** and **Webseal Policy Server Topology by Shell** jobs are as follows:
>
> - These two jobs can retrieve all the WebSeal related configurations across the whole customers' environment.
> - The performance and decrease of the load to the Policy Server itself.

Supported Versions

The following versions are supported:

Job	Versions Supported
IBM Security Access Manager for Web by HTTP	8.x
IBM Security Access Manager for Web by Shell	6-8.x

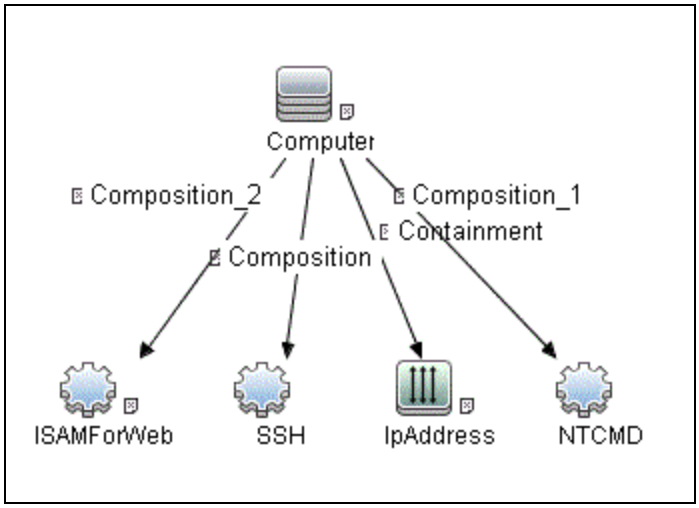
Webseal Connection by Shell Job

This section includes details about the job.

Introduction

This job discovers credentials applied and generic topology for WebSeal by Shell.

Trigger Query



Adapter Information

This job uses the **Webseal Connection by Shell** adapter.

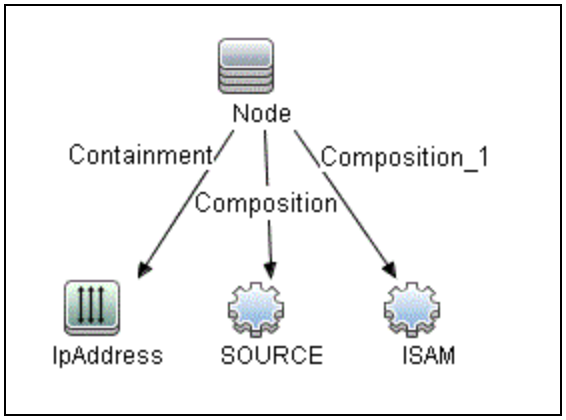
Adapter Type

Jython

Input CIT

Shell

Input TQL



Triggered CI Data

Name	Value	Description
Protocol	${SOURCE.root_class}	Shell type (SSH/NTCMD)
credentialsId	${SOURCE.credentials_id}	Valid Shell credentials ID
hostId	${SOURCE.root_container}	Node UCMDB ID which WebSeal belongs to
ip_address	${SOURCE.application_ip}	Destination IP address
webseal_id_list	${ISAM.root_id}	WebSeal ID list

Used Scripts

- webseal_topology.py
- pdadmin_shell_webseal_discoverer.py
- webseal_connection_by_shell.py

Discovered CITs

- Composition
- Containment
- ISAMForWeb

- IpAddress
- Node

Webseal Connection by Web Services Job

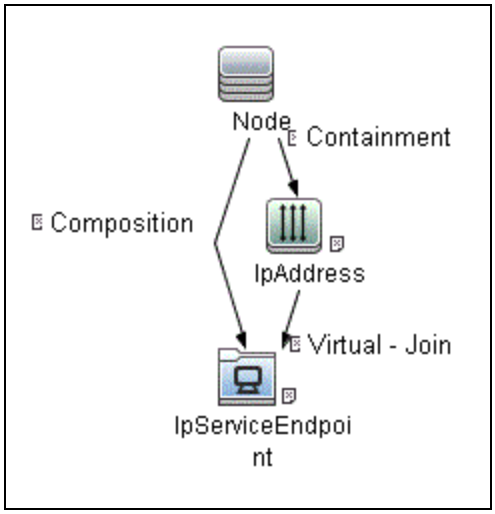
This section includes details about the job.

Introduction

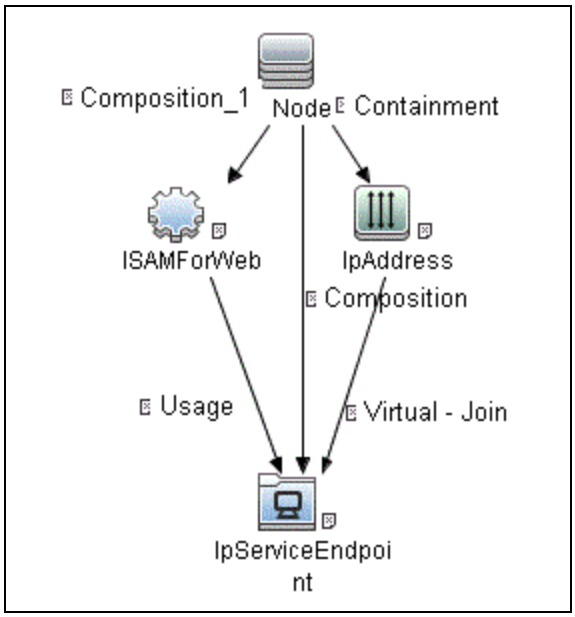
This job discovers the WebSeal topology by **pdadmin** Rest API.

Trigger Query

- **https_ports**



- **isam_with_ipse**



Adapter Information

This job uses the **Webseal by Web Services** adapter.

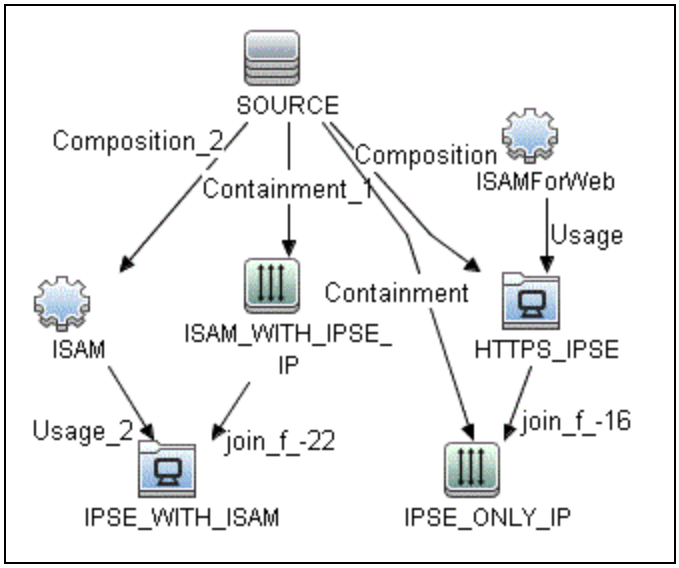
Adapter Type

Jython

Input CIT

Node

Input TQL



Triggered CI Data

Name	Value	Description
https_ipse_ids	${HTTPS_IPSE.root_id:NA}	List of root ids of IpServiceEndpoint in case when trigger is https IpServiceEndpoint without ISAM instance
ipse_only_ips	${IPSE_ONLY_IP.name:NA}	List of ip addresses in case when trigger is https IpServiceEndpoint without ISAM instance
isam_credential_ids	${ISAM.credentials_id:NA}	List of credential id in case when trigger is ISAM instance
isam_ids	${ISAM.root_id:NA}	List of ISAM root ids in case when trigger is ISAM instance
isam_with_ipse_ips	${ISAM_WITH_IPSE_IP.name:NA}	List of ip addresses in case when triger is ISAM instance

Used Scripts

webseal_connection_by_webservices.py

Discovered CITs

- Composition
- Containment
- ISAMForWeb
- IpAddress
- IpServiceEndpoint
- Node
- Usage

Adapter Parameters

Name	Default Value	Description
autoAcceptCerts	true	Temporary accept received certificates as trusted
firmware_settings_api_query	firmware_settings	HTTP query to firmware settings web services API
management_ authentication_api_query	management_ authentication	HTTP query to management authentication web services API
pdadmin_api_query	pdadmin	HTTP query to pdadmin web services API
reverseproxy_api_query	reverseproxy	HTTP query to reverseproxy web services API

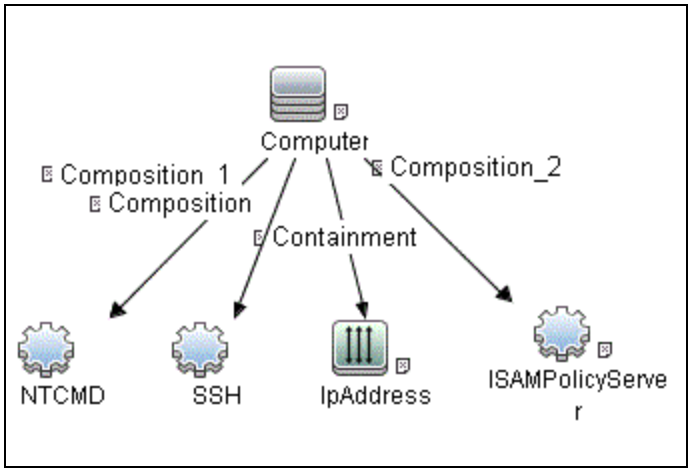
Webseal Policy Server Connection by Shell Job

This section includes details about the job.

Introduction

This job is used to find valid **pdadmin** credentials and store the reference to the ISAMPolicyServer CI.

Trigger Query



CI	Attribute Value
NTCMD	NOT Reference to the credentials dictionary entry Is null
SSH	NOT Reference to the credentials dictionary entry Is null
IpAddress	NOT IP Probe Name Is null

Adapter Information

This job uses the **Webseal Policy Server Connection by Shell** adapter.

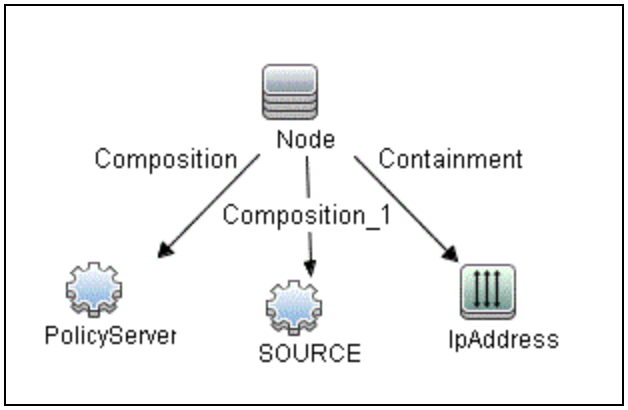
Adapter Type

Jython

Input CIT

Shell

Input TQL



Triggered CI Data

Name	Value
Protocol	${SOURCE.root_class}
credentialsId	${SOURCE.credentials_id}
hostId	${SOURCE.root_container}
ip_address	${SOURCE.application_ip}
policyserver_id_list	${PolicyServer.root_id}

Used Scripts

- webseal_topology.py
- pdadmin_shell_webseal_discoverer.py
- webseal_policy_server_connection_shell.py

Discovered CITs

- ISAMPolicyServer
- Node

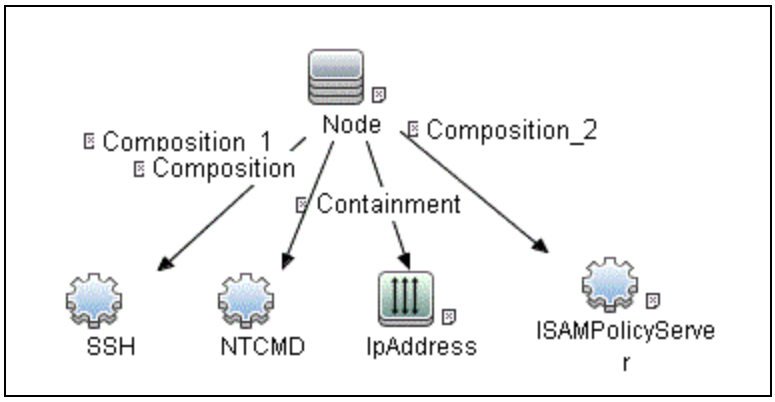
Webseal Policy Server Topology by Shell Job

This section includes details about the job.

Introduction

This job discovers all WebSeal related topology triggering on PolicyServer.

Trigger Query



CI	Attribute Value
SSH	NOT Reference to the credentials dictionary entry Is null
NTCMD	NOT Reference to the credentials dictionary entry Is null
IpAddress	NOT IP Probe Name Is null
ISAMPolicyServer	NOT Reference to the credentials dictionary entry Is null

Adapter Information

This job uses the **Webseal Policy Server Topology by Shell** adapter.

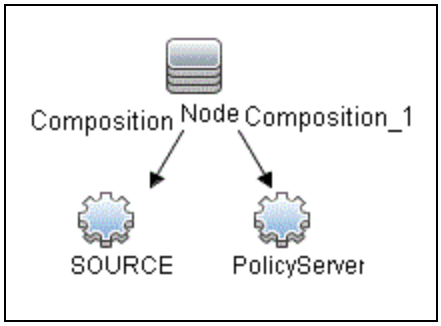
Adapter Type

Jython

Input CIT

Shell

Input TQL



CI	Attribute Value
SOURCE	NOT Reference to the credentials dictionary entry Is null
PolicyServer	NOT Reference to the credentials dictionary entry Is null

Triggered CI Data

Name	Value
Protocol	${SOURCE.root_class}
credentialsId	${SOURCE.credentials_id}
hostId	${SOURCE.root_container}
ip_address	${SOURCE.application_ip}
webseal_credentials_id	${PolicyServer.credentials_id}

Used Scripts

- webseal_topology.py
- pdadmin_shell_webseal_discoverer.py
- webseal_topology_by_shell.py

Discovered CITs

- ISAMForWeb
- ISAMJunction
- ISAMPolicyServer
- IpAddress
- Node

Adapter Parameters

Name	Default Value	Description
WebSealShellTimeout	15000	The WebSeal **pdadmin** tool timeout. This value overrides the default protocol timeout settings.

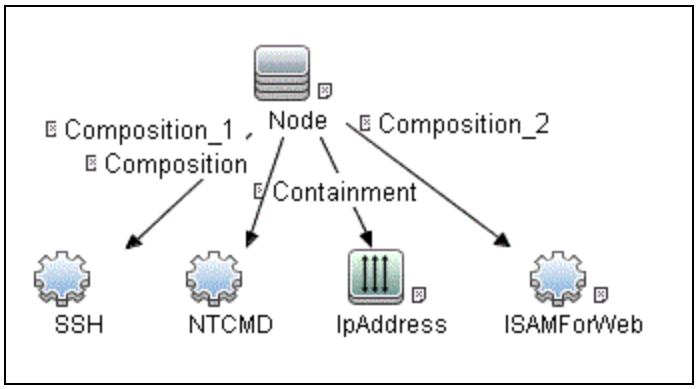
Webseal Topology by Shell Job

This section includes details about the job.

Introduction

This job reports the topology of WebSeal and junctions using Shell protocols.

Trigger Query



Adapter Information

This job uses the **Webseal Topology by Shell** adapter.

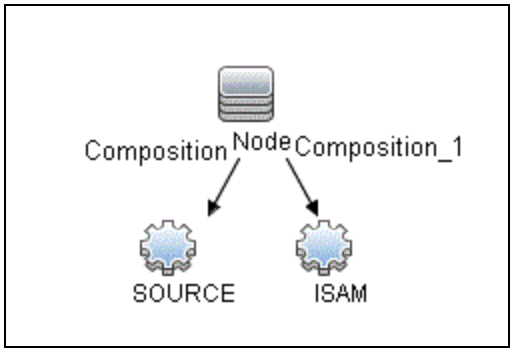
Adapter Type

Jython

Input CIT

Shell

Input TQL



Triggered CI Data

Name	Value	Description
Protocol	${SOURCE.root_class}	Shell type (SSH/NTCMD)
credentialsId	${SOURCE.credentials_id}	Valid Shell credentials ID
hostId	${SOURCE.root_container}	Node UCMDB ID which Webseal belongs to
ip_address	${SOURCE.application_ip}	Destination IP address
websealId	${ISAM.root_id}	Root ID of Webseal
webseal_credentials_id	${ISAM.isam_credentials_id}	Reference to credentials dictionary

Used Scripts

- webseal_topology.py
- pdadmin_shell_webseal_discoverer.py
- webseal_topology_by_shell.py

Discovered CITs

- Composition
- ISAMForWeb
- ISAMJunction
- ISAMPolicyServer
- IpServiceEndpoint
- Membership
- Node
- Usage

Adapter Parameters

Name	Default Value	Description
WebSealShellTimeout	15000	The WebSeal **pdadmin** tool timeout. This value overrides the default protocol timeout settings.

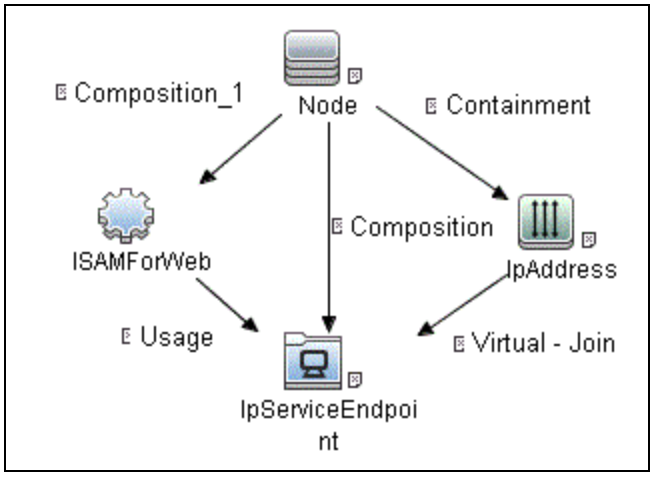
Webseal Topology by Web Services Job

This section includes details about the job.

Introduction

This job discovers the WebSeal topology by **pdadmin** Rest API.

Trigger Query



Adapter Information

This job uses the **Webseal by Web Services** adapter.

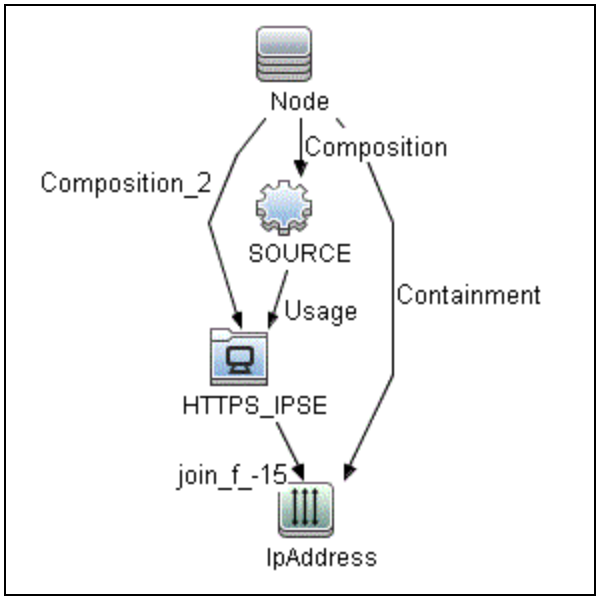
Adapter Type

Jython

Input CIT

ISAMForWeb

Input TQL



Triggered CI Data

Name	Value	Description
cmdbid	${SOURCE.root_id}	Root id of ISAM instance
container_cmdbid	${Node.root_id}	Root id of a container
credential_id	${SOURCE.credentials_id}	Reference to credentials dictionary
ip_address	${IpAddress.name}	List of ip addresses of trigger ISAM instance
name	${SOURCE.name}	Name of ISAM instance

Used Scripts

webseal_topology_by_webservices.py

Discovered CITs

- Composition
- Containment

- DirectoryServer
- ISAMForWeb
- ISAMJunction
- ISAMPolicyServer
- IpAddress
- IpServiceEndpoint
- Node
- RunningSoftware
- Usage

Adapter Parameters

Name	Default Value	Description
autoAcceptCerts	true	Temporary accept received certificates as trusted
firmware_settings_api_query	firmware_settings	HTTP query to firmware settings web services API
management_ authentication_api_query	management_ authentication	HTTP query to management authentication web services API
pdadmin_api_query	pdadmin	HTTP query to pdadmin web services API
reverseproxy_api_query	reverseproxy	HTTP query to reverseproxy web services API

How to Discover IBM Security Access Manager Using HTTP

This task describes how to discover IBM Security Access Manager. It includes the following steps:

- "Prerequisite - Set up protocol credentials" on page 798
- "Prerequisites - Other" on page 798
- "Run the discovery" on page 799

Prerequisite - Set up protocol credentials

Set up the following protocols:

Job	Protocol
IBM Security Access Manager by HTTP	HTTP

Prerequisites- Other

Policy server account availability

HTTP-based discovery is based on Webservices API provided by the WebSeal platform. It uses pdadmin webservices API, and this API requires Policy Server credentials to be configured. Discovery uses the same username and password that were used for the basic authentication. This means that there should be available LDAP user with the same username/password which are configured to access WebSeal management console.

Run the discovery

Activate the following jobs:

- **Range IPs by ICMP**
- **Databases TCP Ports**
- **Webseal Connection by Web Services**
- **Webseal Topology by Web Services**

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

How to Discover IBM Security Access Manager Using Shell

This task describes how to discover IBM Security Access Manager. It includes the following steps:

- "Prerequisite - Set up protocol credentials" on page 798
- "Prerequisites - Other" on page 798
- "Run the discovery" on page 799

Prerequisite - Set up protocol credentials

Set up the following protocols:

Job	Protocol
IBM Security Access Manager by Shell	SSH or NTCMD Optional: LDAP for deep topology discovery.

Prerequisites- Other

Policy server account availability

Shell-based discovery connects to remote nodes and then uses the pdadmin utility. This utility requires an LDAP account that has the same credentials as the WebSeal account.

Run the discovery

Activate the following jobs:

- **Range IPs by ICMP**
- **Host Connection by Shell**
- **Host Applications by Shell**
- **Webseal Connection by Shell** or **Webseal Policy Server Connection by Shell**
- **Webseal Topology by Shell** or **Webseal Policy Server Topology by Shell**

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

Part 14: Middleware > Security Servers

Chapter 75: Oracle Access Management Discovery

This chapter includes:

Oracle Access Management Connection by Web Services Job 1111
Introduction 1111
Topology Map 1111
Support Policy 1111
Adapter Information 1111
Oracle Access Management Policies by Web Services Job 1113
Introduction 1113
Topology Map 1113
Support Policy 1114
Adapter Information 1114
Oracle Access Management Dependencies via URL Job 1115
Introduction 1115
Topology Map 1116
Support Policy 1117
Adapter Information 1117

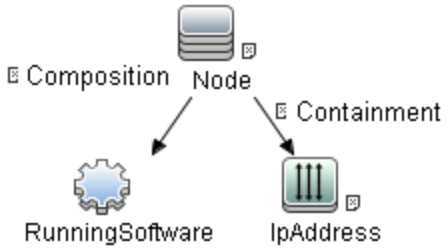
Oracle Access Management Connection by Web Services Job

This section includes details about the job.

Introduction

This job detects the Oracle Access Management server version and the HTTP credential that the Oracle Access Management server is using.

Trigger TQL



Node Name	Condition
IpAddress	NOT IP Probe Name Is null
RunningSoftware	DiscoveredProductName Equal Oracle Access Management

Topology Map

None

Support Policy

Support Oracle Access Management 11.1.2.0.0

Adapter Information

This job uses the **Oracle Access Management Connection by Web Services** adapter.

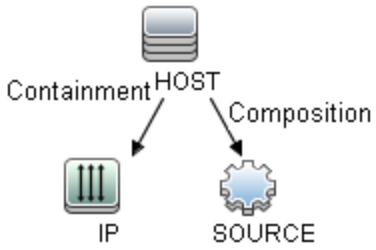
Adapter Type

Jython

Input CIT

RunningSoftware

Input TQL



Triggered CI Data

Name	Value
cmdb_id	${SOURCE.root_id}
ip_address	${IP.name}
ip_domain	${IP.routing_domain}

Workflow Steps

None

Used Scripts

oam_connection_by_webservices.py

Discovered CITs

RunningSoftware

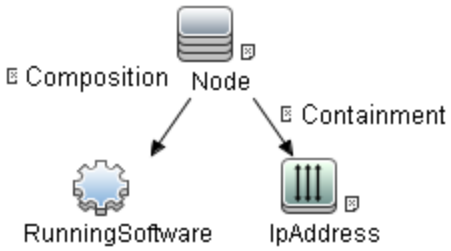
Oracle Access Management Policies by Web Services Job

This section includes details about the job.

Introduction

This job discovers the Oracle Access Management policies by using the HTTP credential detected by the **Oracle Access Management Connection by Web Services** job.

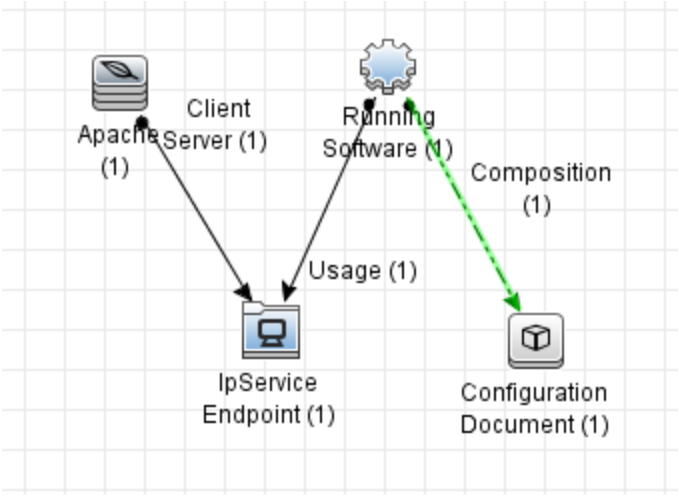
Trigger TQL



Node Name	Condition
IpAddress	NOT IP Probe Name Is null
RunningSoftware	DiscoveredProductName Equal Oracle Access Management AND NOT Version Is null

Topology Map

The **Oracle Access Management Policies by Web Services** topology is shown below.



Support Policy

Support Oracle Access Management 11.1.2.0.0

Adapter Information

This job uses the **Oracle Access Management Policies by Web Services** adapter.

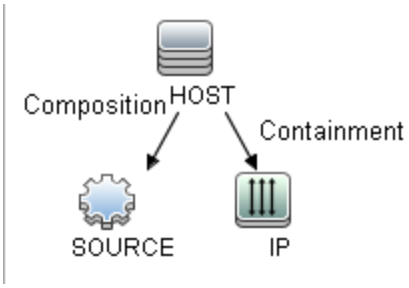
Adapter Type

Jython

Input CIT

RunningSoftware

Input TQL



Triggered CI Data

Name	Value
cmdb_id	${SOURCE.root_id}
credential_id	${SOURCE.credentials_id}
ip_address	${IP.name}
version	${SOURCE.version}

Workflow Steps

None

Used Scripts

oam_policies_by_webservices.py

Discovered CITs

Composition

RunningSoftware

ConfigurationDocument

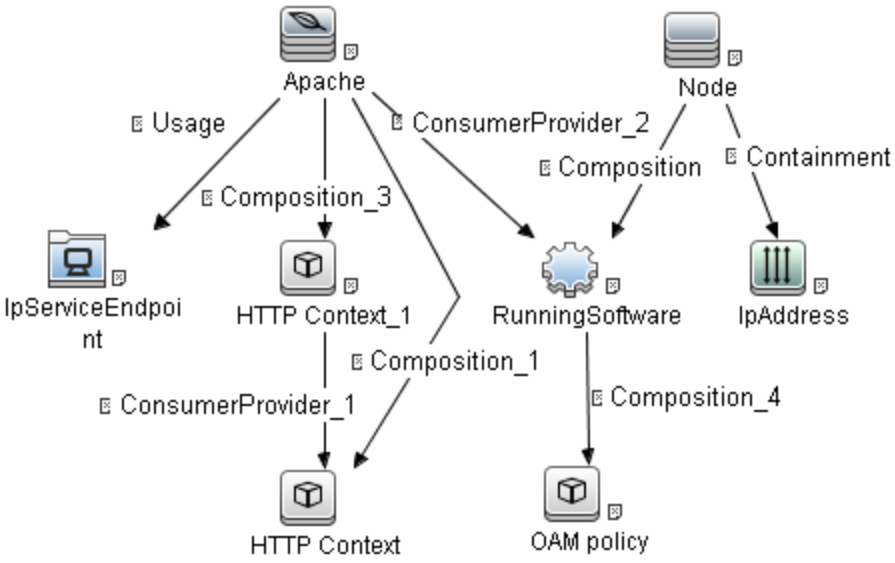
Oracle Access Management Dependencies via URL Job

This section includes details about the job.

Introduction

This job analyzes the Oracle Access Management (OAM) policies, then discovers the redirect URL(s) in OAM server and creates the dependencies between OAM Webgate URL(s) and the redirect URL(s).

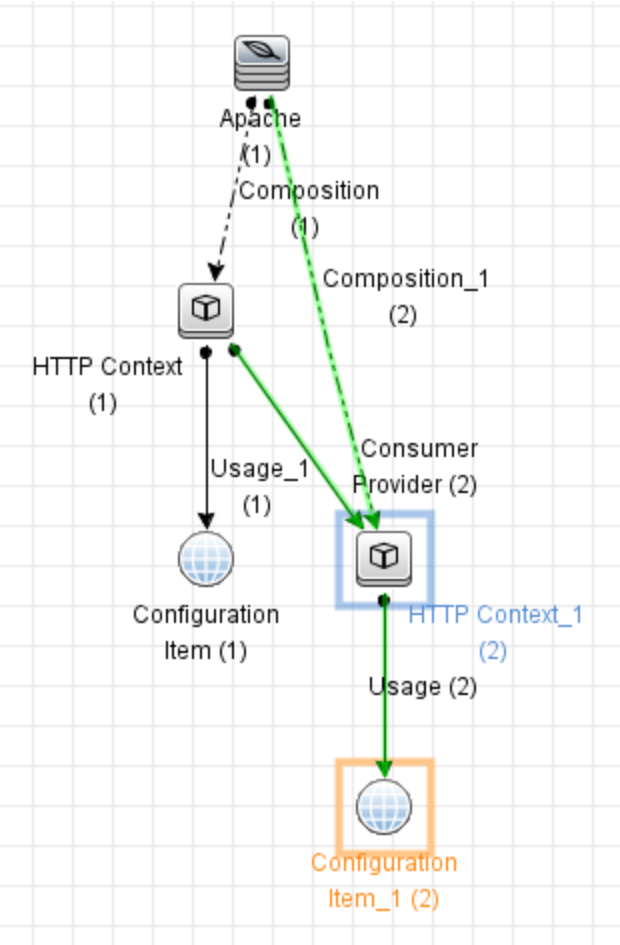
Trigger TQL



Node Name	Condition
Node	None
IpAddress	NOT IP Probe Name Is null
RunningSoftware	None
OAM policy	Name Equal policy.xml
Apache	None
HTTP Context	None
HTTP Context_1	None
IpServiceEndpoint	None

Topology Map

The **Oracle Access Management Dependencies via URL** topology is shown below.



Support Policy

Support Oracle Access Management 11.1.2.0.0

Adapter Information

This job uses the **OAM url dependencies via WebGate url** adapter.

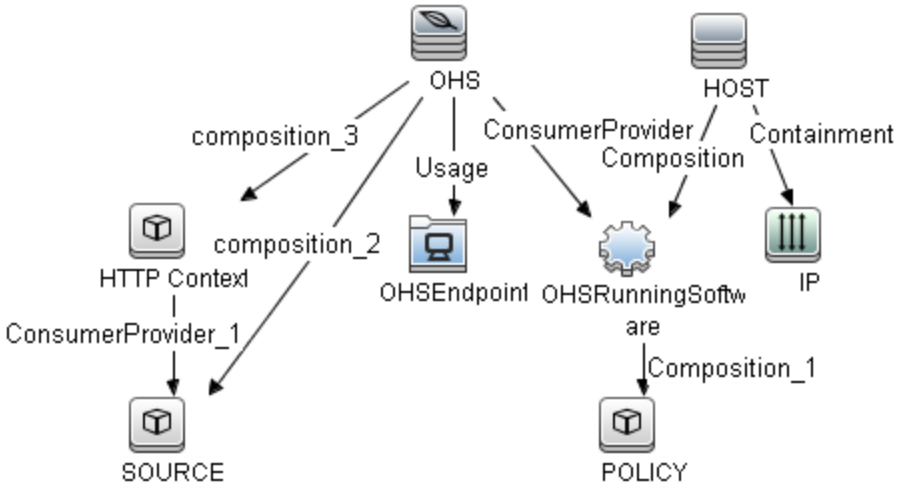
Adapter Type

Jython

Input CIT

HTTP Context

Input TQL



Triggered CI Data

Name	Value
OHS_ADDRESS	${OHSEndpoint.ipserver_address}
OHS_CONTEXT	${SOURCE.httpcontext_webapplicationcontext}
OHS_CONTEXT_ID	${SOURCE.root_id}
OHS_ID	${OHS.root_id}
POLICY_FILE	${POLICY.document_content}

Used Scripts

OAMPolicy.py

OAMURLDependency.py

Discovered CITs

ConfigurationDocument

ConsumerProvider

HTTP Context

Part 15: Network Infrastructure

Chapter 76: Network - Basic Discovery

This chapter includes:

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Adapter Information 1122
Cisco HSRP by SNMP Job 1125
Introduction 1125
Adapter Information 1125
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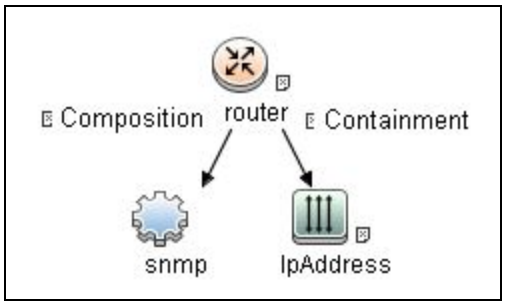
Arp Table by SNMP Job

This section includes details about the job.

Introduction

This job discovers the ARP table of a router using the SNMP protocol. This discovery reveals IP addresses by querying the protocol that translates IP addresses into the Ethernet addresses used by local area networks, as well as the host and network that it belongs to.

Trigger TQL



Node Name	Condition
router	None
snmp	None
IpAddress	NOT IP Probe Name Is null

Adapter Information

This job uses the **Router ARP by SNMP** adapter.

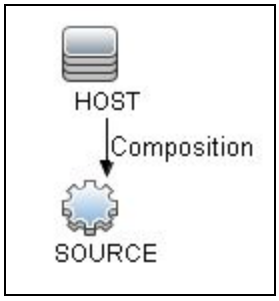
Adapter Type

Jython

Input CIT

SNMP

Input TQL



Triggered CI Data

Name	Value
credentialsId	${SOURCE.credentials_id}
host_id	${HOST.root_id}
ip_address	${SOURCE.application_ip}
netAddress	${SOURCE.application_ip}
port	${SOURCE.snmp_port}
retry	${SOURCE.snmp_retry}
snmpSupportMultiOid	${SOURCE.snmp_supportmultioid}
timeOut	${SOURCE.snmp_timeout}

Used Scripts

- DiscoverArp.py

Required Permissions

Permission	Operation	Usage Description	Objects and Parameters
SNMP	get	Discovers ipAddrEntry	iso.org.dod.internet.mgmt.mib-2.ip.ipAddrTable.ipAddrEntry: 1.3.6.1.2.1.4.20.1
SNMP	get	Discovers ARP table	iso.org.dod.internet.mgmt.mib-2.ip.ipNetToMediaTable.ipNetToMediaEntry.ipNetToMediaPhysAddress: 1.3.6.1.2.1.4.22.1.2
SNMP	get	Discovers ARP physical address	iso.org.dod.internet.mgmt.mib-2.at.atTable.atEntry.atPhysAddress: 1.3.6.1.2.1.3.1.1.2

Discovered CITs

- Composition
- Containment
- Interface
- IpAddress
- IpSubnet
- Membership
- Node
- Parent

Adapter Parameters

Name	Default Value	Description
backupSnmpMethod	walk	Backs up the SNMP method (walk, bulk, getnext).
discoverUnknownIPs	true	Discovers IP addresses that are out of the scope range.
moonWalkBulkSize	100	The moon walk bulk size.

Name	Default Value	Description
moonWalkSleep	100	The moon walk sleep time (in milliseconds).
snmpBulkSize	50	The size of the bulk in a bulk mode.
snmpMethod	bulk	The SNMP method (walk, bulk, getnext).

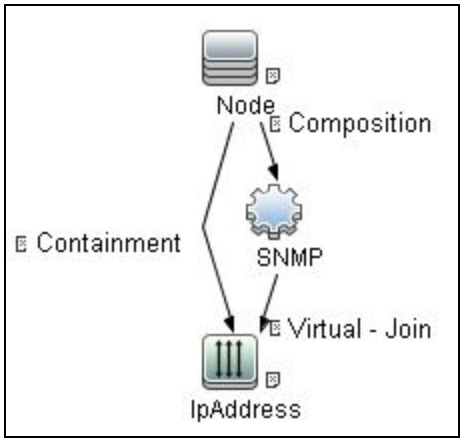
Cisco HSRP by SNMP Job

This section includes details about the job.

Introduction

This job discovers Cisco HSRP routers using the SNMP protocol.

Trigger TQL



Node Name	Condition
Node	None
SNMP	SNMP OID Like 1.3.6.1.4.1.9.9.106%
IpAddress	NOT IP Probe Name Is null

Adapter Information

This job uses the **Cisco HSRP routers by SNMP** adapter.

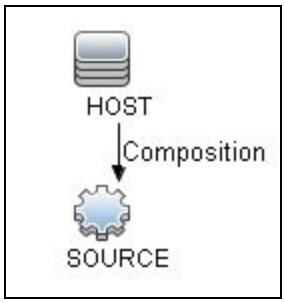
Adapter Type

Jython

Input CIT

SNMP

Input TQL



Triggered CI Data

Name	Value
Protocol	${SOURCE.root_class}
credentialsId	${SOURCE.credentials_id}
ip_address	${SOURCE.application_ip}

Used Scripts

- HSRP_By_SNMP.py

Required Permissions

Permission	Operation	Usage Description	Objects and Parameters
SNMP	get	HSRP group virtual IP addresses	.iso.org.dod.internet.private.enterprises.cisco.ciscoMgmt.ciscoHsrpMIB.ciscoHsrpMIBObjects.cHsrpGroup.cHsrpGrpTable: 1.3.6.1.4.1.9.9.106.1.2.1

Discovered CITs

- Containment
- IpAddress
- Membership
- Node

Class B IPs by ICMP Job

This section includes details about the job.

Introduction

This job performs an IP ping sweep.

Trigger TQL

Node Name	Condition
IpSubnet	Network Class Equal B AND NOT Network Probe Name Is null

Adapter Information

This job uses the **IP ping sweep** adapter.

Adapter Type

Jython

Input CIT

IpSubnet

Input TQL

Triggered CI Data

Name	Value
domain	${SOURCE.routing_domain}
netAddress	${SOURCE.name}
netMask	${SOURCE.network_netmask}
probeName	${SOURCE.network_probename}

Used Scripts

- icmp_utils.py

- IP_by_Network.py

Discovered CITs

- Dependency
- IpAddress
- IpSubnet
- Membership

Adapter Parameters

Name	Default Value	Description
bulkSize	500	The bulk size of IP addresses for one ping.
byScopeDiscover	true	Indicates whether to ping out-of-scope IP addresses.
pingProtocol	1	The ping protocol: ICMP (1), ECHO PORT (2), or both (3).
retryDiscover	3	The number of the ping retry.
threadPoolSize	10	The number of threads in pool that performs port 7 echoing.
timeoutDiscover	3000	The ping timeout (in milliseconds).
virtualModeDiscover	true	Indicates whether to discover the virtual IP addresses.

Class C IPs by ICMP Job

This section includes details about the job.

Introduction

This job performs an IP ping sweep.

Trigger TQL

Node Name	Condition
IpSubnet	Network Class Equal C AND NOT Network Probe Name Is null

Adapter Information

This job uses the **IP ping sweep** adapter.

Adapter Type

Jython

Input CIT

IpSubnet

Input TQL

Triggered CI Data

Name	Value
domain	${SOURCE.routing_domain}

Name	Value
netAddress	${SOURCE.name}
netMask	${SOURCE.network_netmask}
probeName	${SOURCE.network_probename}

Used Scripts

- icmp_utils.py
- IP_by_Network.py

Discovered CITs

- Dependency
- IpAddress
- IpSubnet
- Membership

Adapter Parameters

Name	Default Value	Description
bulkSize	500	The bulk size of IP addresses for one ping.
byScopeDiscover	true	Indicates whether to ping out-of-scope IP addresses.
pingProtocol	1	The ping protocol: ICMP (1), ECHO PORT (2) or both (3).
retryDiscover	3	The number of the ping retry.
threadPoolSize	10	The number of threads in pool that performs port 7 echoing.
timeoutDiscover	3000	The ping timeout (in milliseconds).
virtualModeDiscover	true	Indicates whether to discover the virtual IP addresses.

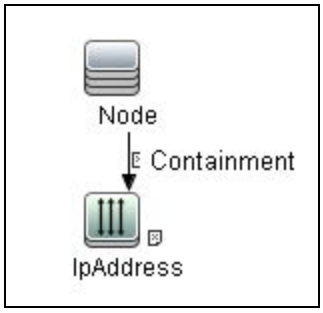
DNS Resolver Job

This section includes details about the job.

Introduction

This job discovers DNS names on IP addresses and hosts.

Trigger TQL



Node Name	Condition
Node	None
IpAddress	NOT IP Probe Name Is null

Adapter Information

This job uses the **DNS Discovery** adapter.

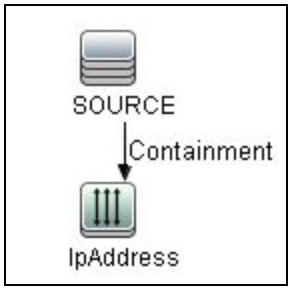
Adapter Type

Jython

Input CIT

Node

Input TQL



Triggered CI Data

Name	Value
host_id	${SOURCE.root_id}
host_name	${SOURCE.name:}
ip_address	${IpAddress.name}
ip_id	${IpAddress.root_id}

Used Scripts

- DNS_Discovery.py

Discovered CITs

- IpAddress
- Node

Adapter Parameters

Name	Description
dnsServers	The comma-separated value of DNS Servers to use upon Node Name lookup.

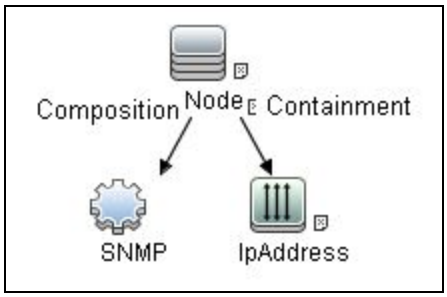
IP MAC Harvesting by SNMP Job

This section includes details about the job.

Introduction

This job collects IP MAC mapping by SNMP and reports delta information to UCMDB.

Trigger TQL



Node Name	Condition
Node	None
SNMP	NOT Reference to the credentials dictionary entry Is null AND ArpCacheAvailable Equal true
IpAddress	NOT IP Probe Name Is null

Adapter Information

This job uses the **IP MAC Harvesting By SNMP** adapter.

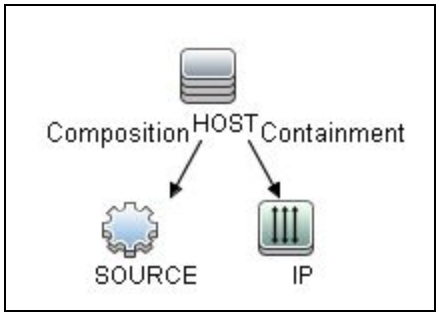
Adapter Type

Jython

Input CIT

SNMP

Input TQL



Triggered CI Data

Name	Value
application_ip	${SOURCE.application_ip:NA}
credentials_id	${SOURCE.credentials_id:NA}
ip_address	${IP.name:NA}
mac_on_agent	${SOURCE.arp_mac:NA}
mac_on_ip	${IP.arp_mac:NA}
root_class	${HOST.root_class:NA}

Used Scripts

- clientdiscoveryutils.py
- SNMP_Networking_Utils.py
- IPMAC_Harvesting.py

Discovered CITs

- IpAddress

Adapter Parameters

Name	Default Value	Description
DelayTimePerSNMPRequest	50	The delay time for every SNMP to get the next request (in milliseconds).
IsCollectDataCenterIP	false	Indicates whether to collect data center IP addresses.
RunOnSwitchRouterOnly	false	Indicates whether to run only on Switchs and Routers.

Manual UriEndpoint Discovery

This section includes:

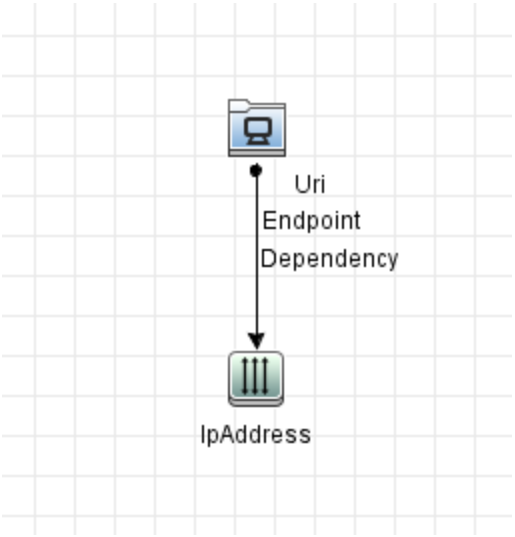
Overview 1137
Topology 1137
How to Discover UriEndpoint CIs Manually 1138
Manual UriEndpoint Discovery Job 1138

Overview

Manual UriEnpoint Discovery can report UriEndpoint CIs with the data configured in **UriEndpointConfiguration.xml**.

Topology

The following image displays the topology of the Manual UriEndpoint Discovery.



How to Discover UriEndpoint CIs Manually

This task contains the following steps:

1. Edit UriEndpointConfiguration.xml
   a. Go to **Data Flow Management > Adapter Management > Resources** pane.
   b. Click the **Find resource** button, enter **UriEndpointConfiguration.xml** in the **Name** field, and then click the **Find Next** button.
   c. In **UriEndpointConfiguration.xml**, set the proper Data Flow Probe name on which the trigger UriEndpoint runs and set the **url** and **type** as follows:

```
<dataflowprobe name="<Data Flow Probe name>">
  <uri-endpoint>
    <url>http://<IP address or hostname>:<port>/<reference></url>
    <type><openstack or azure or cloudfoundry></type>
  </uri-endpoint>
</dataflowprobe>
```

> **Note:** You can refer to **UriEndpointConfigurationSample.xml** in the same directory as **UriEndpointConfiguration.xml** for details.

2. Run the discovery

   Run the **Manual UriEndpoint Discovery** job.

Manual UriEndpoint Discovery Job

This section includes details about the job.

Introduction

This job discovers UriEndpoint CIs.

Trigger TQL

Adapter Information

This job uses the **UriEndpoint Discovery** adapter.

Adapter Type

Jython

Input CIT

Discovery Probe Gateway

Input TQL

Triggered CI Data

Name	Value
probeName	${SOURCE.name}

Used Scripts

- uri_endpoint_discover.py

Discovered CITs

- Dependency
- IpAddress
- UriEndpoint

Global Configuration Files

- UriEndpointConfiguration.xml

Range IPs by ICMP Job

This section includes details about the job.

Introduction

This job performs an IP ping sweep on probe ranges.

Trigger TQL

Adapter Information

This job uses the **IP ping sweep** adapter.

Adapter Type

Jython

Input CIT

Discovery Probe Gateway

Input TQL

Triggered CI Data

Name	Value
probeName	${SOURCE.name}

Used Scripts

- icmp_utils.py
- IP_by_range.py

Discovered CITs

- Dependency
- IpAddress

Global Configuration Files

- globalSettings.xml

Adapter Parameters

Name	Default Value	Description
bulkSize	500	The bulk size of IP addresses for one ping in one system call. All IP addresses should be in one range. For example, if the range contains 900 IP addresses and the bulk size is 500, the job will call DLL API twice. The first call is for the first 500 IP addresses, and the second call is for the remaining 400 IP addresses. If the range contains 500 or less IP addresses, the job will only call DLL API once.
excludePatternsList		The list of wildcard patterns, separated by semicolons (;). IP addresses that match any of the patterns are skipped. Patterns may include: • numbers • dots • * (matches zero or more characters) • ? (matches exactly one character)
isIPv4PingEnabled	true	Indicates whether to ping all IPv4 addresses within the defined ranges.
isIPv6PingEnabled	true	Indicates whether to ping all IPv6 addresses within the defined ranges.
pingProtocol	1	The ping protocol: ICMP (1), ECHO PORT (2), or both (3).
range	NA	The range of IPs to ping, separated by semicolons (;). Sample: 1.2.3.0-1.2.3.10;1.2.3.50-1.2.3.60
retryDiscover	2	The number of the ping retry. When the live IP addresses are missed, you can increase this value.
threadPoolSize	10	The number of threads in pool that performs port 7 echoing.
timeoutDiscover	3000	The ping timeout (in milliseconds). When the network is too slow and the ping reply latency is too high, you can increase this value. If the range contains multiple IP addresses, the timeout is for all the

Name	Default Value	Description
		IP addresses in one ping action instead of only for one IP address.
virtualModeDiscover	false	Indicates whether to discover the virtual IP addresses.

Tip:

- When configuring a lot of IP addresses in one range, you can increase the **bulksize** parameter value for efficiency and increase the **timeoutDiscover** parameter value for not missing the IP addresses.
- When configuring a small number of IP addresses in many small ranges, you can decrease the **timeoutDiscover** parameter value for efficiency.

Chapter 77: DNS Zone Discovery

This chapter includes:

Overview 1145

Supported Versions 1146

How to Discover DNS Zone by nslookup 1147

How to Discover DNS Zone by DNS 1148

How to Discover Hosts by Shell using nslookup on DNS Server 1148

DNS Zone by nslookup Job 1149

Adapter Information 1150

DNS Zone by DNS Job 1152

Adapter Information 1152

Hosts by Shell using nslookup on DNS Server Job 1155

NSLOOKUP on DNS Server Adapter 1156

Discovery Mechanism – Windows 1159

Discovery Mechanism – UNIX-like 1161

Glossary 1162

Overview

DNS Zone discovery retrieves the DNS Zone topology and records that belong to the zone. To transfer the zone, the machine performing the query should be included in a white list configured in the name server. This method requires a special DNS server configuration to permit Probe zone transfer.

The discovery mechanism triggers on a particular name server that records which zones should be reported, as follows:

1. Checks the **zoneList** parameter for the list of zones to transfer alias records.
2. Ignores zones with the name **arpa**, **localhost**, or '**.**' (root).
3. For each zone, transfers all records of type **CNAME** and **A** (second step). If the transfer fails, the zone is not reported.
4. Creates realization links.

For details, see "DNS Zone by nslookup Job" on page 1149.

DNS Zone discovery is implemented in the following ways:

- The **DNS Zone by nslookup** job queries the DNS server for zone records from the Server itself. This method requires Shell access. For details, see "How to Discover DNS Zone by nslookup" on page 1147
- The **DNS Zone by DNS** job queries the DNS server for zone records from the Data Flow Probe machine. This method requires a special DNS server configuration to permit Probe zone transfer. For details, see "How to Discover DNS Zone by DNS" on page 1148

In the case where administrators do not want to add Shell access to DNS servers or read access to the configuration file, you can transfer zones specified in the mandatory **zone**List adapter parameter. For details, see "DNS Zone by nslookup Job" on page 1149.

These implementations retrieve the same topology and have a common discovery mechanism that differs only in the client type (Server or Probe).

> **Note:** The volume of retrieved topology data may be influenced by the parameters set for particular jobs.

Supported Versions

- Microsoft Windows 2000 Advanced Server or later
- UNIX-like OS BIND 9 name server

How to Discover DNS Zone by nslookup

This task includes the following steps:

1. Prerequisite - Set up protocol credentials

   This discovery uses the following protocols:

   - SSH protocol
   - NTCMD protocol
   - Telnet protocol

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Prerequisite - Protocol parameters

   - If some commands are configured to run with **sudo** on the target host, in the **Protocol Parameters** dialog box, fill in the following fields:
     - **Sudo paths**. Enter the full path to the **sudo** executable, together with the name of the executable. You can add more than one entry if executable files are placed in various places on the target operating systems.

       Example: `sudo,/usr/bin/sudo,/bin/sudo`
     - **Command List**. Enter a list of the commands that are prefixed with the **sudo**.

       Example: `lspath,ifconfig`
   - Before activating discovery, confirm that the discovery user has all the required permissions to run the following command:

     ```
     cat <path to named config file and its include files>
     ```

     For details, see "Protocol Parameter Dialog Box" in the *HPE Universal CMDB Data Flow Management Guide*.

3. Run the discovery

   a. Run the **Range IPs by ICMP** job.

   b. Run the **Host Connection by Shell** job.

c. Run the **Host Applications by Shell** job.

d. Run the **DNS Zone by nslookup** job.

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

How to Discover DNS Zone by DNS

This task includes the following steps:

1. Prerequisite - Set up protocol credentials

Discovery is performed by the DNS protocol. To perform discovery, set up the following:

- As all requests are performed from the Probe machine, this machine must be included in the list of servers that can transfer specified zone records. The administrator of the name server grants permissions to transfer the zone from the Probe machine.
- Provide a list of zones that need to be transferred. For details, see "DNS Zone by nslookup Job" on the next page.

2. Run the discovery

a. Run the **Range IPs by ICMP** job.

b. Run the **TCP ports** job.

c. Run the **DNS Zone by DNS** job.

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

How to Discover Hosts by Shell using nslookup on DNS Server

This task includes the following steps:

1. Prerequisite - Set up protocol credentials

This discovery uses the following protocols:

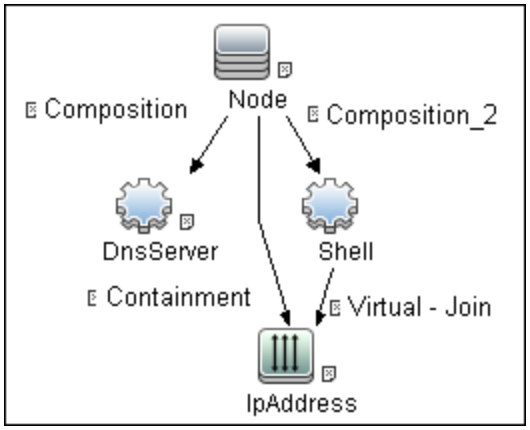
- NTCMD
- SSH
- Telnet
- UDA

2. Run the discovery
   a. Run the **Range IPs by ICMP** job.
   b. Run the **Host Connection by Shell** job.
   c. Run the **Hosts by Shell using nslookup on DNS Server** job.

DNS Zone by nslookup Job

This job discovers the DNS Resource Record topology of DNS Zones by querying name the server using a remote shell.

Trigger Query



CI Attribute Conditions

CI	Attribute Value
Shell	NOT Reference to the credentials dictionary entry Is null
IpAddress	NOT IP Probe Name Is null

Adapter Information

ID

DNS_Zone

Input CIT

Shell

Input Query

Triggered CI Data

Name	Value
connected_os_ credentials_id	${SOURCE.connected_os_credentials_id:NA}
credentialsId	${SOURCE.credentials_id}
ip_address	${SOURCE.application_ip}

Parameters

The adapter includes the following parameters:

Parameter	Description
reportBrokenAliases	If **true**, aliases that do not include a canonical resource are reported. This parameter is needed when an alias points to the address record or another alias record and this record cannot be found in the transferred data. The default value is **false**.
zoneList	Contains a comma separated list of zones to be transferred. This is an optional attribute. By default the zone list is not specified, so it is determined

Parameter	Description
	automatically.
includeOutscopeIPs	If IP address is out of probe range and parameter set to false IP address is not reported. The default value is “false”.

Used Script

- entity.py
- dns.py
- dns_discoverer.py
- dns_zone_by_remote_shell.py

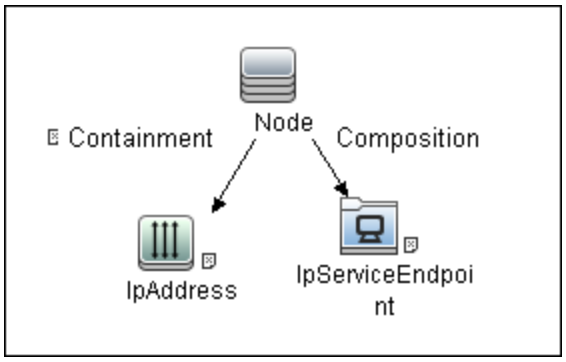
Discovered CITs

- Composition
- DnsRecord
- DnsZone
- IpAddress
- Realization

DNS Zone by DNS Job

This job discovers the DNS Resource Record topology of DNS Zone by querying the server name from the local shell (Probe) via the DNS protocol.

Trigger Query



CI Attribute Condition

CI	Attribute Value
IpServiceEndpoint	(IpServiceName Equal dns OR ServiceNames Contains ldap) AND NOT BoundToIpAddress Is null

Adapter Information

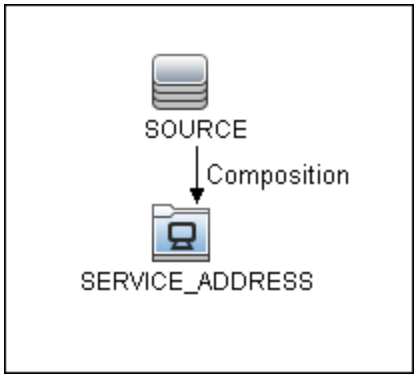
ID

DNS_Zone_by_DNS

Input CIT

Node

Input Query



Triggered CI Data

Name	Value
ip_address	${SERVICE_ADDRESS.bound_to_ip_address}

Used Scripts

- entity.py
- dns.py
- dns_discoverer.py
- dns_zone_by_probe_shell.py

Discovered CITs

- Composition
- DnsRecord
- DnsZone
- IpAddress
- Realization

Parameters

Name	Description
includeOutscopeIPs	If the IP is out of the probe range and this parameter set to **false**, the IP is not reported. The default value is **false**.
reportBrokenAliases	If this parameter is set to **true**, aliases for which canonical resources do not exist are reported .
zoneList	Contains a comma separated list of zones to be transferred. This is a mandatory attribute.

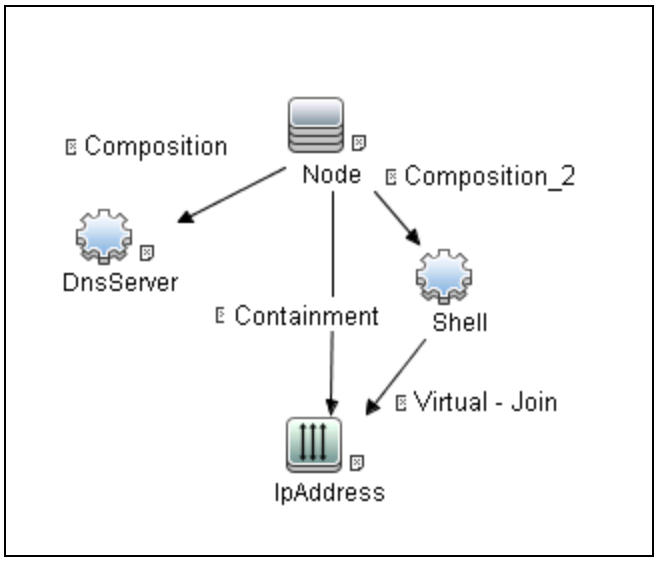
Hosts by Shell using nslookup on DNS Server Job

This job discovers hosts by querying all available DNS servers.

Adapter

ID: NSLOOKUP_on_DNS_Server

Trigger TQL



Node Name	Condition
IpAddress	NOT IP Probe Name Is null
Shell	NOT Reference to the credentials dictionary entry Is null

Parameters

Name	Description
DNSServerDomain	The DNS Server Domain.
DNSServerName	The DNS Server Name.
discoverUnknownIPs	This flag determines whether to discover IPs that are out of the probe range.

Discovery Flow

1. Establish a connection with the DNS server.
2. Determine target DNS server and domain to transfer by checking the input parameters **DNSServerName** and **DNSServerDomain** respectively, and running the **nslookup** command to request the default server name and its domain.
3. List and process all IPv4 (A) DNS records.
4. Report hosts based on listed IP addresses.

NSLOOKUP on DNS Server Adapter

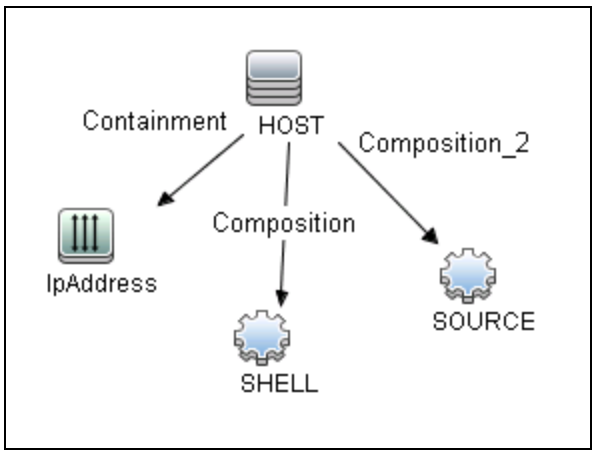
ID

NSLOOKUP_on_DNS_Server

Input CIT

Shell

Input TQL



Node Name	Condition
IpAddress	IpAddressType Equal IPv4

Node Name	Condition
Shell	CI Type Equal ssh OR CI Type Equal uda

Triggered CI Data

Name	Value
Protocol	${SOURCE.root_class}
codepage	${SOURCE.codepage:NA}
credentialsId	${SOURCE.credentials_id}
connected_os_credentials_id	${SOURCE.connected_os_credentials_id:NA}
ip_address	${SOURCE.application_ip}
language	${SOURCE.language:NA}
sshKeyPath	${SHELL.ssh_keypath:NA}

Used Script

- flow.py
- dns.py
- dns_discoverer.py
- dns_flow.py
- NSLOOKUP.py

Discovered CITs

- Windows
- Node
- IpAddress
- Net Printer
- Unix
- Containment

Global Configuration File

- globalSettings.xml

Parameters

Name	Description
DNSServerDomain	The DNS server domain.
DNSServerName	The DNS server name.
discoverUnknownIPs	If **true**, the job also discovers IPs that are out of probe range.

Discovery Mechanism – Windows

This section includes the following commands:

Query Windows Registry for Zone Information

Command

```
Reg query "HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows NT\CurrentVersion\DNS Server\Zones"
```

Output

```
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows NT\CurrentVersion\DNS Server\Zones\104.24.172.in-addr.arpa
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows NT\CurrentVersion\DNS Server\Zones\foo.bar.net
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows NT\CurrentVersion\DNS Server\Zones\od5.lohika.com
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows NT\CurrentVersion\DNS Server\Zones\ucmdb-ex.dot
```

Mapping

CMD Output Attribute	CI Name	CI Attribute
Key name	DNS Zone	Name

List Root Domain to Transfer Resource Records

Zone resource records of type **CNAME** and **A** are transferred by listing the root domain of the zone in the **nslookup** command.

Command

```
echo ls -d <domain> | nslookup - <name server>
```

Output

```
Ns-2.od5.lohika.com. CNAME dc05-2.od5.lohika.com

od5.lohika.com. A  134.44.98.22
ftp.od5.lohika.com. CNAME  od5.lohika.com.
```

Mapping

CMD Output Attribute	CI Name	CI Attribute
First column	DNS Alias	Name
Third column	DNS Alias	Canonical name

Discovery Mechanism – UNIX-like

This section includes the following commands:

Parse Named Server Configuration File to Retrieve Zone Information

1. Try to find information about the named server configuration file in the command like the corresponding process.

   Command

   ```
   ps -ef | grep named | awk '{for(i=11; i < NF; i++) {printf("%s ", $i)}printf ("\n")}'
   ```

   Output

   ```
   /usr/sbin/named -t /var/lib/named -u
   ```

   Mapping

   The path specified for the **-t** option is the path to the configuration file.

2. If the path is recognized, the job tries to retrieve information about zones and include files to process. The default paths are **/etc/named.conf** and **/etc/namedb/named.conf**.

   Command

   ```
   cat <configuration file path> | awk '/zone|include/ {print}'
   ```

   Output

   ```
   zone "." in {
   zone "localhost" in {
   zone "od5.lohika.com" in {
   ```

   Mapping

CMD Output Attribute	CI Name	CI Attribute
Key name	DNS Zone	Name

List Root Domain to Transfer Resource Records

Zone resource records of type **CNAME** and **A** are transferred using the **dig** command and the **axfr** transfer type.

Command

```
dig @<server> <domain> axfr | awk '/(CNAME|A)/{print $1, "\t", $4, "\t", $5}'
```

Output

```
Ns-2.od5.lohika.com.  CNAME     dc05-2.od5.lohika.com
od5.lohika.com.         A         134.44.98.22
ftp.od5.lohika.com.   CNAME          od5.lohika.com.
```

Mapping

CMD Output Attribute	CI Name	CI Attribute
First column	DNS Alias	Name
Third column	DNS Alias	Canonical name

Glossary

- **CNAME record or Canonical Name record**

  A type of resource record in the Domain Name System (DNS) that specifies that the domain name is an alias of another canonical domain name.

- **Zone transfer**

  Listings of records contained in the zone.

Chapter 78: Firewall Discovery

This chapter includes:

Overview 1164

Topology 1164

How to Discover Firewalls 1164

Firewall Topology by SNMP Job 1165

Introduction 1165

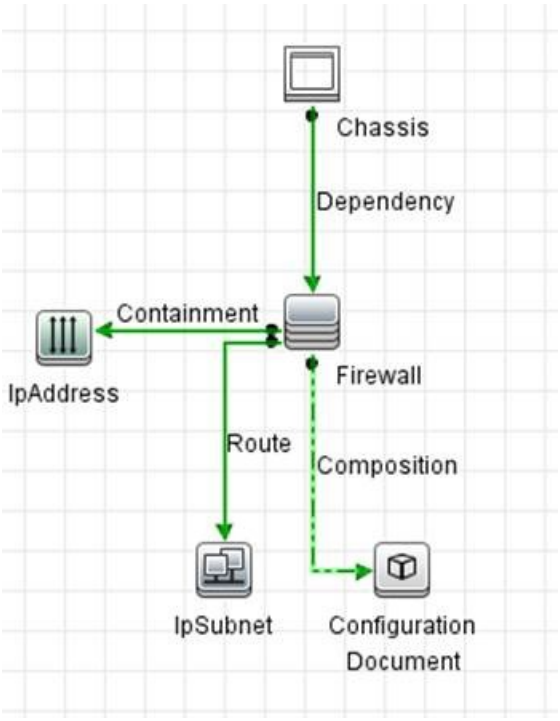
Adapter Information 1166

Overview

The firewall discovery allows you to discover Juniper and Fortinet firewalls using the **Firewall Topology by SNMP** job through SNMP Protocol.

Topology

The following image displays the topology of the **Firewall Topology by SNMP** discovery.



How to Discover Firewalls

This task includes the following steps:

1. Prerequisite - Set up protocol credentials

   This discovery uses SNMP Protocol.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Run the discovery

   Run the following jobs in the following order:

   a. **Range IPs by ICMP**

   b. **Host Connection by SNMP**

   c. **Firewall Topology by SNMP**

   For details on running jobs, see "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

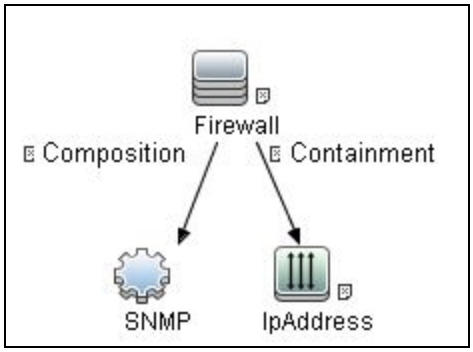
Firewall Topology by SNMP Job

This section includes details about the job.

Introduction

This job discovers Juniper and Fortinet firewalls by SNMP.

Trigger TQL



CI	Attribute Value
SNMP	NOT Reference to the credentials dictionary entry Is null
IpAddress	NOT IP Probe Name Is null

Adapter Information

This job uses the **Firewall Topology by SNMP** adapter.

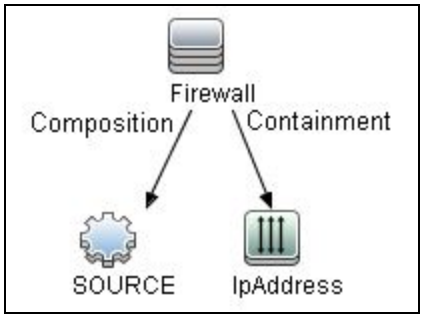
Adapter Type

Jython

Input CIT

SNMP

Input TQL



CI	Attribute Value
SOURCE	NOT Reference to the credentials dictionary entry Is null
IpAddress	NOT IP Probe Name Is null

Triggered CI Data

Name	Value
Protocol	${SOURCE.root_class}
codepage	${SOURCE.codepage:NA}
credentialsId	${SOURCE.credentials_id}
discovered_vendor	${Firewall.discovered_os_vendor:NA}

Name	Value
hostId	${SOURCE.root_container}
ip_address	${SOURCE.application_ip}
language	${SOURCE.language:NA}

Used Scripts

- firewall.py
- firewall_discoverer.py
- firewall_topology_by_snmp.py

Discovered CITs

- Chassis
- Composition
- ConfigurationDocument
- Dependency
- Firewall
- IpAddress
- IpServiceEndpoint
- Usage

Chapter 79: Host Connection

This chapter includes:

- Overview 1170
- How to Discover Host Connection by Shell 1171
- How to Discover Host Connection by SNMP 1172
- How to Discover Host Connection by WMI 1173
- How to Discover Client Connection by SNMP 1173
- Host Connection by Shell Job 1174
  - Discovery Mechanism 1174
  - Trigger Query 1181
  - Job Parameters 1182
  - Adapter 1183
  - Discovered CITs 1183
  - Troubleshooting and Limitations – Host Connection by Shell Job 1184
- Host Connection by SNMP Job 1186
  - Discovery Mechanism 1186
  - Trigger Query 1187
  - Job Parameters 1188
  - Adapter 1189
  - Discovered CITs 1189
  - Troubleshooting and Limitations – Host Connection by SNMP Job 1190
- Host Connection by WMI Job 1191
  - Discovery Mechanism 1191
  - Trigger Query 1193
  - Job Parameters 1194
  - Adapter 1194
  - Discovered CITs 1194
  - Troubleshooting and Limitations – Host Connection by WMI Job 1195
- Client Connection by SNMP Job 1195

Discovery Mechanism 1196
Trigger CI 1197
Job Parameters 1197
Triggered CI Data 1198
Discovered CITs 1198

Overview

You activate the jobs in the network modules to establish a Shell connection to host machines. Discovery tries to connect to the remote machine through the SSH, Telnet, and NTCMD protocols, until the first valid connection is found.

The module includes the following jobs:

- **Host Connection by Shell**. Establishes the connection to remote machines through the SSH, Telnet, NTCMD, and Universal Discovery protocols. This job discovers host type, OS information, and network connectivity information. For details, see "How to Discover Host Connection by Shell" on the next page.
- **Host Connection by SNMP**. Discovers SNMP agents by trying to connect, using the SNMP protocol, to a data center machine (whose IP addresses have previously been discovered and populated in IpAddress CIs in UCMDB). It then updates the correct host class (Windows, UNIX, router, and so on) according to the relevant OID. For details, see "How to Discover Host Connection by SNMP" on page 1172.
- **Host Connection by WMI**. Establishes the connection to remote machines through the WMI protocol and discovers host type, OS information, and network connectivity information. For details, see "How to Discover Host Connection by WMI" on page 1173.
- **Client Connection by SNMP**. Discovers SNMP agents by running a ping sweep of all client ranges configured in the Data Flow Probe (or Management Zone). If successful, it connects to the IP address using the SNMP protocol, and updates the correct host class (Windows, UNIX, router, and so on) according to the relevant OID. For details, see "How to Discover Client Connection by SNMP" on page 1173.

For details on using a wizard to discover the network, see "Infrastructure Discovery Wizard" in the *HPE UCMDB Discovery and Integrations Content Guide - Discovery Activities* document.

For information about each job's discovery mechanism, see:

- **Host Connection by Shell.** "Discovery Mechanism" on page 1174
- **Host Connection by SNMP**. "Discovery Mechanism" on page 1186
- **Host Connection by WMI**. "Discovery Mechanism" on page 1191
- **Client Connection by SNMP**. "Discovery Mechanism" on page 1196

How to Discover Host Connection by Shell

This task includes the following steps:

1. Prerequisites - Set up protocol credentials

   This discovery uses the following protocols:

   - NTCMD protocol
   - SSH protocol
   - Telnet protocol
   - Universal Discovery protocol

   > **Note:** To discover Windows machines running an SSH server, set the **Shell Command Separator** attribute of the protocol to **AutoDetect**.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Prerequisites - Host Connection by Shell job

   When running the **Host Connection by Shell** job to discover Windows machines on which an SSH server running the F-Secure application is installed, you must make the following modifications to F-Secure:

   - Stop the F-Secure service completely.
   - Verify that there are no F-Secure leftover processes still running (**fssh*** processes).
   - Alter the following lines in the **sshd2_config** file. This is an F-Secure configuration file that resides in the F-Secure installation directory.
     - The **DoubleBackspace** setting should contain a **no** value, that is, `DoubleBackspace no`.
     - The **EmulationType** setting should contain a **raw** value, that is, `EmulationType raw`.
     - The **EmulationTypeForCommands** setting should contain a **raw** value, that is, `EmulationTypeForCommands raw`.
   - Save the altered **sshd2_config** file.
   - Restart the F-Secure service.

> **Note:** The Data Flow Probe enables an SSH-based connection to remote Windows machines only if the remote SSH server providers are **Open-SSH** or **F-Secure**.
>
> For **Open-SSH** (that provides SSH servers for the Windows, UNIX, and Linux operating systems), DFM supports connections to Open-SSH only if the Open-SSH version is later than, or equal to, 3.7.1 (for any operating system).

3. Run the discovery

   Run the **Host Connection by Shell** job.

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

Note: The Data Flow Probe enables an SSH-based connection to remote Windows machines only if the remote SSH server providers are **Open-SSH** or **F-Secure**.

For **Open-SSH** (that provides SSH servers for the Windows, UNIX, and Linux operating systems), DFM supports connections to Open-SSH only if the Open-SSH version is later than, or equal to, 3.7.1 (for any operating system).

How to Discover Host Connection by SNMP

This task includes the following steps:

1. Prerequisites - Set up protocol credentials

   This discovery uses the SNMP protocol.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Run the discovery

   Run the **Host Connection by SNMP** job.

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

How to Discover Host Connection by WMI

This task includes the following steps:

1. Prerequisites - Set up protocol credentials

   This discovery uses the WMI protocol.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Run the discovery

   Run the **Host Connection by WMI** job.

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

How to Discover Client Connection by SNMP

This task includes the following steps:

1. Prerequisites - Set up protocol credentials

   This discovery uses the SNMP protocol.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Run the discovery

   Run the **Client Connection by SNMP** job.

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

Host Connection by Shell Job

This subject includes the following sections:

Discovery Mechanism 1174
Trigger Query 1181
Job Parameters 1182
Adapter 1183
Discovered CITs 1183
Troubleshooting and Limitations – Host Connection by Shell Job 1184

Discovery Mechanism

This part of the discovery depends on whether you are discovering components installed on Windows machines, UNIX-based machines, or Nexus machines. For details on the DFM processes, see:

- "Windows Processes" on the next page
- "UNIX-Based Processes" on page 1176
- "Nexus Processes" on page 1181

Note:

- DFM runs through the credentials defined for the protocol and tries to connect successfully through one of them. Whenever there is a successful connection, the discovery remembers the last successful credential and caches it for reuse the next time the discovery is run.
- If the credentials (last used for this destination) do not exist, DFM iterates through the list of all configured shell credentials.

  DFM uses the following flow for this iteration: SSH, then Telnet, then NTCMD protocol credentials, to try to connect to the discovered destination.

  DFM skips credential entry if the IP Address of the discovered destination is outside the IP range scope of the credential.

  DFM immediately stops using a protocol for the discovered destination if:

- There is no agent on the remote machine
- Connection is refused
- Connection times out
- There is an IO exception on opening a socket

DFM stops iteration through the list of configured credentials if:

- It successfully establishes connection
- It fails to connect to the discovered destination after trying all configured credentials

Windows Processes

This section describes the part of the workflow that DFM performs for discovering components residing on Windows machines.

1. DFM discovers host attributes (OS name, version, build number, service pack, installation type). DFM starts by using the first instruction in the following list to discover the host attributes. If that fails, DFM continues to the next:
   a. WMIC "OS" object;

      Full command:

      ```
      'wmic os get caption, otherTypeDescription, version, buildnumber,
      csdversion /format:list < %SystemRoot%\win.ini'
      ```

   b. Windows registry;

      Full query:

      ```
      HKEY_LOCAL_MACHINE\Software\Microsoft\Windows NT\CurrentVersion VER
      command; %SYSTEMROOT%\system32\prodspec.ini processing
      ```

2. Define BIOS UUID (**wmic**)

   Full command:

   ```
   'wmic path win32_ComputerSystemProduct get uuid /format:list <
   %SystemRoot%\win.ini'
   ```

3. Define the default gateway (**netstat**).

   Full command:

   ```
   'netstat -r -n'
   ```

4. Define the DNS server IPs (**ipconfig**).
5. Define the boot date.

   Full command:

   ```
   'wmic OS Get LastBootUpTime /format:list < %SystemRoot%\win.ini'
   ```

6. Define the network interfaces. The **wmic** command is used first because it retrieves more information about the interface. If that fails, the output of the **ipconfig** command is used.

   a. Querying NICCONFIG object we get information about MAC address, IP addresses, interface description, subnet IPs, dynamic or static flag.

      Full command:

      ```
      'wmic nicconfig where "MACAddress <> NULL" get
      IPAddress,MACAddress,IPSubnet,Description,DhcpEnabled /format:list <
      %SystemRoot%\\win.ini'
      ```

   b. IP filtering. Malformed and local IPs are ignored.

7. DFM checks whether the destination IP is local. If it is, DFM reports the host and IP only. If it is not local:

   a. DFM reports network interfaces apart from:

      - Interfaces that do not have a MAC address
      - Interfaces that belong to one of the following types: loopback, wireless, virtual, WAN miniport, RAS ASYNC, Bluetooth, FireWire, VPN, IPv6 tunneling.
      - The VMware interface, if **ignoreVmwareInterfaces** is set to **true** in the **globalSettings.xml** configuration file.

   b. DFM reports networks, IPs, and corresponding links.

UNIX-Based Processes

This section describes the part of the workflow that DFM performs for discovering components residing on UNIX-based machines. DFM defines the Operating System. For details, see the descriptions below of what DFM discovers for the following Operating Systems:

- "AIX" on the next page
- "FreeBSD" on page 1178
- "HPUX" on page 1178

- "LINUX" on page 1179
- "OpenBSD" on page 1179
- "SunOs" on page 1180
- "VMKernel" on page 1180

Full command: `'uname -a'`

> **Note:**
>
> Before reporting the discovery, DFM makes the following verifications:
>
> - If the destination IP is a virtual address, only the IP and host are reported.
> - In the case of the ZLinux OS, when the host model is **s390x**, the host is defined by the IP and domain name.
> - If the interface has an invalid MAC address, DFM does not report it.

AIX

DFM discovers:

1. The DHCP enabled network interfaces (**ps**).

   Full command: `'ps -aef | grep dhcpcd | grep -v grep'`

2. The network interfaces (MAC address, name, description) (**lsdev**, **entstat**)

   Full command: `'lsdev -Cc adapter -S | egrep ^ent'`

3. The IPs (**ifconfig**).

   Full command: `'ifconfig -a inet'`

4. DFM defines the boot date, domain name, and default gateway in the same manner as for FreeBSD.

5. The model and vendor (**uname**).

   Full command: `'uname -M'`

6. The serial number (**lsattr**).

7. The OS version (**oslevel**).

FreeBSD

DFM discovers:

1. The DHCP enabled interfaces (**ps**).

   Full command:`'ps aux | grep dhclient | grep -v grep'`

2. The boot date (**uptime**).
3. The network interfaces (**name**, **MAC**, **IP**, **network mask**, **DHCPenabled flag**) and IPs (**ifconfig**).

   Full command:`'ifconfig -a'`

   The host is defined by the lowest MAC address among the network interfaces.

4. The OS version and host model (**uname**).

   Full command:

   `'uname -r'` for the version

   `'uname -m'` for the model

5. The domain name (**domainname**).

   Report only filtered name: `'(none)','localdomain'`

6. The BIOS UUID (**dmidecode**).

   Full command:`'dmidecode | grep UUID'`

7. The default gateway (**netstat**).

   Full command:`'netstat -r -n'`

HPUX

1. DFM discovers the network interfaces by one of the following methods:
   a. **nwmgr**
   b. **lanscan** (if **nwmgr** is unsuccessful)
2. DFM defines aliases (**netstat**) for the discovered interfaces.

   Full command:`'netstat -I'`

3. For each interface, DFM defines IPs (**ifconfig**).

4. DFM discovers the host model, boot date, OS version, serial number, and default gateway.
5. DFM discovers the OS flavor (**swlist**).

   Full command:`'swlist | grep -E "HPUX.*?OE"'`

LINUX

DFM discovers:

1. The DHCP enabled network interfaces (**ps**).

   Full command:`'ps aux | grep dhclient | grep -v grep'`
2. The IPs and network interfaces (MAC address, name, description) (**ifconfig**).

   Full command:`'ifconfig -a'`
3. The boot date, serial number (**dmidecode**), OS version, host model, domain name, and default gateway.
4. Information about HMC (Hardware Management Console) and its IPs (**lshmc**).

   Full command:`'lshmc -V'`
5. The BIOS UUID (**dmidecode**).

   Full command:`'dmidecode | grep UUID'`
6. The OS flavor (**redhat-release**).

   Full command:`'cat /etc/redhat-release'`

OpenBSD

DFM discovers:

1. The DHCP enabled interfaces (**ps**).

   Full command:`'ps aux | grep dhclient | grep -v grep'`
2. The boot date (**uptime**).
3. The network interfaces (**name**, **MAC**, **IP**, **network mask**, **DHCPenabled flag**) and IPs (**ifconfig**).

   Full command:`'ifconfig -a'`

   The host is defined by the lowest MAC address among the network interfaces.

4. The OS version and host model (**uname**).

   Full command:

   `'uname -r'` for the version

   `'uname -m'` for the model

5. The domain name (**domainname**).

   Report only filtered name: `'(none)','localdomain'`

6. The BIOS UUID (**dmidecode**).

   Full command:`'dmidecode | grep UUID'`

7. The default gateway (**netstat**).

   Full command:`'netstat -r -n'`

SunOs

DFM discovers:

1. The network interfaces (**netstat**)

   Full command:`'netstat -np'`

2. The IP addresses.

   Full command:`'ifconfig -a'`

3. The boot date, domain name, BIOS UUID, and default gateway.

4. The OS version and release (**uname**).

   Full command:`'uname -rv'`

5. The host model (**prtdiag**)

6. The manufacturer (**showrev**)

7. The serial number (**dmidecode**)

   Full command:`'dmidecode | grep UUID'`

VMKernel

DFM discovers:

1. The network interfaces (MAC address, name) and IPs (**esxcfg-vmknic**)

   Full command: `'esxcfg-vmknic -l'`

2. The boot date, OS version, and host model.
3. The domain name (**esxcfg-info**).

   Full command: `'esxcfg-info | grep Domain'`

4. The BIOS UUID (**esxcfg-info**).

   Full command: `'esxcfg-info | grep \'BIOS UUID\'`

5. The serial number (**esxcfg-info**).

   Full command: `'esxcfg-info -w | grep \'Serial Number\''`

6. The default gateway (**esxcfg-route**).
7. The OS flavor (**vmware**)

   Full command: `'vmware -v'`

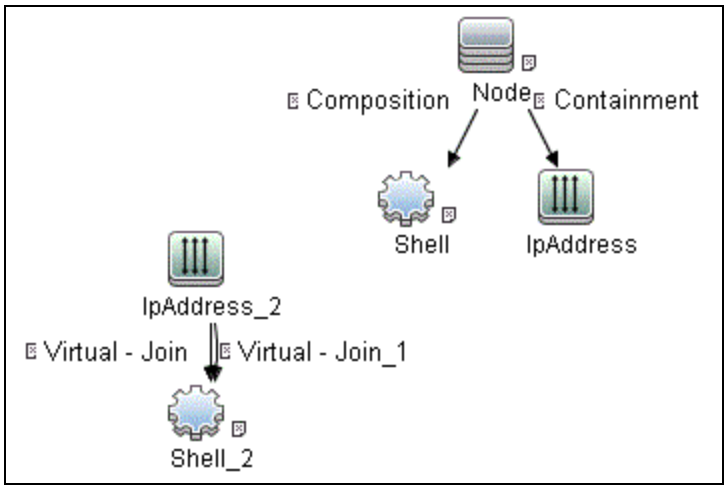
Nexus Processes

This section describes the part of the workflow that DFM performs for discovering components residing on Nexus machines.

1. DFM gets the host name using the command **sh hostname**.
2. DFM gets version, build and feature information for the switch using the command **sh ver**.
3. DFM gets dns server and local host data using the command **sh hosts**.
4. DFM get interface and configured IP information using the command **sh int**.

Trigger Query

- **Trigger CI**. The IP address.
- **Trigger TQL**. DFM uses this query to retrieve IPs that do not have Shell or have Shell with the same IP to reconnect.



- **Node conditions:**
  - IP Node

    Probe Name Is NOT null (IP Is Broadcast Equal false OR IP Is Broadcast Is NOT null)

Job Parameters

Parameter	Description
codepage	The discovered machine code page. **Default:** NA.
enableStamping	Determines whether or not **ud_unique_id** is stamped on the managed computer. **Default:** false.
language	The language of the discovered machine.
onlyStampingClient	Determines whether or not to only stamp the client machine. If set to false, both data-center and client machine are stamped. **Default:** true.
udaConnectionOrder	The position of UD in the order of protocol connections. Possible values are: **first**, **last**, and **none**. **Default:** last.
useAIXhwid	Whether to identify IBM AIX machines through their hardware ID. When set to **true** and used together with SNMP discovery, duplicate hosts may be created. If set to **false**, no AIX LPAR is discovered.

Parameter	Description
	Default: false.
useLastSuccessConnection	Whether to use the last success protocol. When set to **true**, this job uses the last success connection without considering the value of **udaConnectionOrder**. **Default:** true.

Adapter

Triggered CI data:

Name	Value
connected_os_credentials_id	${SHELL.connected_os_credentials_id:NA}
host_cmdbid	${NA}
host_key	${HOST.host_key:NA}
ip_address	${SOURCE.name}
ip_domain	${SOURCE.routing_domain}
ip_mac_address	${SOURCE.arp_mac:NA}
mac_addrs	${NA}

Discovered CITs

- ATM Switch
- Composition
- Containment
- DnsServer
- HP NonStop
- IPMP Group
- Interface
- IpAddress
- IpSubnet

- Membership
- NTCMD
- Node
- OpenVMS
- Parent
- Realization
- Remote Access Service
- Router
- RunningSoftware
- SEA Adapter
- SNMP
- SSH
- Switch
- Telnet
- Terminal Server
- UDA
- Unix
- Usage
- Windows

Troubleshooting and Limitations – Host Connection by Shell Job

Troubleshooting

- **Problem**: When running the **Host Connection by Shell** job, the following error may be displayed:

  ```
  Error: Multiple connections to a server or shared resource by the same user,
  using more than one user name, are not allowed.
  ```

  Solution: This may be caused by one of the following NetBIOS protocol limitations:

- The network share is considered to be in use even though it is not, that is, the session is frozen. In this case, try the following command:

  ```
  net use * /delete
  ```

- The network share is in use by another user whose user name is bound to the local machine user name. In this case, you can reconfigure the remote machine security policy, or wait for the other user to finish working.

- **Problem**: If **HPCmd Commands Execution Context** is set to **User**, the **Host Connection by Shell** job fails NTCMD discovery if the user's account does not have the right to **Log on as a service**.

  Solution: The user's account must have the right to **Log on as a service**. For details how to configure users with the right to **Log on as a service**, see http://technet.microsoft.com/en-us/library/cc739424(v=ws.10).aspx

- **Problem: Access Denied Error Message**

  The following error message may appear while trying to discover Windows 2008 SP2 destination by NTCMD protocol:

  ```
  Connecting to remote server failed with the following error message: Access is denied. For more information, see the about_Remote_Troubleshooting Help topic.
  ```

  This appears if the user attempting to discover the destination host is not a local Administrator user. (It does not matter if the user is a member of the Administrators group.)

  Solution: The solution requires additional configuration of the security policy.

  The **LocalAccountTokenPolicy** key should be changed to allow users from the Administrator group to connect remotely with Administrator privileges. Run the following command in PowerShell on the discovered host:

  ```
  Set-ItemProperty -Path HKLM:\SOFTWARE\Microsoft\Windows\CurrentVersion\
  Policies\System -Name LocalAccountTokenFilterPolicy -Value 1 -Type DWord
  ```

  For details of this special case, see "HOW TO ENABLE REMOTING FOR ADMINISTRATORS IN OTHER DOMAINS" at http://technet.microsoft.com/en-us/library/dd347642.aspx.

Limitations

- **Limitation:** If an interface has a MAC address of 0, the job does not report that interface or the IP address assigned to it.

- **Limitation:** This discovery supports the reporting of PAE state only for Windows Operating systems.

Host Connection by SNMP Job

This subject includes the following sections:

Discovery Mechanism 1186
Trigger Query 1187
Job Parameters 1188
Adapter 1189
Discovered CITs 1189
Troubleshooting and Limitations – Host Connection by SNMP Job 1190

Discovery Mechanism

1. DFM runs through the credentials defined for the protocol and tries to connect successfully through one of them. Whenever there is a successful connection, the discovery remembers the last successful credential and caches it for reuse the next time the discovery is run.
2. DFM executes an SNMP query and obtains the class name, vendor name, host OS name, host model, host version, and host release:

```
Using OIDs:
    SNMP MIB-2 System 1.3.6.1.2.1.1
SNMP MIB-2 Interfaces 1.3.6.1.2.1.20
3.
x3x.x3.x.xxxxxxxxxx x
The vendor's authoritative identification of the network management subsystem
obtained from the system table.
```

3. DFM retrieves the host IP and mask:

```
Using OIDs:
    ipAdEntNetMask (1.3.6.1.2.1.4.20.1.3) for subnet mask
    ipAdEntBcastAddr (1.3.6.1.2.1.4.20.1.4) for the least-significant bit in
the IP broadcast address
    ipAdEntIfIndex (1.3.6.1.2.1.4.20.1.2) for the index value which uniquely
identifies the interface
```

4. DFM retrieves the network interface information:

```
OID (1.3.6.1.2.1.2.2.1) - an interface entry containing objects at
the subnetwork layer and below for a particular interface.
```

5. DFM retrieves the default gateway:

```
Used OIDs:
    ipRouteDest (1.3.6.1.2.1.4.21.1.1) -
 for the destination IP address of this route
    ipRouteMask (1.3.6.1.2.1.4.21.1.11) -
 for the mask
    ipRouteDest (1.3.6.1.2.1.4.21.1.1) -
 for the destination IP address of this route
    ipRouteMetric1 (1.3.6.1.2.1.4.21.1.3) -
 for the primary routing metric for this route
    ipRouteNextHop (1.3.6.1.2.1.4.21.1.7) -
 for the IP address of the next hop of this route
```

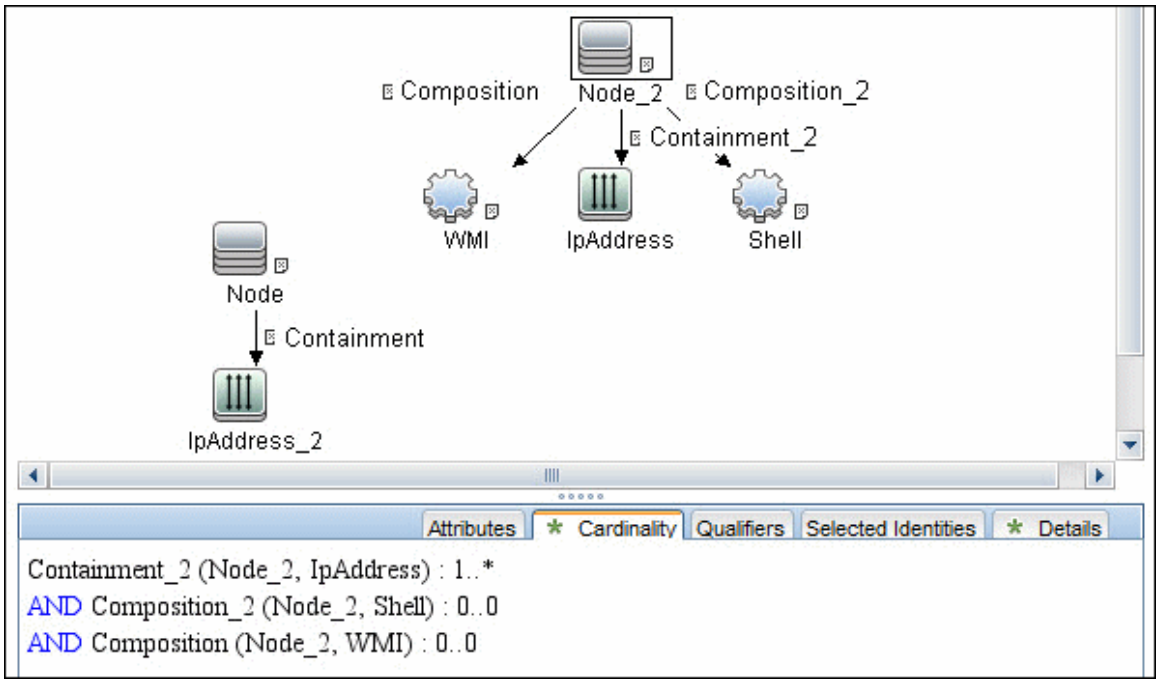
6. DFM retrieves the serial number of the host. It will get the serial number from a public MIB, or failing that a private MIB. In both cases it retrieves the OID. This job supports a wide range of devices. However, should the serial number be available but DFM is unable to extract it, you should open a Support Case (ensuring you provide full details from MIB Walk) so we can add support in a future Content Pack or Update.
7. If possible, DFM retrieves remote management cards of the host. For example, HPE iLO cards, or Dell DRAC cards.

```
Get iLO cards from OID table 1.3.6.1.4.1.232.9.2.5.1
```

```
Get DRAC cards from OID table 1.3.6.1.4.1.674.10892.1.1900.10
```

Trigger Query

- **Trigger CI**. The IP address.
- **Trigger TQL**This query enables the retrieval of IP addresses that are either (a) not connected to a Node by a Containment link; or (b) connected to a Node which has neither the Shell nor the WMI Agent.



- **Node conditions**.
  - IP Node:

```
NOT IP Lease Time equal Short
AND NOT IP Probe Name Is null
AND (IP Is Broadcast Equal false
OR IP Is Broadcast Is null)
```

Job Parameters

Parameter	Description
reportInterfaceName	Allows you to specify whether you want the job to report the Interface Name of nodes. **Default:** True.

Adapter

- Triggered CI data:

Name	Value
host_cmdbid	${NA}
host_key	${HOST.host_key:NA}
ip_address	${SOURCE.name}
ip_domain	${SOURCE.routing_domain}
ip_mac	${SOURCE.arp_mac:NA}
mac_addrs	${NA}

Discovered CITs

- ATM Switch
- Composition
- Containment
- Fibre Channel Switch
- Firewall
- Interface
- IpAddress
- IpSubnet
- LDOM Virtual Switch
- Load Balancer
- Mainframe CPC
- Marconi ATM Switch
- Membership
- Net Device
- Net Printer

- Node
- OpenVMS
- Parent
- Remote Access Service
- Router
- SNMP
- Switch
- Terminal Server
- Unix
- VMware Virtual Switch
- Windows

Troubleshooting and Limitations – Host Connection by SNMP Job

- **Problem**: Following the run of the **Host Connection by SNMP** or **Host Networking by SNMP** jobs, many warning messages are displayed:

  ```
  Detected multiple updates in bulk - found attribute:
  'interface_description' on current CIT: 'interface'
  ```

  These messages can be safely ignored. To prevent the messages being displayed, you can change the **multipleUpdateIgnoreTypes** parameter in the **globalSettings.xml** file:

  ```
  <!--multipleUpdateIgnoreTypes
  - don't check multiple updates for the following types-->
  <property name="multipleUpdateIgnoreTypes">
  process,clientserver,node</property>
  ```

  Add the **interface** CIT to this list of CITs to be ignored.

- **Problem**: Host connection discovery uses the following workflow: **Host Connection by Shell**, then **Host Connection by WMI** and then **Host Connection by SNMP**. Therefore, if **Host Connection by Shell** is successful, neither of the following jobs complete. Also, if **Host Connection by WMI** is successful, **Host Connection by SNMP** does not complete.

  Solution: To skip this restriction, change the Trigger Query for these jobs:

- Select **Host Connection by SNMP**.
- Select the **Properties** tab.
- Delete the Trigger Query **ip_with_snmp_or_without_host**.
- Click the button in the **Trigger Query** section to create a new Trigger Query. The **Choose Discovery Query** dialog box appears.
- Select **ip** from the list and click **OK**.

Host Connection by WMI Job

This subject includes the following sections:

Discovery Mechanism 1191
Trigger Query 1193
Job Parameters 1194
Adapter 1194
Discovered CITs 1194
Troubleshooting and Limitations – Host Connection by WMI Job 1195

Discovery Mechanism

1. DFM runs through the credentials defined for the WMI protocol and tries to connect successfully through one of them.
2. DFM performs a WMI query for `Win32_ComputerSystem` to retrieve the machine name.

   WMI query:

   ```
   select Name from Win32_ComputerSystem
   ```

   DFM performs a WMI query for **`Win32_NetworkAdapterConfiguration`** to retrieve the following interface information: IP addresses, MAC address, subnet IPs, description, and DHCP enabled attribute. DFM ignores local IPs in the interfaces.

   WMI query:

   ```
   'SELECT DnsHostName,IPAddress,MACAddress,IPSubnet,Description,
   DhcpEnabled FROM Win32_NetworkAdapterConfiguration
   WHERE MACAddress <> NULL'
   ```

3. DFM checks whether the destination IP address is a local IP address. If it is, DFM reports IPs and hosts only.

   If DFM cannot discover hosts by this manner, DFM tries to create a host defined by the lowest MAC address among the discovered network interfaces. If there is no interface to provide a valid MAC address, DFM defines the host by the destination IP address.

   MAC addresses are used only in such interfaces that comply with the following rules:

   - The interface has a valid MAC address.
   - The interface does not belong to one of the following types: loopback, wireless, virtual, WAN miniport, RAS ASYNC, Bluetooth, FireWire, VPN, or IPv6 tunneling.
   - The component is not the VMware interface, and the **ignoreVmwareInterfaces** option is not set to **1** in the **globalSettings.xml** configuration file.

4. DFM queries `Win32_OperatingSystem` to retrieve the host vendor, OS name, version, boot time, and installation type.

   WMI query:

   ```
   select Caption,Version,
   ServicePackMajorVersion,ServicePackMinorVersion,
   BuildNumber,Organization,RegisteredUser,TotalVisibleMemorySize,
   LastBootUpTime,OtherTypeDescription from Win32_OperatingSystem
   ```

5. DFM queries `Win32_IP4RouteTable` to retrieve the default gateway.

   WMI query:

   ```
   select NextHop, Metric1 from Win32_IP4RouteTable Where destination
   = '0.0.0.0' and mask = '0.0.0.0'
   ```

6. DFM queries `Win32_ComputerSystem` to retrieve the host manufacturer, the number of processors, host model, and OS domain.

   WMI query:

   ```
   select Manufacturer,NumberOfProcessors,Model,Domain from
   Win32_ComputerSystem
   ```

7. DFM retrieves the serial number by:

   - Querying `Win32_BaseBoard`.

     WMI query:

     ```
     SELECT SerialNumber FROM Win32_BaseBoard
     ```

   - Querying `Win32_SystemEnclosure`.

WMI query:

```
SELECT SerialNumber,SMBIOSAssetTag FROM Win32_SystemEnclosure
```

8. DFM queries `Win32_SystemEnclosure` to retrieve the system asset tag.

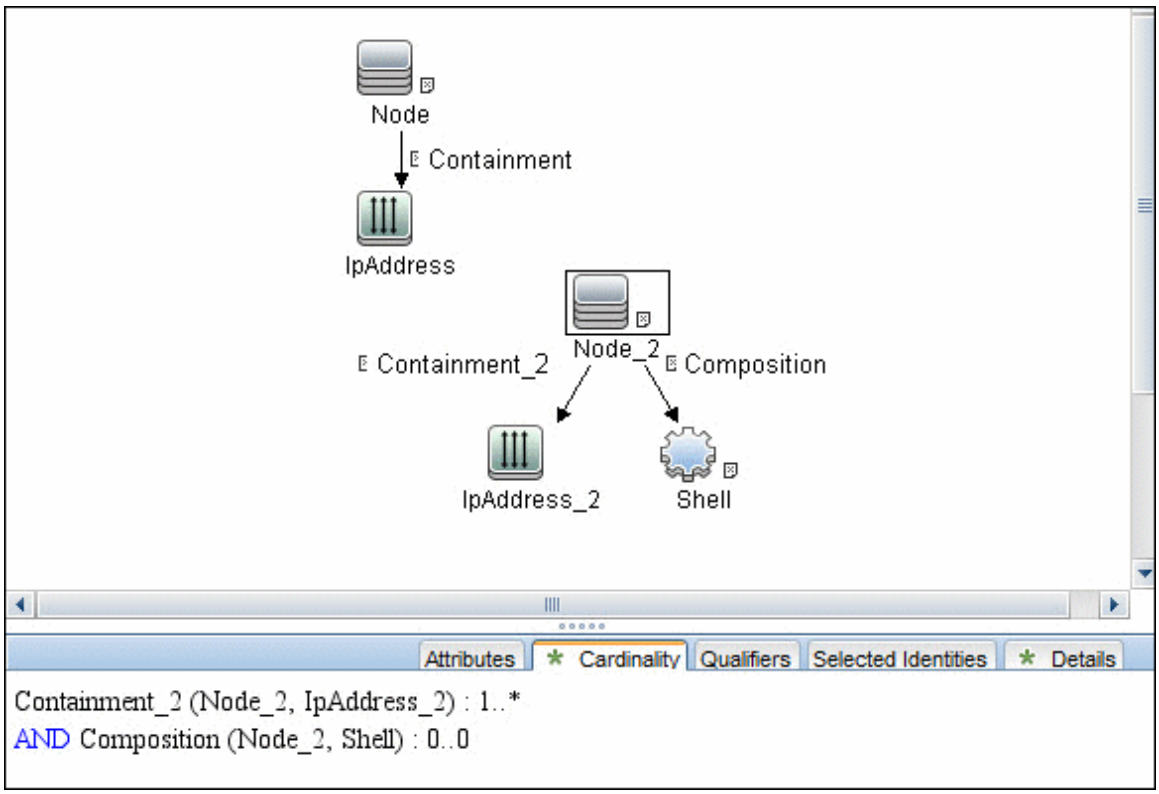
   WMI query:

   ```
   SELECT SerialNumber,SMBIOSAssetTag FROM Win32_SystemEnclosure
   ```

9. If the connection is successful, DFM clears all errors and warnings that may have been generated in previous connection attempts, and returns the results.
10. If the connection is unsuccessful, DFM continues with the next WMI credential entry until all are tried.

Trigger Query

- **Trigger CI**. The IP address.
- **Trigger TQL**. This query enables the retrieval of IPs that are either (a) not connected to a Node by a Containment link; or (b) connected to a Node that does not have the Shell Agent.



- **Node conditions**.
  - IP Node:

```
Probe Name Is NOT null
(IP Is Broadcast Equal false OR IP Is Broadcast Is NOT null)
```

Job Parameters

None.

Adapter

Triggered CI data:

Name	Value
host_cmdbid	${HOST.root_id:NA}
host_key	${HOST.host_key:NA}
ip_address	${SOURCE.name}
ip_domain	${SOURCE.routing_domain}
ip_mac_address	${SOURCE.arp_mac:NA}
mac_addrs	${NA}

Discovered CITs

- **Composition**
- **Containment**
- **Interface**
- **IpAddress**
- **IpSubnet**
- **Membership**
- **Node**

- **Parent**
- **WMI**

Troubleshooting and Limitations – Host Connection by WMI Job

- **Problem:** Host connection discovery uses the following workflow: **Host Connection by Shell**, then **Host Connection by WMI** and then **Host Connection by SNMP**. Therefore, if **Host Connection by Shell** is successful, neither of the following jobs complete. Also, if **Host Connection by WMI** is successful, **Host Connection by SNMP** does not complete.

  Solution: To skip this restriction, change the Trigger Query for these jobs:

  - Select **Host Connection by WMI**.
  - Select the **Properties** tab.
  - Delete the Trigger Query **ip_with_wmi_or_without_host**.
  - Click the button in the **Trigger Query** section to create a new Trigger Query. The **Choose Discovery Query** dialog box appears.
  - Select **ip** from the list and click **OK**.

Client Connection by SNMP Job

This subject includes the following sections:

Discovery Mechanism 1196
Trigger CI 1197
Job Parameters 1197
Triggered CI Data 1198
Discovered CITs 1198

Discovery Mechanism

1. DFM runs a ping sweep for client type IP ranges to get details of the active client machines.
2. DFM runs through the credentials defined for the protocol and tries to connect successfully through one of them. Whenever there is a successful connection, the discovery remembers the last successful credential and caches it for reuse the next time the discovery is run.
3. DFM executes an SNMP query and obtains the class name, vendor name, host OS name, host model, host version, and host release:

```
Using OIDs:
    SNMP MIB-2 System 1.3.6.1.2.1.1
SNMP MIB-2 Interfaces 1.3.6.1.2.1.20
3.
x3x.x3.x.xxxxxxxxxx x
The vendor's authoritative identification of the network management subsystem
obtained from the system table.
```

4. DFM retrieves the host IP and mask:

```
Using OIDs:
    ipAdEntNetMask (1.3.6.1.2.1.4.20.1.3) for subnet mask
    ipAdEntBcastAddr (1.3.6.1.2.1.4.20.1.4) for the least-significant bit in
the IP broadcast address
    ipAdEntIfIndex (1.3.6.1.2.1.4.20.1.2) for the index value which uniquely
identifies the interface
```

5. DFM retrieves the network interface information:

```
OID (1.3.6.1.2.1.2.2.1) - an interface entry containing objects at
the subnetwork layer and below for a particular interface.
```

6. DFM retrieves the default gateway:

```
Used OIDs:
    ipRouteDest (1.3.6.1.2.1.4.21.1.1) -
 for the destination IP address of this route
    ipRouteMask (1.3.6.1.2.1.4.21.1.11) -
 for the mask
    ipRouteDest (1.3.6.1.2.1.4.21.1.1) -
 for the destination IP address of this route
    ipRouteMetric1 (1.3.6.1.2.1.4.21.1.3) -
 for the primary routing metric for this route
    ipRouteNextHop (1.3.6.1.2.1.4.21.1.7) -
 for the IP address of the next hop of this route
```

7. DFM retrieves the serial number of the host. It will get the serial number from a public MIB, or

failing that a private MIB. In both cases it retrieves the OID. This job supports a wide range of devices. However, should the serial number be available but DFM is unable to extract it, you should open a Support Case (ensuring you provide full details from MIB Walk) so we can add support in a future Content Pack or Update.

8. If possible, DFM retrieves remote management cards of the host. For example, HPE iLO cards, or Dell DRAC cards.

   ```
   Get iLO cards from OID table 1.3.6.1.4.1.232.9.2.5.1
   ```

   ```
   Get DRAC cards from OID table 1.3.6.1.4.1.674.10892.1.1900.10
   ```

Trigger CI

Discovery Probe Gateway

Job Parameters

Parameter	Description
excludePatternsList	A list of wildcard patterns, separated by semicolons. IP addresses matching any of the patterns are skipped. The pattern may include numbers, dots, or the wildcards * (matches zero or more characters) or ? (matches exactly one character).
pingProtocol	A number representing the chosen ping protocol: 1 for ICMP, 2 for echo port, and 3 for both. **Default:** 1
range	Range of IP addresses to ping, separated by a semicolon.
retryDiscover	The number of times the job tries to ping. **Default:** 2
threadPoolSize	Number of threads in pool that performs port 7 echoing. **Default:** 10
timeoutDiscover	Ping timeout in milliseconds. **Default:** 3,000

Triggered CI Data

Name	Value
probeName	${SOURCE.name}

Discovered CITs

- ATM Switch
- Composition
- Containment
- Fibre Channel Switch
- Firewall
- Interface
- IpAddress
- IpSubnet
- LDOM Virtual Switch
- Load Balancer
- Mainframe CPC
- Marconi ATM Switch
- Membership
- Net Device
- Net Printer
- Node
- OpenVMS
- Parent
- Remote Access Service
- Router

- SNMP
- Switch
- Terminal Server
- Unix
- VMware Virtual Switch
- Windows

Chapter 80: Host Connection by PowerShell Discovery

This chapter includes:

Overview 1201

Supported Versions 1201

How to Discover Host Connection by PowerShell 1201

Host Connection by PowerShell Job 1202

Troubleshooting and Limitations – Host Connection by PowerShell Discovery 1210

Overview

Windows PowerShell is Microsoft's task automation framework, consisting of a command-line shell and associated scripting language built on top of, and integrated with, the .NET Framework. PowerShell provides full access to COM and WMI, enabling administrators to perform administrative tasks on both local and remote Windows systems.

In PowerShell, administrative tasks are generally performed by **cmdlets** (pronounced command-lets), which are specialized .NET classes implementing a particular operation. Sets of cmdlets may be combined together in scripts, executables (standalone applications), or by instantiating regular .NET classes (or WMI/COM Objects). These work by accessing data in different data repositories, like the file system or registry, which are made available to PowerShell via Windows PowerShell providers.

Supported Versions

This discovery supports PowerShell 2.0 or later .

How to Discover Host Connection by PowerShell

The following sections describe the Host Connection by PowerShell discovery.

1. ## Prerequisite - Set up protocol credentials

   The Host Connection by PowerShell discovery solution is based on the PowerShell protocol.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. ## Prerequisite - Configure PowerShell

   Before starting the discovery, ensure that PowerShell v2.0 or later is installed and configured on the Data Flow Probe machine. To access the installation files, see http://support.microsoft.com/kb/968929).

   a. Enable PowerShell remoting:

   - Launch PowerShell v2.0 or later as an administrator.
   - Run the **Enable-PSRemoting** cmdlet. This starts the WinRM service and sets the startup

type to Automatic, enables a firewall exception for WS-Management communications, and creates a listener to accept requests on any IP address.

> **Note:** To enable PowerShell remoting on all computers in your domain, in Domain Group Policy: Computer Configuration > Policies > Administrative Templates > Windows Components > Windows Remote Management (WinRM) > \WinRM Service, select **Allow automatic configuration of listeners**.

b. To trust all hosts, run the following from the command line:

```
Set-Item WSMan:\localhost\Client\TrustedHosts *
```

To trust only restricted IP addresses, specify the addresses in place of the asterisk (*).

c. Restart WinRM by running the following from the command line:

```
restart-Service winrm
```

> **Note:** By default, WinRM uses Kerberos for authentication. To configure WinRM for https, see http://support.microsoft.com/kb/2019527.

3. Run the discovery

a. Run the **Range IPs by ICMP** job.

b. Run the **Host Connection by PowerShell** job.

For details on running jobs, see "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

Host Connection by PowerShell Job

This section includes details about the job.

Commands

This section describes each of the commands used by Host Connection by PowerShell discovery.

Command

```
Get-WmiObject -Query "SELECT BuildNumber, Caption, Version, csdversion,
lastBootUpTime, otherTypeDescription FROM Win32_OperatingSystem " | Format-List
BuildNumber, Caption, Version, csdversion, lastBootUpTime, otherTypeDescription
```

- **Output**

```
BuildNumber : 2600
Caption : Microsoft Windows XP Professional
Version : 5.1.2600
csdversion : Service Pack 3
lastBootUpTime : 20101108094626.357090+120
otherTypeDescription :
```

- **Mapping**

  The output of this command is used to fill in the attributes of the CIs:

Command Output Attribute	CI Type	CI Attribute
BuildNumber	Windows	Host Operating System Release
Caption(1)	Windows	Host Operating System
Version	Windows	Host Operating System Version
csdversion	Windows	Windows Service Pack
lastBootUpTime	Windows	Host Boot Time
Caption(2)	Windows	Host Operating System Installation Type

Command

```
Get-WmiObject -Query "SELECT Domain, Manufacturer, Model, Name FROM Win32_
ComputerSystem " | Format-List Domain, Manufacturer, Model, Name
```

- **Output**

```
Domain : od5.lohika.com
Manufacturer : INTEL_
Model : D946GZIS
Name : DDM-RND-SV
```

- **Mapping**

  The output of this command is used to fill in the attributes of the CIs:

Command Output Attribute	CI Type	CI Attribute
Domain	Windows	OS domain name
Manufacturer	Windows	PC manufacturer
Model	Windows	Host model
Name	Windows	Host name

Command

```
Get-WmiObject -Query "SELECT name, uuid FROM win32_ComputerSystemProduct " |
Format-List name, uuid
```

- **Output**

```
name :
uuid : EAB9B406-CE4F-DB11-9150-0013D4D0773D
```

- **Mapping**

  The output of this command is used to fill in the attributes of the CIs:

Command Output Attribute	CI Type	CI Attribute
Uuid	Windows	Host BIOS UUID
Name	Windows	Host model

Command

```
Get-WmiObject -Query "SELECT serialNumber FROM Win32_BIOS " | Format-List
serialNumber
```

- **Output**

```
serialNumber : BQJO749007TY
```

- **Mapping**

  The output of this command is used to fill in the attributes of the CIs:

Command Output Attribute	CI Type	CI Attribute
serialNumber	Windows	Host serial number

Command

```
Get-WmiObject -Query "SELECT serialNumber FROM Win32_SystemEnclosure " | Format-
List serialNumber
```

- **Output**

```
serialNumber : BQJO749007TY
```

- **Mapping**

  The output of this command is used to fill in the attributes of the CIs:

Command Output Attribute	CI Type	CI Attribute
serialNumber	Windows	Host serial number

Command

```
Get-WmiObject -Query "SELECT metric1, nextHop FROM Win32_IP4RouteTable WHERE
destination = '0.0.0.0' and mask = '0.0.0.0'" | Format-List metric1, nextHop
```

- **Output**

```
metric1 : 20
nextHop : 134.44.98.7
```

- **Mapping**

  The output of this command is used to fill in the attributes of the CIs:

Command Output Attribute	CI Type	CI Attribute
nextHop where metric value is minimal	Windows	Default gateway

Command

```
Get-WmiObject -Query "SELECT dnsServerSearchOrder FROM Win32_
NetworkAdapterConfiguration WHERE domainDnsRegistrationEnabled <> NULL" | Format-
List dnsServerSearchOrder
```

- **Output**

```
dnsServerSearchOrder : {16.110.135.51, 16.110.135.52}
dnsServerSearchOrder : {134.44.98.21, 134.44.98.22}
```

- **Mapping**

  The output of this command is used to fill in the attributes of the CIs. Based on the IP addresses, incomplete hosts are created with the attached DNS Server application CI.

Command

```
Get-WmiObject -Query "SELECT WinsPrimaryServer, WinsSecondaryServer FROM Win32_
NetworkAdapterConfiguration WHERE WinsPrimaryServer <> NULL or WinsSecondaryServer
<> NULL" | Format-List WinsPrimaryServer, WinsSecondaryServer
```

- **Output**

```
WinsPrimaryServer : 16.232.7.246
WinsSecondaryServer : 16.236.105.246
```

- **Mapping**

  The output of this command is used to fill in the attributes of the CIs. Based on the IP addresses, incomplete hosts are created with the attached WINS Server application CI.

Command

```
Get-WmiObject -Query "SELECT dhcpServer FROM Win32_NetworkAdapterConfiguration
WHERE dhcpServer <> NULL" | Format-List dhcpServer
```

- **Output**

  ```
  dhcpServer : 134.44.98.22
  ```

- **Mapping**

  The output of this command is used to fill in the attributes of the CIs. Based on the IP addresses, incomplete hosts are created with the attached DHCP Server application CI.

Command

```
Get-WmiObject -Query "SELECT Caption, Description, DhcpEnabled, IPAddress,
IPSubnet, MACAddress FROM Win32_NetworkAdapterConfiguration WHERE MACAddress <>
NULL" | Format-List Caption, Description, DhcpEnabled, IPAddress, IPSubnet,
MACAddress
```

- **Output**

  ```
  Caption : [00000003] WAN Miniport (PPTP)
  Description : WAN Miniport (PPTP)
  DhcpEnabled : False
  IPAddress :
  IPSubnet :
  MACAddress : 50:50:54:50:30:30
  Caption : [00000004] WAN Miniport (PPPOE)
  Description : WAN Miniport (PPPOE)
  DhcpEnabled : False
  IPAddress :
  IPSubnet :
   MACAddress : 33:50:6F:45:30:30
  Caption : [00393219] WAN Miniport (IP)
  Description : WAN (PPP/SLIP) Interface
  DhcpEnabled : False
  IPAddress : {16.213.65.117}
  IPSubnet : {255.255.255.255}
  MACAddress : 00:53:45:00:00:00
  Caption : [00000007] Packet Scheduler Miniport
  Description : Packet Scheduler Miniport
  DhcpEnabled : False
  ```

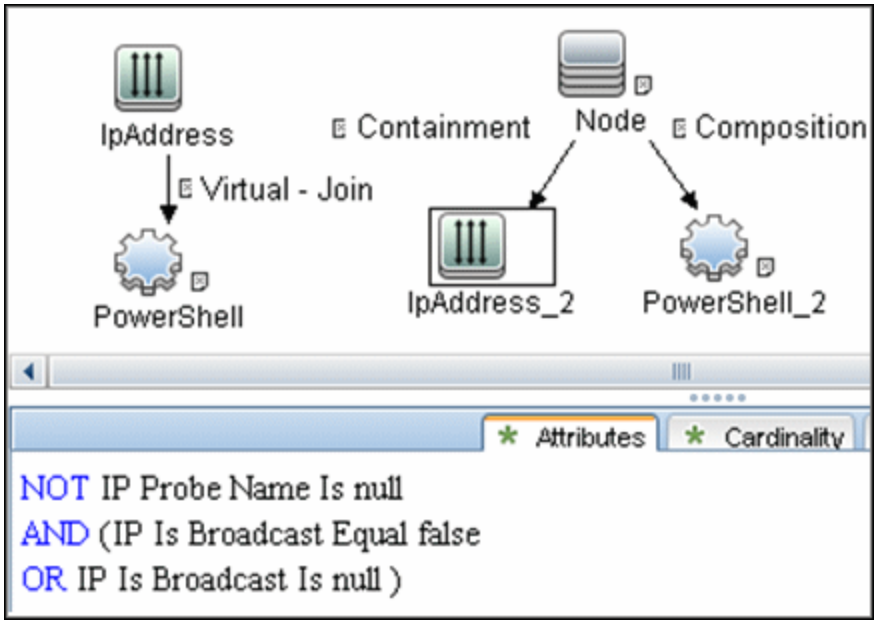
```
IPAddress :
IPSubnet :
MACAddress : 4A:6F:20:52:41:53
Caption : [00000008] Intel(R) PRO/100 VE Network Connection
Description : Intel(R) PRO/100 VE Network Connection - Teefer2 Miniport
DhcpEnabled : True
IPAddress : {134.44.99.108}
IPSubnet : {255.255.252.0}
MACAddress : 00:16:76:BE:7E:DD
Caption : [00000009] Packet Scheduler Miniport
Description : Packet Scheduler Miniport
DhcpEnabled : False
IPAddress :
IPSubnet :
MACAddress : 00:16:76:BE:7E:DD
Caption : [00000013] Teefer2 Miniport
Description : Teefer2 Miniport
DhcpEnabled : False
IPAddress :
IPSubnet :
MACAddress : 00:16:76:BE:7E:DD
Caption : [00000014] Teefer2 Miniport
Description : Teefer2 Miniport
DhcpEnabled : False
IPAddress :
IPSubnet :
MACAddress : 4A:6F:20:52:41:53
```

- **Mapping**

  The output of this command is used to fill in the attributes of the CIs:

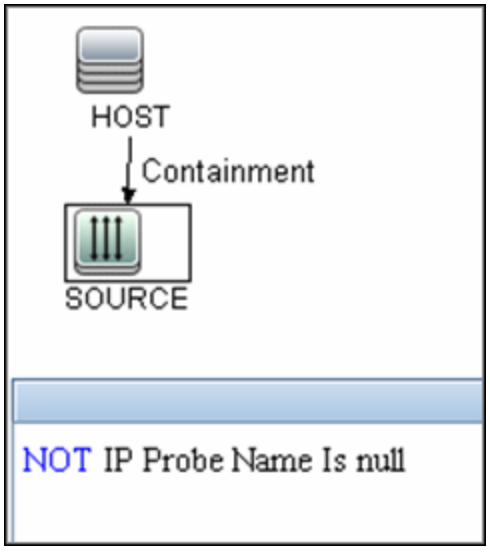
Command Output Attribute	CI Type	CI Attribute
Description	Interface	Interface description
DhcpEnabled	Interface	DHCP Enabled
IPAddress	IpAddress	IP address
IPSubnet	IpAddress	IP Network Address
MACAddress	Interface	Interface MAC Address

Trigger Query



Adapter

- **Input query:**



- **Used Scripts:**

- networking.py
- Host_connection_by_powershell.py
- Host_discoverer.py
- Host_win.py
- Host_win_shell.py
- Host_win_wmi.py
- Networking_win.py
- Networking_win_shell.py
- Networking_win_wmi.py

- **Triggered CI Data:**

Name	Value
host_cmdbid	${HOST.root_id:NA}
host_key	${HOST.host_key:NA}
ip_address	${SOURCE.ip_address}
ip_domain	${SOURCE.ip_domain}
mac_addrs	${NA}

Discovered CITs

- Composition
- Containment
- DnsServer
- Interface
- IpAddress
- IpSubnet
- Membership
- Node
- Parent

- PowerShell
- RunningSoftware
- Terminal Server
- Windows

Created/Changed Entities

Entity Name	Entity Type	Entity Description
powershell.xml	CIT	Represents the PowerShell protocol
Host Connection by Powershell.xml	Job	Main Job
Powershell_host_connection.xml	Adapter	Job adapter
Host_connection_by_powershell.py	Script	Discovery script
Host_win.py	Script	Discovery script
Host_win_shell.py	Script	Discovery script
Networking_win.py	Script	Discovery script
Networking_win_shell.py	Script	Discovery script
Networking_win_wmi.py	Script	Discovery script
Host_win_wmi.py	Script	Discovery script

Troubleshooting and Limitations – Host Connection by PowerShell Discovery

This section describes troubleshooting and limitations for Host Connection by PowerShell Discovery.

Problem: Access Denied Error Message

The following error message may appear while trying to discover Windows 2008 SP2 destination by PowerShell protocol:

```
Connecting to remote server failed with the following error message: Access is
denied. For more information, see the about_Remote_Troubleshooting Help topic.
```

This appears if the user attempting to discover the destination host is not a local Administrator user. (It does not matter if the user is a member of the Administrators group.)

Solution: The solution requires additional configuration of PowerShell.

The **LocalAccountTokenPolicy** key should be changed to allow users from the Administrator group to connect remotely with Administrator privileges. Run the following command in PowerShell on the discovered host:

```
Set-ItemProperty -Path HKLM:\SOFTWARE\Microsoft\Windows\CurrentVersion\Policies\
System -Name LocalAccountTokenFilterPolicy -Value 1 -Type DWord
```

For details of this special case, see "HOW TO ENABLE REMOTING FOR ADMINISTRATORS IN OTHER DOMAINS" at http://technet.microsoft.com/en-us/library/dd347642.aspx.

Chapter 81: AS400 Host Discovery

This chapter includes:

Overview 1213

Supported Versions 1213

Topology 1214

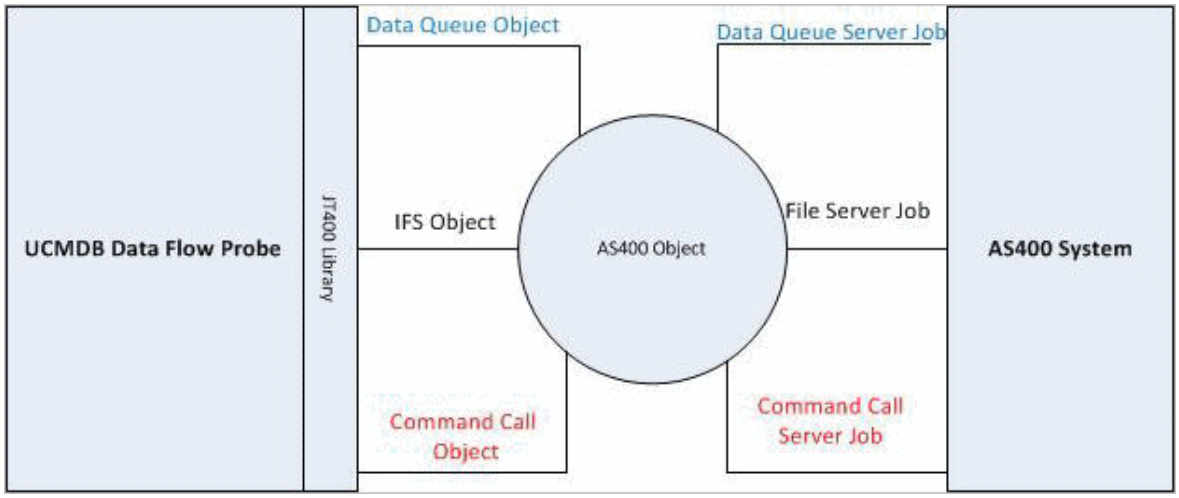
How to Discover AS400 Hosts 1215

Host Connection to AS400 Job 1216

Overview

AS400 Host discovery is a simple host connection discovery for AS400 computers. The UCMDB Data Flow Probe uses an AS/400 object created by the IBM(R) jt400 library to access the AS400 system to retrieve host information.

A high-level architectural diagrams for this discovery solution is illustrated in the following image:



Supported Versions

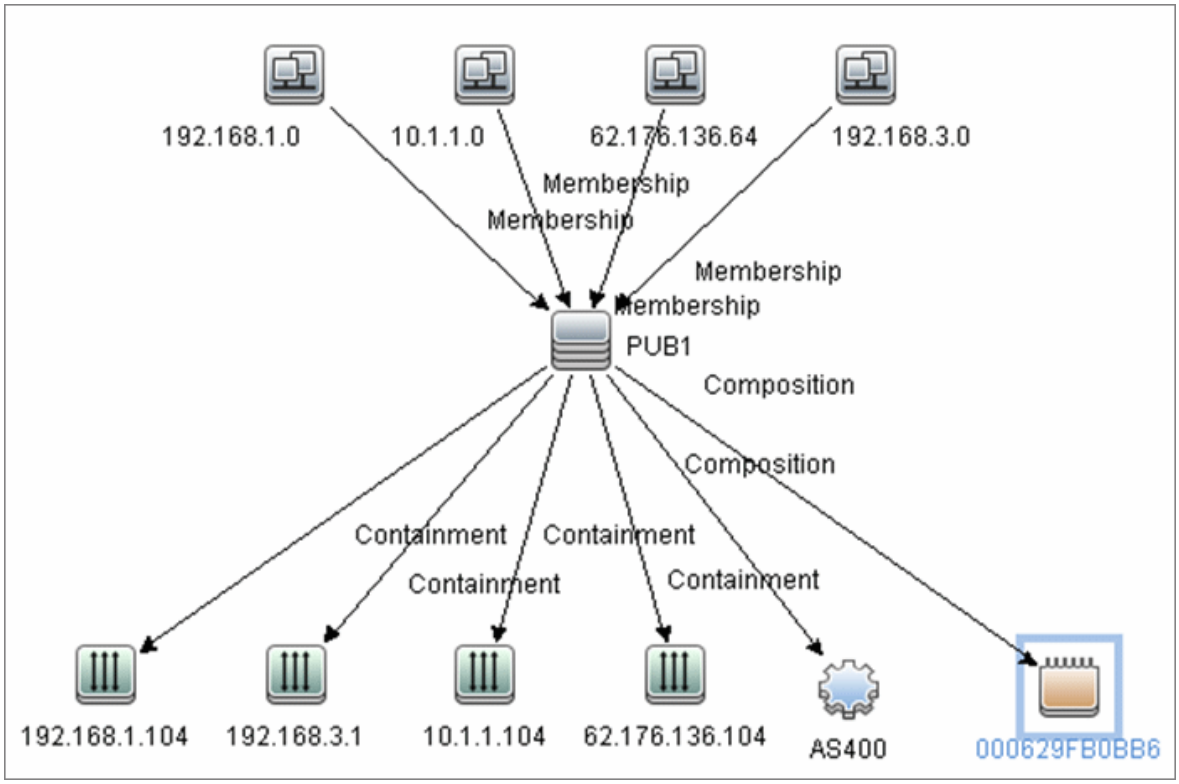
This discovery supports the following versions of AS400:

- V4R2M0
- V3R2M1
- V3R2M0
- V4R5M0
- V5R3
- V5R4MO
- V6R1

Topology

The following image displays the topology of the AS400 Host discovery with sample output:

Note: For a list of discovered CITs, see "Host Connection to AS400 Job" on page 1216.



How to Discover AS400 Hosts

This task explains how to discover AS400 hosts and includes the following steps:

1. Prerequisite - Set up protocol credentials

   This discovery uses the AS400 protocol.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Prerequisites - IP Addresses and permissions

   - Make sure that an IP ping sweep has been done on the ranges intended for AS400 host discovery.
   - Ensure that the user has the relevant permissions on the AS400 system to run the discovery.
     - *OBJMGT
     - *OBJEXIST
     - *ADD
     - *READ
     - *EXCLUDE
     - *EXECUTE
     - *CHANGE
     - *USE
     - *SHRNUP

3. Run the discovery

   Activate the **Host Connection to AS400** discovery job.

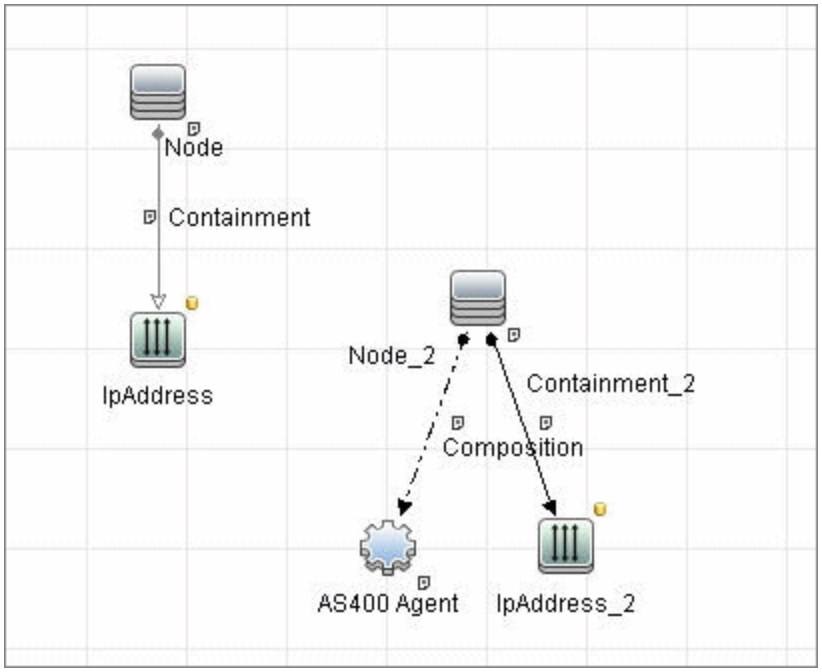
   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

Host Connection to AS400 Job

This section includes details about the job.

Trigger Query

Trigger CI:ip_address



Discovered CITs

- AS400Agent
- Composition
- Containment
- Interface
- IpAddress
- IpSubnet
- Membership

- Node
- Parent

> **Note:** To view the topology, see "Topology" on page 1214.

Chapter 82: Host Platform by Shell Discovery

This chapter includes:

- Overview 1219
- Topology 1219
- How to Discover Host Platform by Shell 1219
- Host Platform by Shell Job 1220
  - Introduction 1220
  - Adapter Information 1221
- Troubleshooting and Limitations – Host Platform by Shell Discovery 1222

Overview

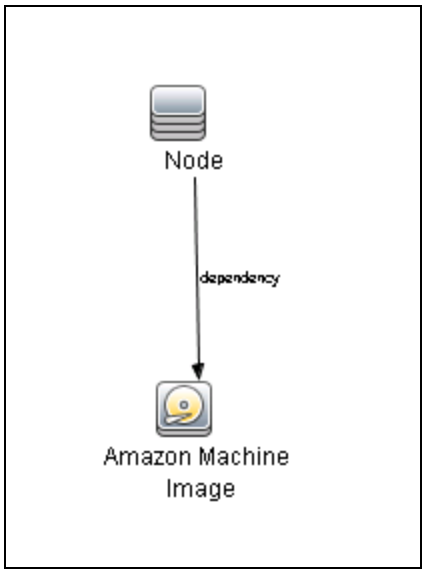
The Host Platform by Shell discovery allows you to discover the platform information for a host using the shell protocol, such as the platform vendor and cloud instance ID.

For Amazon Elastic Compute Cloud (Amazon EC2) instances, the **Host Platform by Shell** job can discover the cloud instance ID for the host and Amazon Machine Index (AMI) data.

Currently, it only supports the Amazon Web Services discovery.

Topology

The following image displays the topology of the Host Platform by Shell discovery.



How to Discover Host Platform by Shell

This task describes how to discover the host platform information using the Shell protocol.

1. Prerequisite - Set up protocol credentials

   Define one of the following protocols:

- NTCMD Protocol
- PowerCmd Protocol
- SSH Protocol
- Universal Discovery Protocol

For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Run the discovery

   a. Run the **Range IPs by ICMP** job.

   b. Run the **Host Connection by Shell** job.

   c. Run the **Host Platform by Shell** job.

   For details on running jobs, see "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

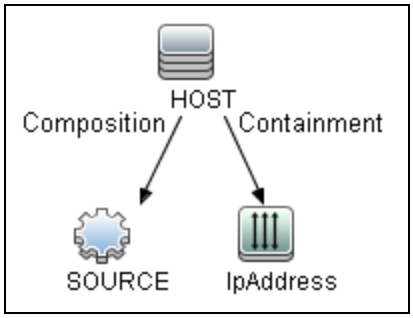
Host Platform by Shell Job

This section includes details about the job.

Introduction

This job discovers host platform details on UNIX and Windows machines using NTCMD, SSH, PowerCmd, or Universal Discovery protocols.

Trigger Query



CI	Attribute Value
IpAddress	NOT IP Probe Name Is null

Adapter Information

This job uses the **Host Platform by Shell** adapter.

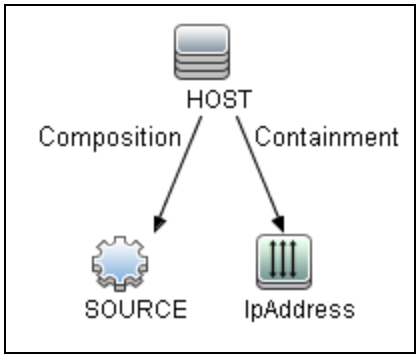
Adapter Type

Jython

Input CIT

Shell

Input TQL



CI	Attribute Value
IpAddress	NOT IP Probe Name Is null

Triggered CI Data

Name	Value
credentialsId	${SOURCE.credentials_id:}
host_id	${HOST.root_id}

Name	Value
ip_address	${SOURCE.application_ip:}
protocol	${SOURCE.root_class}

Used Scripts

- aws_by_shell.py
- host_platform_shell.py

Discovered CITs

- Amazon Machine Image
- Dependency (node, aws_ami)
- Node

Troubleshooting and Limitations – Host Platform by Shell Discovery

This section describes troubleshooting and limitations for the Host Platform by Shell discovery.

Problem: The **Host Platform by Shell** job fails with the following warning message: "`No platform information discovered`".

Solution: Do as follows:

1. Check if the target host is an Amazon EC2 instance.
2. Run the following commands on the target host:
   - Windows PowerShell

     ```
     Invoke-WebRequest -UseBasicParsing -Uri
     http://169.254.169.254/latest/meta-data/instance-id
     ```

   - Linux

     ```
     curl -s http://169.254.169.254/latest/meta-data/instance-id
     ```

Chapter 83: Layer2 Discovery

This chapter includes:

Overview 1225
Supported Devices 1226
How to Discover Layer2 Objects 1227
How to Discover Layer2 Connections Using Saved Files 1230
How to Discover Layer2 Connections Using CDP or LLDP MIB 1231
How to Discover Layer2 Topology by Shell 1231
Layer2 Topology Bridge-based by SNMP Job 1232
Layer2 Topology by Shell Job 1233
Layer2 Topology CDP-LLDP based by SNMP Job 1235
Layer2 Topology VLAN-based by SNMP Job 1235
Process Layer2 Saved Files Job 1236
Merge VLANs by Ports Job 1238
Report Linux with Duplicated MAC Layer2 Job 1239
Introduction 1239
Adapter Information 1239
VLAN ports by SNMP Job 1242
VLANs by SNMP Job 1243
L2 Bridge by SNMP Adapter 1245
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CDP/LLDP Neighbors Layer 2 Devices by SNMP Adapter 1249
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Relationships 1260
Layer2 Discovery Flow 1260

Possible Use Cases 1261
Discovery Flow 1261
Layer2 Discovery Troubleshooting and Limitations 1265
Layer2 Discovery Troubleshooting 1265

Overview

The Layer2 package discovers the Layer2 topology that includes the switches tree topology (the backbone links between the switches) and also the end user connections to the switch-ports (the Layer2 CIs between a switch and a host).

The package can discover information from the following resources:

- **Forwarding Database (FDB)**
  Depending on device type, the FDB is found in the BRIDGE-MIB, QBRIDGE MIB, or STATISTICS-MIB.
- **Cisco Discovery Protocol MIB (CDP-MIB)**
  This MIB contains information collected by CDP about directly connected Cisco network devices.
- **Link Layer Discovery Protocol MIB (LLDP-MIB)**
  This MIB contains information collected by LLDP about directly connected network devices.

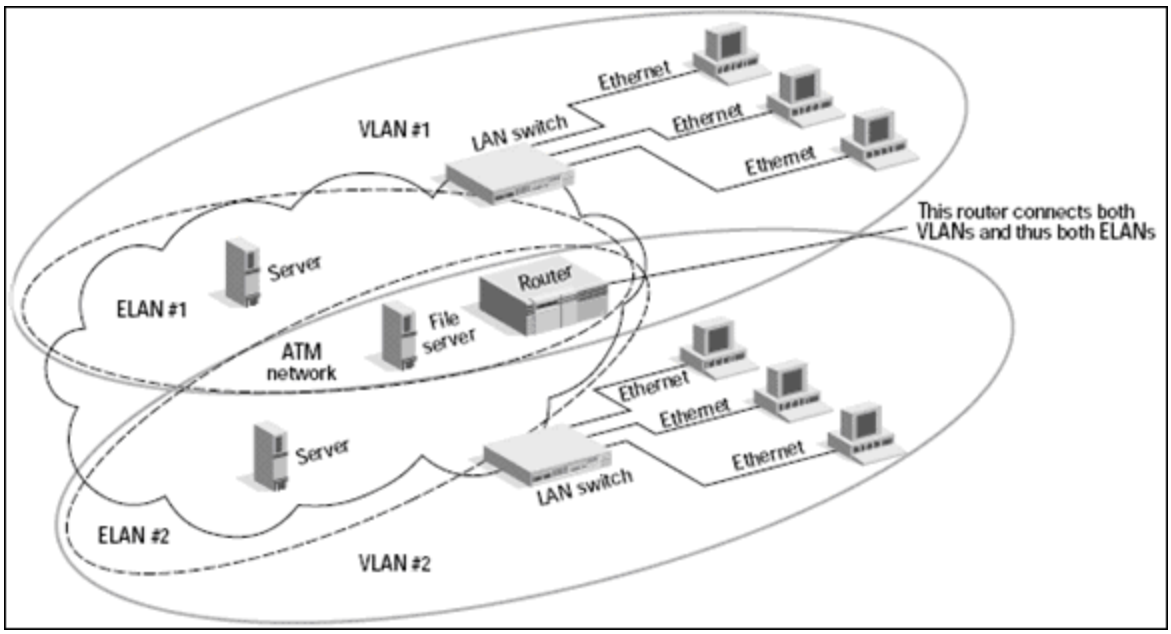
The **Layer2 Topology Bridge-based by SNMP** and **Layer2 Topology VLAN-based by SNMP** jobs select Layer2 connections information from the forwarding database, create the Layer2 CIs between a switch and an endpoint host, and put information about switch to switch Layer2 connections into files on the probe's file system.

The **Process Layer2 Saved Files** job selects data from the probe's file system (created by the **Layer2 Topology Bridge-based by SNMP** and **Layer2 Topology VLAN-based by SNMP** jobs) and creates switch to switch Layer2 connections.

The **Layer2 Topology CDP-LLDP based by SNMP** job selects Layer2 connections information from CDP or LLDP MIBs, and reports Layer2 connections from the discovered device to directly connected network devices.

The Layer2 package is based on the SNMP protocol.

The following image illustrates a router connecting overlapping VLANs/ELANs:



Supported Devices

This discovery supports devices by the following:

- 3Com
- Cisco
- H3C
- HP ProCurve
- Juniper

How to Discover Layer2 Objects

This task describes how to discover Layer2 objects.

This task includes the following steps:

1. Prerequisite - Set up protocol credentials

   The SNMP protocol is required to discover Layer2 objects. When defining the SNMP protocol credentials, have available the Port and Community authentication parameters.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Prerequisite - Other

   - Make sure that there is SNMP access to all switches in the environment to be discovered. This is a key requirement for fully discovering the Layer2 topology.

3. Run the discovery

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

   Activate the jobs in the following order:

   a. Activate the **Host Connection by SNMP** job. This job saves SNMP CIs to the CMDB.

      > **Note:** Layer2 discovery is based on the connection jobs for the following reasons:
      >
      > - The Layer2 connectivity between the switch-port to the host is based on the host MAC address. These MAC addresses are discovered by the network connection jobs (Host Interfaces).
      > - The trigger of the Layer2 job is dependent on the type of the discovered switch. The switch class and type is discovered by the Host Networking by SNMP job for the Layer2 module.

   b. Activate the **Host Networking by SNMP** job. This job discovers host networking topology using SNMP route and system tables. You should run this job on all SNMP agents on the switches that were discovered in the environment. The to-be discovered Layer2 link names are dependent on this discovery. (Layer2 CIs names are the same as the relevant interface name and interface description on the destination network interface adapter which we are

discovering.)

c. Activate the **VLANs by SNMP** job.

The trigger for this job is the **snmp_of_catalyst_switch** query. The Switch CIT is either:

- an SNMP object
- an SNMP agent that is connected to a switch

The `SNMP_Net_Dis_Catalyst_Vlans.py` script retrieves the VLAN, ELAN name, and VLAN number per ELAN tables.

d. Activate the **VLAN ports by SNMP** job.

The trigger for this job is the **catalyst_vlan** query. This is a VLAN object that has a connection to:

- a switch with an SNMP object
- a switch

The trigger is placed on the VLAN object instead of on the SNMP itself because the VLAN object must be authenticated with a special community string (and not with the regular community string that was discovered on the SNMP object on the discovered switch). This community string should hold the value `<COMMUNITY>@<VLAN NUMBER>`. For example, if the community string is **public** and the discovered VLAN number is **16**, the community string is **public@16**.

The `SNMP_Net_Dis_VMS_catalyst.py` script retrieves the Base MAC table and Port number If Index table.

For details on the SNMP protocol parameters, see SNMP Protocol in the *HPE Universal CMDB Data Flow Management Guide*.

e. Activate the **Layer2 Topology Bridge-based by SNMP** job.

The trigger for this job is the **catalyst_bridge_no_vlan** query. This is a Bridge object that has a connection to:

- a switch with an SNMP object
- a switch

Both this job (**Layer2 Topology Bridge-based by SNMP**) and the following job (**Layer2 Topology VLAN-based by SNMP**) use the `bridgePortDisc.py` script. The difference between the jobs in this script is as follows:

For Cisco network devices.

- **Layer2 Topology Bridge-based by SNMP** uses the regular SNMP community authentication. The job is triggered on the Bridge only when the discovered switch has no VLANS.
- **Layer2 Topology VLAN-based by SNMP** is triggered on each one of the VLANs discovered on the switch. This job uses the relevant special community authentication, as explained in "Activate the VLAN ports by SNMP job." on the previous page, based on the triggered VLAN number.

For other network devices.

- **Layer2 Topology Bridge-based by SNMP** uses the BRIDGE-MIB to discover Layer2 connections.
- **Layer2 Topology VLAN-based by SNMP** uses QBRIDGE-MIB or STATISTICS-MIB to discover Layer2 connections.

> **Note:**
>
> - The Layer2 Topology Bridge-based by SNMP job discovers Layer2 connections per default VLAN. (The default VLAN is #1.) The Layer2 Topology VLAN-based by SNMP job discovers all Layer2 connections for all VLANs, including the default one. Therefore:
>   - If you want to discover Layer2 connections for the default VLAN only, you do not need to run the VLANs by SNMP and LVAN ports by SNMP jobs.
>   - If you execute the VLANs by SNMP job, and it reports any VLAN CIs connected to the network device, the Layer2 Topology Bridge-based by SNMP job does not discover Layer2 connections because the device is excluded from the job's trigger TQL query. To discover Layer2 connections on a device with discovered VLANs, you must use the Layer2 Topology VLAN-based by SNMP job.
>   - If you dispatch the Bridge-based Layer2 job on the bridge of a switch that holds VLANs, only the default VLAN Layer2 topology is discovered.
> - The Layer2 Topology Bridge-based/VLAN-based by SNMP jobs only report switches to host Layer2 connections. To report switch to switch, you must also run the Process Layer2 Saved Files job.

f. Activate the **Layer2 Topology VLAN-based by SNMP** job.

The trigger for this job is the **catalyst_vlan_with_bridge** query. This is a VLAN object with a value in its `bridge_mac` attribute. It should also have a connection to either:

- a switch with an SNMP object
- a switch

For details on the **bridgePortDisc.py** script, see "Activate the Layer2 Topology Bridge-based by SNMP job." on page 1228.

How to Discover Layer2 Connections Using Saved Files

This task includes the following steps:

1. Prerequisite - Set up protocol credentials

   The SNMP protocol is required to discover Layer2 objects. When defining the SNMP protocol credentials, have available the Port and Community authentication parameters.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Run the discovery

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

   Run the jobs in the following order:

   a. Run the **Range IPs by ICMP** job to discover the target IPs.

   b. Run the **Host Connection by SNMP** job to discover the target host and connectivity to it.

   c. Run either or both of the **Layer2 Topology Bridge-based by SNMP** and **Layer2 Topology VLAN-based by SNMP** jobs, according to your environment.

   d. After all the preceding jobs have completed, run the **Process Layer2 Saved Files** job.

How to Discover Layer2 Connections Using CDP or LLDP MIB

This task includes the following steps:

1. Prerequisite - Set up protocol credentials

   The SNMP protocol is required to discover Layer2 objects. When defining the SNMP protocol credentials, have available the Port and Community authentication parameters.

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Run the discovery

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

   Run the jobs in the following order:

   a. Run the **Range IPs by ICMP** job to discover the target IPs.

   b. Run the **Host Connection by SNMP** job to discover the target host and connectivity to it.

   c. Run the **Layer2 Topology CDP-LLDP based by SNMP** job.

How to Discover Layer2 Topology by Shell

To discover Layer2 Topology by Shell, run the following jobs:

1. **Range IPs by ICMP**
2. **Host Connection by Shell**
3. **Layer2 Topology by Shell**

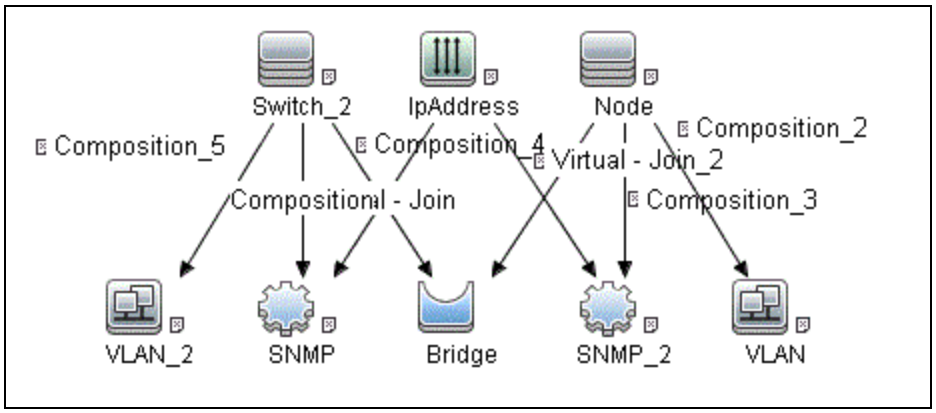
Layer2 Topology Bridge-based by SNMP Job

This section includes details about the job.

Adapter

This job uses the L2 Bridge by SNMP adapter.

Trigger TQL Query



Node Name	Condition
Switch_2	CI Type Equal switch OR NodeRole Contains switch
IpAddress	NOT IP Probe Name Is null
Node	CI Type Equal switch OR NodeRole Contains switch
SNMP	NOT Reference to the credentials dictionary entry Is null
SNMP_2	NOT Reference to the credentials dictionary entry Is null

Discovery Flow

This discovery includes the following parts:

- Connection to the destination machine.
- Discovery of VLAN related data.

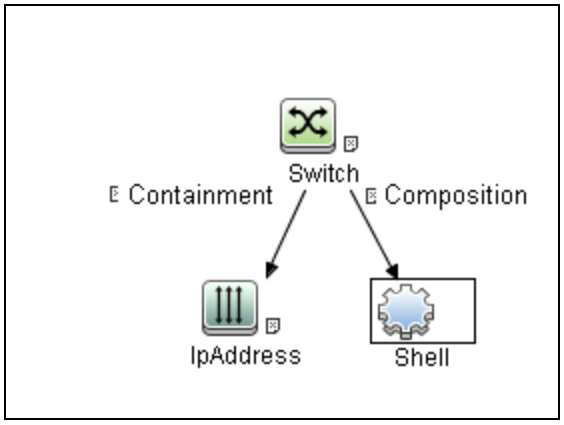
Layer2 Topology by Shell Job

This job reports Layer2 related data for Cisco Nexus 1000, 5000, and 7000 series of switches, and Juniper EX and QFX series of switches.

Adapter

ID: `Layer2 Topology by Shell`

Trigger TQL



Parameters

None

Prerequisites

- Set up SSH protocol credentials. For more information on this, see the section explaining SSH protocol credentials in *HPE UCMDB Discovery and Integrations Content Guide - Supported Content*.

Discovery Flow

The discovery flow for the Layer2 Topology by Shell job is as follows:

1. Get interface details using the command **sh int**.
2. Get configured vlans and ports using the command **sh vlan all-ports**.
3. Get the list of connected devices using the command **sh cdp neighbours detail**.

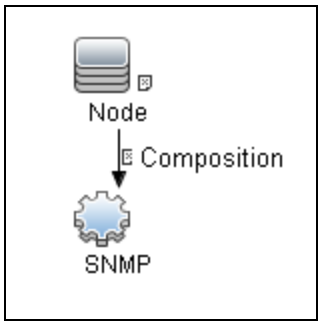
Layer2 Topology CDP-LLDP based by SNMP Job

This section includes details about the job.

Adapter

This job uses the CDP/LLDP neighbors layer 2 devices by SNMP adapter.

Trigger TQL Query



Node Name	Condition
Node	CI Type Equal switch OR CI Type Equal switchrouter OR NodeRole Contains switch OR NodeRole Contains router
SNMP	NOT Reference to the credentials dictionary entry is null

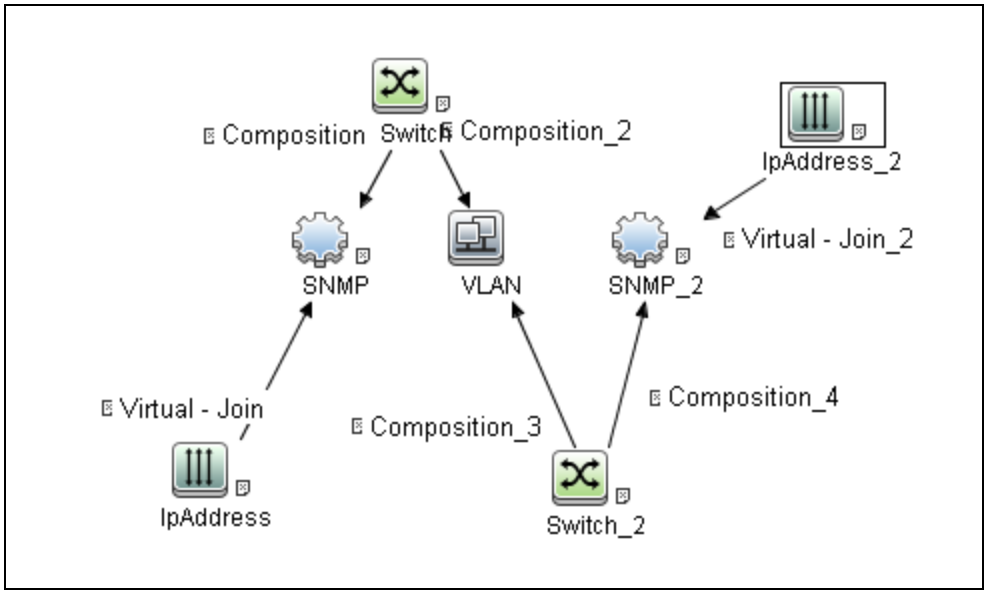
Layer2 Topology VLAN-based by SNMP Job

This section includes details about the job.

Adapter

This job uses the L2 Vlan by SNMP adapter.

Trigger TQL Query



Node Name	Condition
IpAddress	NOT IP Probe Name Is null
IpAddress_2	NOT IP Probe Name Is null
SNMP	NOT Reference to the credentials dictionary entry is null
SNMP_2	NOT Reference to the credentials dictionary entry is null
VLAN	NOT VLAN Bridge MAC Is null

Discovery Flow

This discovery includes the following parts:

- Connection to the destination machine.
- Discovery of VLAN related data.

Process Layer2 Saved Files Job

This section includes details about the job.

Discovery Flow

This job finds any connection between the MAC of one switch interface and the MAC of another switch interface. Where there is such a connection, the discovery creates a Layer2 Connection.

Adapter

This job uses the Process Layer2 Collected Files adapter.

Trigger TQL Query

Merge VLANs by Ports Job

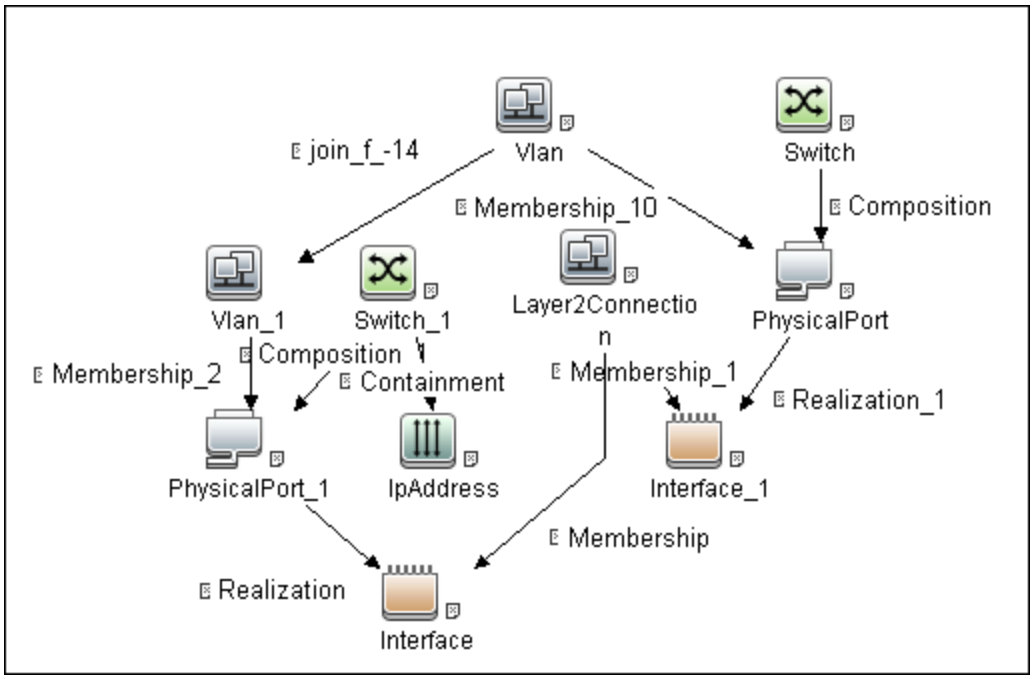
The functionality of this job is similar to that of enrichment or reconciliation. It works only with data which is already inside UCMDB, and merges VLANs where the topology is as follows:

1. The ports that are related to a VLAN are connected by a Layer2 Connection; and
2. The VLAN id is the same.

Adapter

This job uses the Merge VLANs adapter

Trigger TQL Query



Node Name	Condition
IpAddress	NOT IP Probe Name Is null

Discovery Flow

This discovery includes the following parts:

- Connection to the destination machine.
- Discovery of VLAN related data.

Report Linux with Duplicated MAC Layer2 Job

This section includes details about the job.

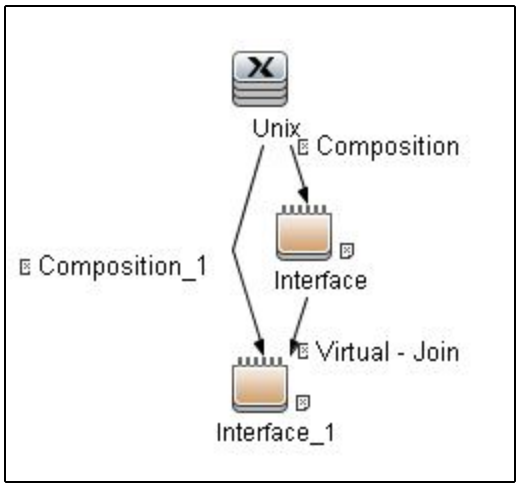
Introduction

This is a post-processing job running on the top of results collected on the Data Flow Probe File System by the **Layer2 Topology VLAN-based by SNMP** job.

This job triggers on Linux boxes that have interfaces with the same MAC and share the VLAN-enabled interface name notation, for example, **<iface name>.<vlan id>@<iface name>**.

When this job is enabled, and then according to each Node's interface, the job will look for the saved Layer2-related data on the File System and report a Layer2 CI by setting all available reconciliation Interface CIT attributes, thus resolving the "Multiple Match" issue.

Trigger Query



Adapter Information

This job uses the **Process Linux Servers With Duplicated Macs** adapter.

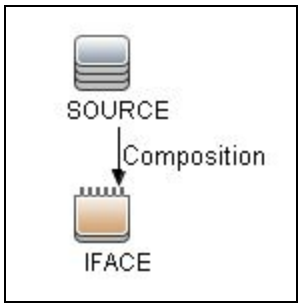
Adapter Type

Jython

Input CIT

Node

Input Query



Triggered CI Data

Name	Value
host_id	${SOURCE.root_id}
interface_mac	${IFACE.mac_address:NA}
interface_name	${IFACE.interface_name:NA}

Used Scripts

- process_linux_with_multyple_macs.py

Discovered CITs

- Composition
- Interface
- Layer2Connection

- Membership
- Node

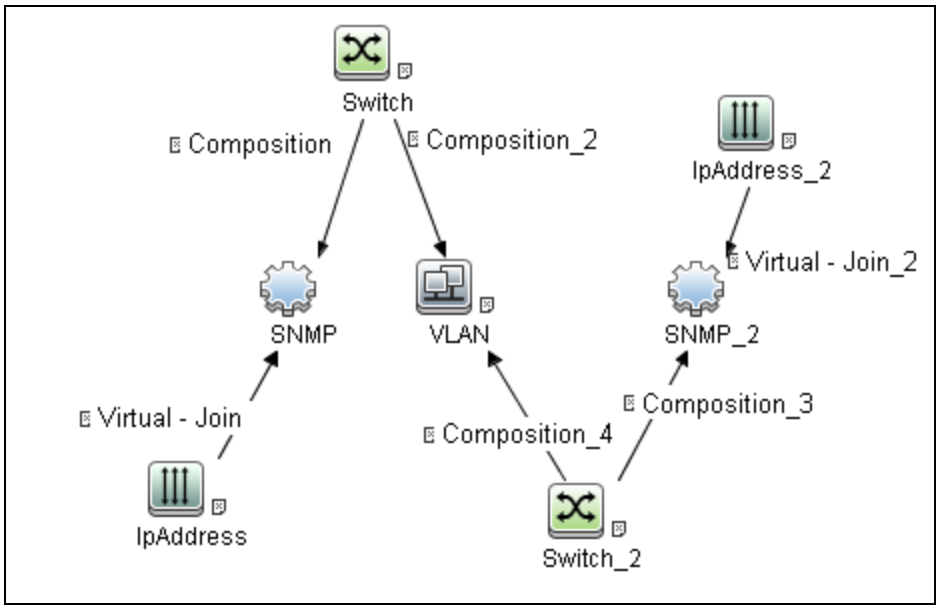
VLAN ports by SNMP Job

This section includes details about the job.

Adapter

This job uses the VMS Catalyst by SNMP adapter.

Trigger TQL Query



Node Name	Condition
IpAddress	NOT IP Probe Name Is null
IpAddress_2	NOT IP Probe Name Is null
SNMP	NOT Reference to the credentials dictionary entry is null
SNMP_2	(SNMP Description Like %atalyst% OR SNMP Description Like ignore case %cisco%) AND NOT Reference to the credentials dictionary entry Is null
Switch	DiscoveredOsName Like %atalyst% OR DiscoveredModel Like %atalyst% OR DiscoveredOsName Like ignore case %cisco% OR DiscoveredModel Like ignore case %cisco%

Discovery Flow

This discovery includes the following parts:

- Connection to the destination machine.
- Discovery of VLAN related data.

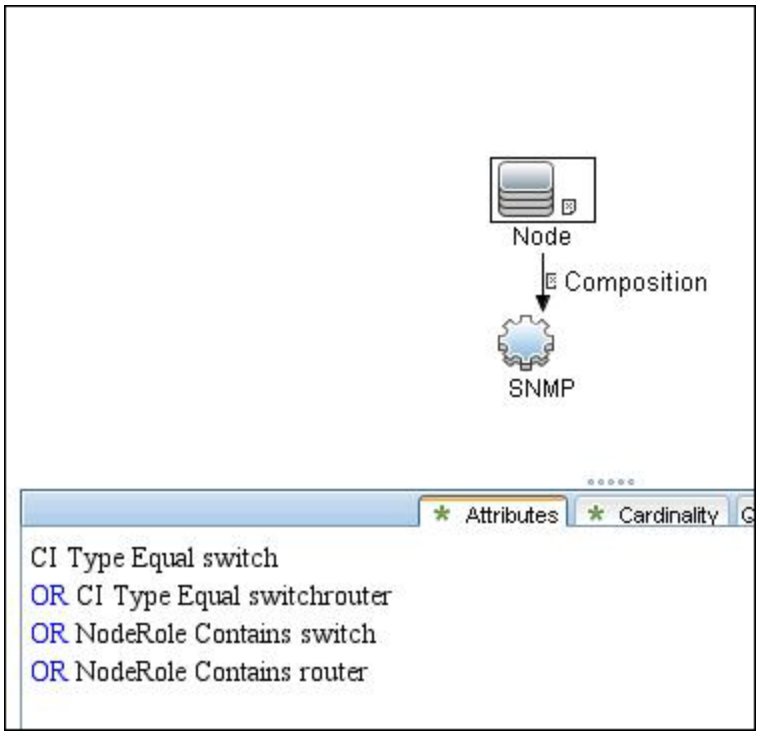
VLANs by SNMP Job

This section includes details about the job.

Adapter

This job uses the Catalist Vlans by SNMP adapter.

Trigger TQL Query



Discovery Flow

This discovery includes the following parts:

- Connection to the destination machine.
- Discovery of VLAN related data.

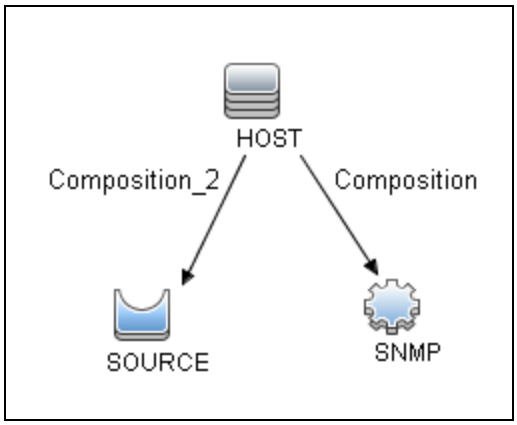
L2 Bridge by SNMP Adapter

This section includes details about the adapter.

Input CIT

Bridge

Input TQL Query



Triggered CI Data

Name	Value
bridgeId	${SOURCE.bridge_basemacaddr}
credentialsId	${SNMP.credentials_id}
hostId	${HOST.root_id}
ip_address	${SNMP.application_ip}

Used Scripts

- bridgePortDisc.py
- networking_win.py

- SNMP_Networking_Utils.py

Discovered CITs

- Bridge
- Composition
- Interface
- Layer2Connection
- Membership
- Node
- PhysicalPort
- Realization

Layer2 Topology by Shell Adapter

This section includes details about the adapter.

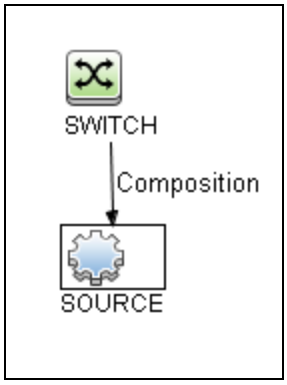
ID

```
Layer2 Topology by Shell
```

Input CIT

```
Shell
```

Input TQL



Triggered CI Data

Name	Value
credentialsId	${SOURCE.credentials_id}
hostId	${SWITCH.root_id}
ip_address	${SOURCE.application_ip}
ip_domain	${NA}
Protocol	${SOURCE.root_class}

Used Scripts

- layer2.py
- layer2_shell_discoverer.py
- switch_layer2_by_shell.py
- TTY_Connection_Utils.py

Discovered CITs

- Composition
- Interface

- Layer2Connection
- Membership (layer2_connection,interface)
- Node
- Realization
- Switch
- PhysicalPort

Parameters

None

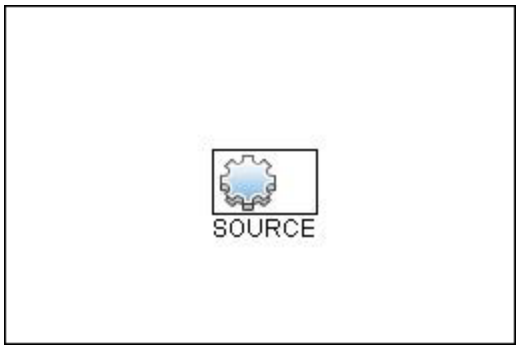
CDP/LLDP Neighbors Layer 2 Devices by SNMP Adapter

This section includes details about the adapter.

Input CIT

SNMP

Input TQL Query



Triggered CI Data

Name	Value
credentialsId	${SOURCE.credentials_id}
hostId	${HOST.root_id}
ip_address	${SOURCE.application_ip}

Used Scripts

- networking_win.py
- SNMP_Networking_Utils.py
- SNMP_CDP_LLDP.py

Discovered CITs

- Composition
- Containment
- Interface
- IpAddress
- Layer2Connection
- Membership
- Node

Adapter Parameters

Parameter	Default Value	Description
discoverCdpMib	true	Indicates whether to perform the Layer2 discovery from CDP MIB.
discoverLldpMib	true	Indicates whether to perform the Layer2 discovery from LLDP MIB.
mapLLDPPortsByNames	false	If setting the parameter to **true**, the LLDP entry is mapped to the local port based on names. If setting the parameter to **false**, the LLDP entry is mapped to the local port based on indexes.

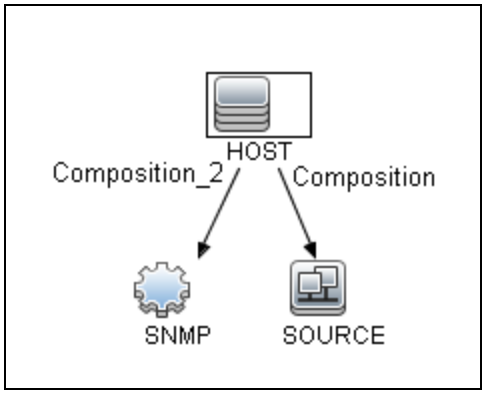
L2 Vlan by SNMP Adapter

This section includes details about the adapter.

Input CIT

Vlan

Input TQL Query



Triggered CI Data

Name	Value
bridgeId	${SOURCE.vlan_bridgemac}
credentialsId	${SNMP.credentials_id}
hostId	${HOST.root_id}
hostModel	${HOST.discovered_model:NA}
hostOs	${HOST.discovered_os_name:NA}
ip_address	${SNMP.application_ip}
smpDescription	${SNMP.snmp_description:NA}
snmpCommunityPostfix	${SOURCE.vlan_id}

Used Scripts

- bridgePortDisc.py
- networking_win.py
- SNMP_Networking_Utils.py

Discovered CITs

- Bridge
- Composition
- Interface
- Layer2Connection
- Membership
- Node
- PhysicalPort
- Realization

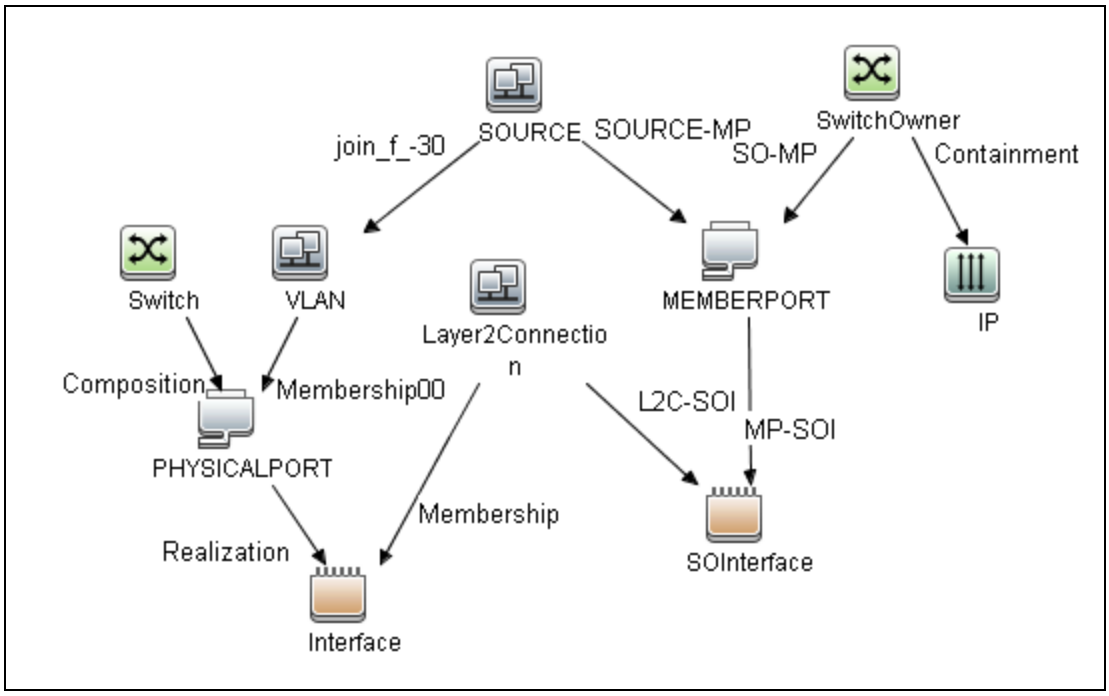
Merge VLANs Adapter

This section includes details about the adapter.

Input CIT

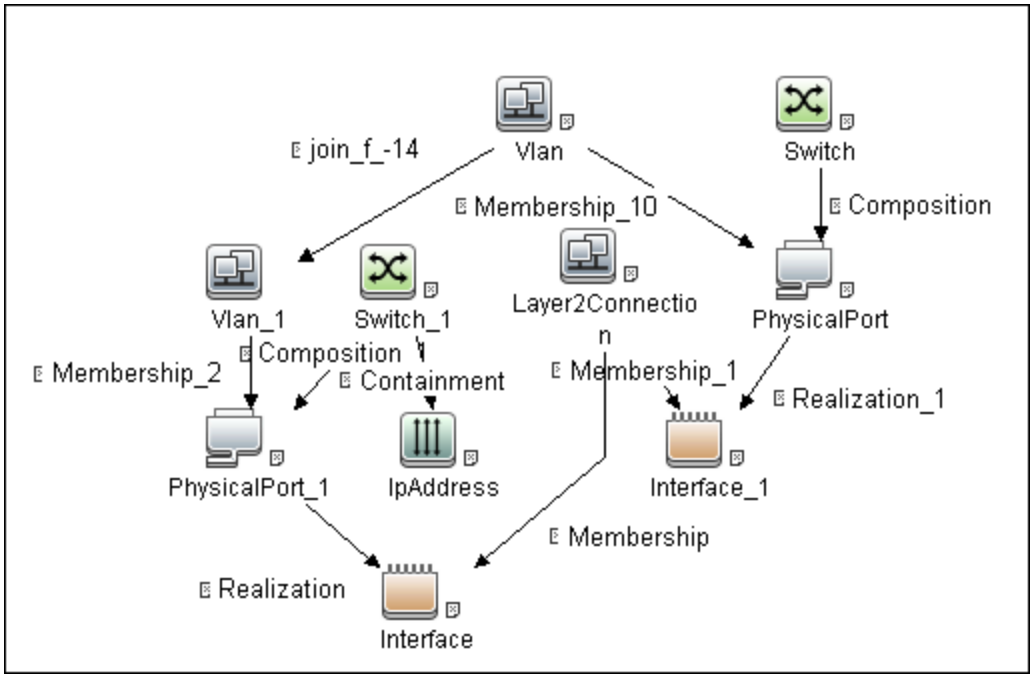
Vlan

Input Query



Node Name	Condition
IP	NOT IP Probe Name Is null

Trigger TQL Query



Node Name	Condition
IpAddress	NOT IP Probe Name Is null

Triggered CI Data

Name	Value
memberId	${MEMBERPORT.root_id}
portId	${PHYSICALPORT.root_id}
vlanId	${SOURCE.vlan_id}

Used Scripts

merge_vlans_by_ports.py

Discovered CITs

- Membership
- PhysicalPort
- Vlan

Process Layer2 Collected Files Adapter

This section includes details about the adapter.

Input CIT

Discovery Probe Manager

Input TQL Query

Used Script

processL2Files.py

Discovered CITs

- Composition
- Interface
- Layer2Connection
- Membership
- Node

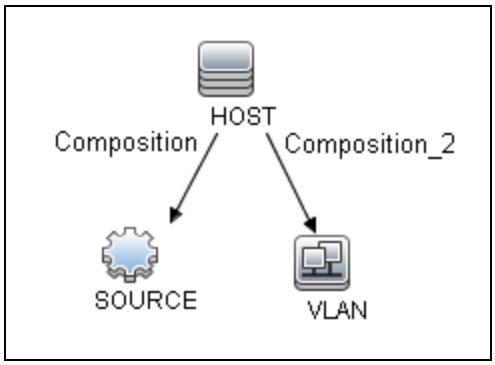
VMS Catalyst by SNMP Adapter

This section includes details about the adapter.

Input CIT

SNMP

Input TQL Query



Triggered CI Data

Name	Value
credentialsId	${SOURCE.credentials_id}
hostId	${SOURCE.application_ip_domain}
ip_address	${HOST.root_id}
snmpCommunityPostfix	${VLAN.vlan_id}

Used Scripts

SNMP_Net_Dis_VMS_catalyst.py

Discovered CITs

- Bridge

- Composition
- Containment
- Dependency
- Membership
- PhysicalPort
- Vlan

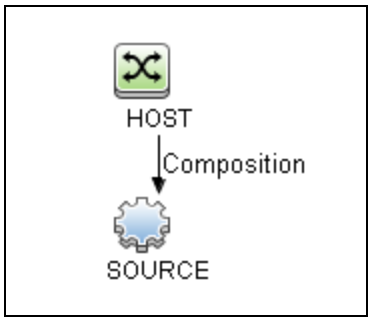
Catalyst Vlans by SNMP Adapter

This section includes details about the adapter.

Input CIT

SNMP

Input TQL Query



Triggered CI Data

Name	Value
credentialsId	${SOURCE.credentials_id}
hostId	${HOST.root_id}
hostModel	${HOST.discovered_model:NA}
hostOs	${HOST.discovered_os_name:NA}

Name	Value
ip_address	${SOURCE.application_ip}
smpDescription	${SOURCE.snmp_description:NA}

Used Scripts

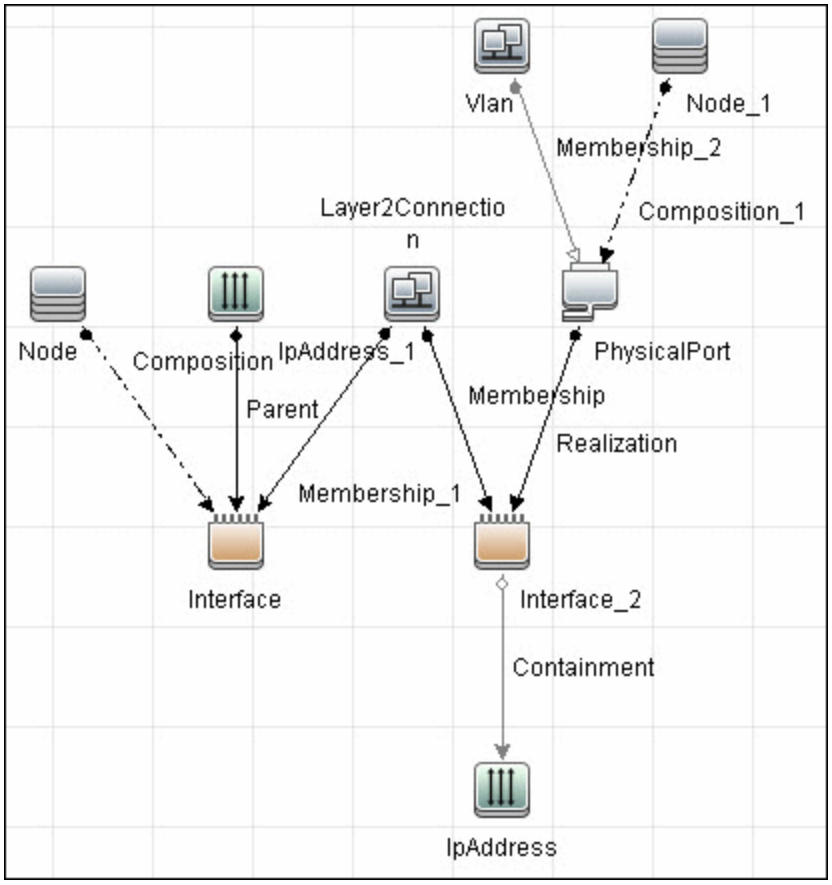
SNMP_Net_Dis_Catalyst_Vlans.py

Discovered CITs

- Bcast Domain
- Composition
- ELAN
- ELAN-VLAN Map
- Membership
- PhysicalPort
- Vlan

Relationships

- A Layer2 switch can be connected to its ports directly or through a VLAN.
- The Bridge CIT represents the basic MAC address (Network Interface Card) on which the ports are located.
- Each port on the switch can be connected to a host or interface object (the end user machines) by a Layer2 CI, or to a port-switch by a Backbone link.



Layer2 Discovery Flow

This section describes the possible use cases and the discovery flow of the Layer2 Discovery.

Possible Use Cases

In general any Layer2 end-to-end discovery scenario might be a composition of the following items:

- Discovery of inter-Switch connectivity
- Discovery of Host to Switch connectivity
- Discovery of Virtual Machine to Physical Switch connectivity

Discovery Flow

In Universal Discovery, a set of Layer2-related jobs must be run in a particular sequence to get the full topology. Though depending on the use case and customer environment, the configuration here might be some shortcuts.

> **Note:** These discovery flows are not isolated ones, and it is expected that some or all of them might be used at the same time to reach the final goal – a full traversal of Layer2 Connections.

Default (Legacy) Flow

This discovery flow is the first one that appeared in UCMDB many years ago. It can report both Switch-to-Switch and Switch-to-Server connections. All the information is fetched from the Switch side, so all discovery jobs trigger on switches or routers and the related topology pieces.

The background idea of this discovery flow is to filter out ignored or virtual MAC addresses in reading the ARP caches for a particular interface on the switch, and then to decide if that port or interface is connected to a Switch or to the Server.

- The criterion that the port is considered to be connected to the Server is that only one physical MAC address is behind that port; otherwise the port is considered to be a Switch-to-Switch connection port.

  If the port or interface is considered to be a Server connectivity port, the Layer2 Connection CI is reported right away; otherwise the data is dumped to the Data Flow Probe File System to make a post-analysis later on in another job and to find the proper second interface on the remote Switch to report a Layer2 Connection CI.
- The criterion according to which interfaces on two different switches are considered to have a relationship is as follows:

a. MAC address of Interface A is present in the ARP cache of Interface B

b. MAC address of Interface B is present in the ARP cache of Interface A

c. If rules **a** and **b** match for more than two interfaces, the length of the ARP caches is also measured, and the one with the lowest amount of MAC addresses is selected, which means that the interfaces are the closest ones; thus the interfaces are the really connected ones.

> **Note:** If a switch port has multiple VLANs assigned, the ARP caches for the very same interface under different VLANs are completely different ones. So "interface" in this topic means the interface instance with the real life limitations and setup.

Prerequisites

- The SNMP protocol is defined.
- Switches related IP address ranges are defined.

Run the discovery

Run the jobs in the following order:

1. **Range IPs by ICMP**
2. **Host Connection by SNMP**
3. **Host Networking by SNMP**
4. **VLANs by SNMP**
5. **VLAN ports by SNMP**
6. **Layer2 Topology VLAN-based by SNMP** – For Switches with VLANs (In the modern world all of them) **or**
   Layer2 Topology Bridge-based by SNMP – For Non-VLAN based Switch connectivity
7. **Process Layer2 Saved Files**

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

Limitations

- It is expected that relationships to virtualization solution boxes are not detected because more than one MAC address will be visible on the interface pointing to, for example, VMware ESX server.
- If some other dummy device or the one does not support the corresponding SNMP Management Information Bases (MIBs) in the Layer2, the device will not be detected.

- For a set of devices that have the same MAC addresses on multiple interfaces, the reported topology might fail to reconcile.

Specific Switch Discovery Protocol Based Flow

The task of finding out "who is on the other side of the wire" is not a new one in the Network Industry. To have a good answer for that question, a set of specialized protocols have been developed. Some of them are open; others are not.

Currently, Universal Discovery supports Cisco Discovery Protocol (CDP) and Link Layer Discovery Protocol (LLDP) as data sources for obtaining the Layer2 related information. In order to get anything using these protocols, it is mandatory for both sides (both devices on the wire) connected to each other to support and activate the same discovery protocol. Due to that fact these protocols are widely referenced as Switch-to-Switch discovery protocols. In general that is true, but last days it is possible to hear that the support for those protocols are added on the OS level as well (for example, Linux) and it will be reasonable to expect that one day that limitation will go away, but as of now only Switch-to-Switch Layer2 connections are expected to be discovered.

Prerequisites

- The SNMP protocol is defined.
- Switches related IP address ranges are defined.
- CDP or LLDP is supported by the target devices.

Run the discovery

Run the jobs in the following order:

1. **Range IPs by ICMP**
2. **Host Connection by SNMP**
3. **Host Networking by SNMP**
4. **Layer2 Topology CDP-LLDP based by SNMP**

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

Limitations

- Only Switch-to-Switch relationships are reported.
- The corresponding protocol must be supported by the device.

Virtual Machine to External Physical Switch Relationship

Currently, only the VMware solution is well supported if the environment is managed by the vCenter. These types of relationships come out from the VMware related jobs, not from the Layer2 discovery. The key point to report such an external topology piece is that VMware ESX servers have a option to support CDP and LLDP protocols, so the information regarding "who is on the other side of the wire" might be available. By default this option is turned off. If this option is enabled by the administrator in the vCenter UI and in the corresponding API, that information becomes available, so you can discover and report it.

> **Note:**
>
> - If the support for CPD or LLDP is enabled on the ESX, it is also possible to fetch the ESX interface to Physical Switch interface via the **Layer2 Topology CDP-LLDP based by SNMP** job, but if no VMware related jobs run, the Virtual Network Topology part will not be available.
> - Virtual Network Topology is modeled in a different manner than the real one, so do not expect to the same network connectivity picture for virtual machines as for physical machines.

Prerequisites

- The VMware VIM protocol is defined.
- IP address ranges are defined.
- CDP or LLDP is supported by the target devices.
- The SNMP protocol is defined for the Physical Switches.

Run the discovery

Run the jobs in the following order:

1. **Range IPs by ICMP**
2. **Host Connection by SNMP** (to get the physical switches in the UCMDB)
3. **VMware vCenter Connection by VIM**
4. **VMware vCenter Topology by VIM**

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

Limitation

Must enable the support for CDP or LLDP on both the ESX server and the connected Switch.

Layer2 Discovery Troubleshooting and Limitations

This section describes troubleshooting and limitations for Layer2 discovery.

- If the results of the discovery return empty, verify that you have access to the discovered SNMP agent (or to the SNMP agent using the special community authentication) and that all the requested MIB tables are responding to SNMP requests from the Data Flow Probe machine. For details on the MIB tables, refer to the appropriate script.
- In cases where the reported bridge MAC address is `000000000000`, "", or `null`, the adapter does not report results.
- If the retrieved basic bridge MAC (retrieved from the `1.3.6.1.2.1.17.1.1` table) is not the same as the given `bridgeId` in the destination data, the adapter returns zero results.
  In the case of SNMP_Dis_L2_Bridge, `bridgeId` is set by bridge_basemacaddr.
  In the case of SNMP_Dis_L2_VLAN, `bridgeId` is set by `vlan_bridgemac`.

Layer2 Discovery Troubleshooting

In general, the following types of issues might occur in the Layer2 discovery:

- "Permission related issues" below
- "Discovery flow related issues" on the next page
- "Reconciliation related issues" on page 1267

Permission related issues

Most of Layer2 discovery jobs are SNMP-based, you must meet the following conditions to perform the actual discovery:

- Device must support the used Management Information Bases (MIBs).
- Discovery user (or community if talking about SNMP v1-v2) must have read permission for the required Object Identifiers (OIDs). The list of used OIDs is specified in the **Required Permissions** section of the corresponding adapter and in the *HPE Universal CMDB Discovery and Integration Content Permissions*.

To identify whether you deal with a permission issue, you should examine the communication log and check the fetched results. If SNMP does not clearly state that you are not allowed to get some data,

and it returns nothing or claims that "required OID doesn't exist", it is strongly recommended that you use the **snmpwalk** tool to manually check if the data is reachable.

Discovery flow related issues

- **Problem:** The **Layer2 Topology VLAN-based by SNMP** job is missing triggers for a particular switch.

  Cause: The **VLANs by SNMP** or **VLAN ports by SNMP** job fails to consistently run against the Switch.

  Solution:

  a. Check the corresponding communication logs if the permissions are set correctly.

  b. If that is SNMPv3, the Content Pack version is prior to CP17, and those are Cisco devices, it is a limitation because "`snmp v3 vlan context handling in CISCO style`" is not supported. This issue is solved in CP17.

  c. On some SNMP agents, there is a bug for SNMPv2 for "Community Postfix" and interface state related MIB, the relevant requests will return nothing even though the permissions are set correctly. This issue can be solved by the agent upgrade.

- **Problem:** The **Layer2 Topology VLAN-based by SNMP** or **Layer2 Topology Bridge-based by SNMP** job has run but no Switch-to-Switch relationships are present.

  Solution: Run the **Process Layer2 Saved Files** job.

- **Problem:** Some particular switch port is connected to a server or another switch but the required Layer2 Connection CI is not there in UCMDB.

  Solution:

  - If talking about the **Layer2 Topology CDP-LLDP based by SNMP** job, you can simply check the communication logs and find out what data is fetched for the problematic port.
  - If this is the default flow, do the following:

    i. Prerequisites – the following information is required:

    - Switch Interface MAC address
    - Switch Interface VLAN if any
    - Which Data Flow Probe has performed the discovery and has access to its File System

    ii. Go to the Data Flow Probe File System and locate the **l2process** folder.

    iii. Search the file context using the OS native search to look for the files coating the specific

MAC address (file names should be in hexadecimal format without extensions)

iv. Among the found files, pick up the one whose first line looks like the following:

<The MAC address that you look for >:::*<Interface Name>*:::*<digits>*:::*<digits>*:::*<digits>*:::*<digits>*:::*<Name>*:::*<Your VLAN ID or None>*

This file contains the interface data in the first line, and the ARP cache for the interface in the specific VLAN.

v. Check how many MAC addresses are present in the second line and if the server side MAC address is present there. As a rule, the referenced MAC address is present but along with other MAC addresses, which prevents the job from creating a Layer2 relationship because it is considered to be a Switch-to-Switch relationship.

vi. If the second attached device is also a switch, you must repeat the above-mentioned steps to find the file for that interface. In case of the Switch-to-Switch relationship, the issue might appear only if those switches and the relevant topology are discovered by different Data Flow Probes. Therefore, the **Process Layer2 Saved Files** job does not simply have all the required information in one place.

To fix this issue, copy the content of the **l2process** directory to a single Data Flow Probe and run the **Process Layer2 Saved Files** job. Such copy must be done on a scheduler basis. This is the limitation of this Flow.

vii. If the second attached device is a server, it means that one of the following happens:

- There is some other network device in the middle that is not discovered.

  Solution: Find out what it is and discover it if possible.

- The remote box is some kind of virtualization solution box, such as X-Frame, or VMware ESX Server. The default flow does not support the virtualization solution hardware boxes. This is a limitation.

- In addition to the real MAC address, some virtual ones are visible from that server. It might happen for some Microsoft based Cluster heartbeat virtual interfaces.

  Solution: Filter out the virtual MAC address to keep only one physical MAC address present.

Reconciliation related issues

Problem: Layer2 Connection CI is reported but the following reconciliation error occurs "`CIs were ignored due to Multiple Match ...`".

Cause: This issue occurs if UCMDB fails to properly identify one of the reported nodes. Most often, this issue occurs when the **Layer2 Topology VLAN-based by SNMP** job runs. The fact is that the only thing that is known about the remote server is the MAC address, which means that if there are more than one interface with such a MAC address in UCMDB, the reported Layer2 topology will fail to reconcile.

Possible Solution: Run the **Report Linux with Duplicated MAC Layer2** job if the "remote" server is Linux and it is discovered. Another option to get the ignored relationship back is to run the **Build Layer 2 CIs using PortNextMAC** enrichment rule, which will report the same topology but based on CI IDs thus solving the reconciliation problem.

Chapter 84: No-Credentials Discovery

This chapter includes:

Overview 1270

How to Set Up the Data Flow Probe Machine 1271

How to Discover Host Fingerprint with nmap 1272

How to Discover Range IPs by nmap 1272

Host Fingerprint using nmap Job 1273

Range IPs by nmap Job 1275

Troubleshooting and Limitations – No-Credentials Discovery 1277

Overview

Nmap is a utility for network exploration that uses raw IP packets to determine which hosts are available on the network, which services those hosts are offering, which operating systems they are running on, and so on.

Nmap also calculates to what extent the operating system result is accurate - for example, 80% accuracy.

DFM uses the nmap utility in the following jobs:

- **Host Fingerprint using nmap**

  This job reports the Nmap accuracy value on the `host_osaccuracy` attribute on the Host CI.

- **Range IPs by NMAP**

  This job reports on live hosts.

How to Set Up the Data Flow Probe Machine

Perform the following procedure on every Data Flow Probe machine that is to run either or both of the **Host Fingerprint using nmap** or **Range IPs by nmap** jobs.

1. Run **nmap-6.25-setup.exe** from **C:\hp\UCMDB\DataFlowProbe\tools\nmap_install**.
2. Accept the terms of the license and click **I agree**. The **Choose Components** dialog box opens.
3. Select **Nmap Core Files**, **Register Nmap Path**, and **WinPcap 4.2.1**.
4. Click **Next**.

   The **Choose Install Location** dialog box opens.
5. Accept the default location or enter another location. Click **Install**.

   Nmap is installed. The WinPcap installation dialog box opens immediately after the Nmap installation is complete.
6. Accept the terms of the license and click **Next**. The **Choose Install Location** dialog box opens.
7. Accept the default location or enter another location. Click **Install**.

   The Finished dialog box opens.
8. Click **Finish**. The WinPcap Options dialog box opens.
9. Clear the check boxes and click **Next**.
10. Click **Finish**.

    The following software is added to the Data Flow Probe machine:

    - Nmap 6.2.5
    - winpcap-nmap 4.1.2
    - Microsoft Visual C++ Redistributable - x86 2010

    To verify, access the **Add/Remove Programs** window.

How to Discover Host Fingerprint with nmap

This task describes how to use the **Host Fingerprint using nmap** job to discover hosts, operating systems, network interfaces, applications, and running services.

This task includes the following steps:

1. Prerequisites- Set up protocol credentials

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

2. Prerequisites - Set up Data Flow Probe machine

   See "How to Set Up the Data Flow Probe Machine" on the previous page.

3. Run the discovery

   This job is triggered on any discovered IP address.

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

How to Discover Range IPs by nmap

This task includes the following steps:

1. Prerequisites - Set up Data Flow Probe machine

   See "How to Set Up the Data Flow Probe Machine" on the previous page.

2. Run the discovery

   Run the **Range IPs by nmap** job.

   For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

Host Fingerprint using nmap Job

This section includes details about the job.

Adapter

This job uses the **OS_Fingerprint** adapter.

Parameters

To view the parameters, go to **Universal Discovery > Discovery Modules/Jobs > Network Infrastructure > No-Credentials Discovery > Host Fingerprint using nmap > Properties tab > Parameters pane**.

For details on overriding parameters, see "Parameters Pane" in the *HPE Universal CMDB Data Flow Management Guide*.

Parameter	Description
Create_ Application_ CI	**True.** Creates an application CI based on the port fingerprint information.
Perform_ Port_ Fingerprints	**True.** Tries to discover opened ports.
discover_ os_name	**True.** Discovers host OS, which may have some inaccuracy.
nmap_host_ timeout	The length of time nmap is allowed to spend scanning a single host (in seconds).
nmap_ location	Full path to nmap executable file. Example: **C:\Program Files (x86)\Nmap\nmap.exe** **Note:** If empty, the job looks in the system path.
scan_ known_ ports_only	Scans for ports listed in the **portNumberToPortName.xml** file. **Default:** False
scan_	Limits the range of ports to be scanned. For example: `T:1-10,42,U:1-30` (discover

Parameter	Description
these_ ports_only	TCP ports 1 to 10 and 42 and UDP ports 1-30). If this parameter is left empty, the Nmap default is used.

Discovered CITs

To view discovered CITs, select a specific adapter in the Resources pane.

For details, see "Discovered CITs Pane" in the *HPE Universal CMDB Data Flow Management Guide*.

Range IPs by nmap Job

This section includes details about the job.

Adapter

This job uses the **IpRange_by_nmap** adapter.

Parameters

To view the parameters, go to **Universal Discovery > Discovery Modules/Jobs > Network Infrastructure > Basic > Range IPs by nmap > Properties tab > Parameters pane**.

For details on overriding parameters, see "Parameters Pane" in the *HPE Universal CMDB Data Flow Management Guide*.

Name	Description
excludePatternsList	A list of wildcard patterns, separated by semicolons. IP addresses matching any of the patterns are skipped. The pattern may include numbers, dots, or the wildcards ***** (matches zero or more characters) or **?** (matches exactly one character).
nmap_location	Full path to the **nmap** executable file. Example: **C:\Program Files (x86)\Nmap\nmap.exe** **Note:** If empty, the job looks in the system path.
range	A range of IPs to ping, separated by a semicolon. For example: 1.2.3.0-1.2.3.10;1.2.3.50-1.2.3.60

Discovered CITs

IpAddress

Discovery Flow

The discovery is performed for each range specified in the probe, as follows:

1. Filter IPs in range, applying the patterns specified in the **excludePatternsList** parameter.
2. Perform ping scan on filtered IPs.

   > **Note:** Nmap performs a ping scan of filtered IPs, 10 at a time. So, if 100 IPs are passed to check, the nmap command executes 10 times. This is because of command line size limitations, especially in Windows.

3. Send live IPs to UCMDB before processing the next range.

Troubleshooting and Limitations – No-Credentials Discovery

This section describes troubleshooting and limitations for No-Credentials discovery.

Error Message	Reason	Solution
Can't parse XML document with Nmap results. Skipped.	nmap.exe failed before it could create a valid XML file.	• Try to restart the Nmap job. • Try to reduce the number of threads for the Nmap job.
Error nmap result file is missing	nmap.exe failed before it could create an XML file.	• Try to restart the Nmap job. • Try to reduce the number of threads for the Nmap job.
The system cannot execute the specified program (in the communication log file)	The Windows system cannot launch the Nmap application.	Verify that: • The correct Nmap version has been downloaded and installed. • WinPcap has been installed. For details on these installations, see "Prerequisites- Set up protocol credentials" on page 1272. If you have installed Nmap and WinPcap, and the error message still appears in the communication log, install **vcredist_x86.exe** from **C:\hp\UCMDB\DataFlowProbe\runtime\probeManager\discoveryResources**.
Nmap is not installed on Probe machine	Nmap is not installed on the Probe machine.	Try to launch Nmap from the command line. Make sure that Nmap is installed. For details on the installation, see "Prerequisites- Set up protocol credentials" on page 1272.

Chapter 85: Active and Passive Network Connections Discovery

This chapter includes:

- Overview 1279
- Supported Versions 1279
- Topology 1280
- How to Discover Processes 1281
- TCP Traffic Jobs 1282
- Network Connectivity Data Analyzer Job 1283
- TcpDiscoveryDescriptor.xml File 1285
  - Server Detection Approaches 1285
  - Filtering 1286
  - Reporting 1287

Overview

All jobs in these modules run queries against the Data Flow Probe's PostgreSQL database to retrieve network connectivity information inserted by the **Host Resources and Applications** and/or **TCP By Shell/SNMP** and/or **Collect Network Data by Netflow** jobs.

For details on Host Resource jobs, see "Host Resources and Applications Discovery" on page 842.

The Data Flow Probe includes a built-in PostgreSQL database so there is no need to install a separate PostgreSQL instance for NetFlow. Instead, data is saved to a dedicated scheme (called `netflow` for historical reasons).

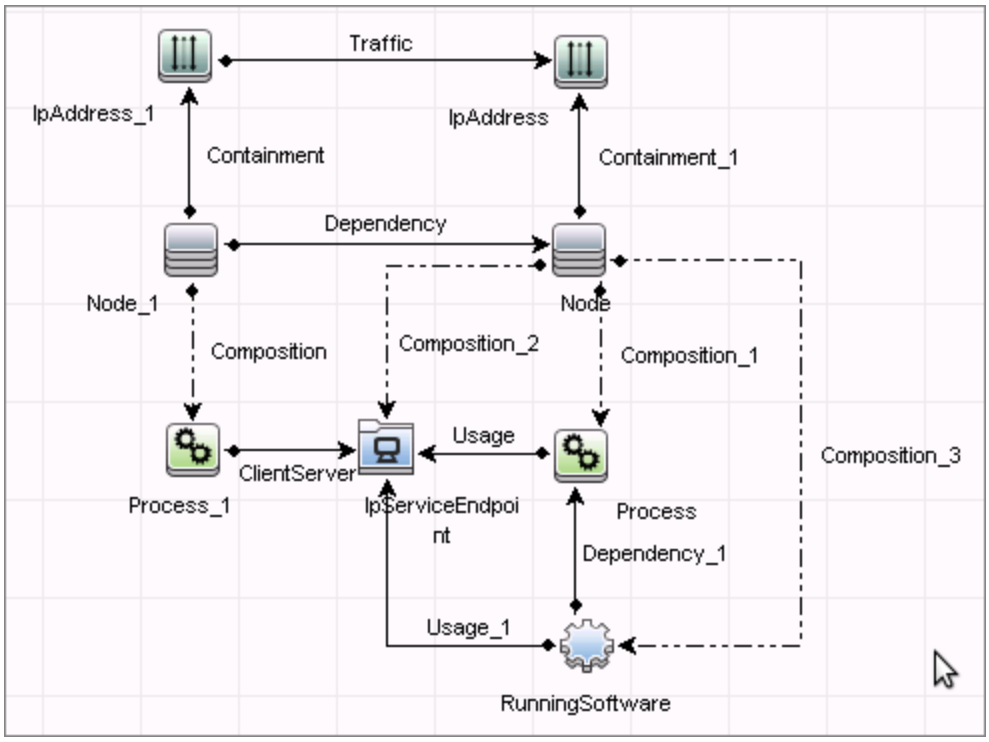
Supported Versions

This discovery supports NetFlow versions 5, 9, and v10 (IPFIX).

> **Note:** By default, support for NetFlow versions is enabled. To disable support for any version, set the **flow.collector.V{netflow_version}.enabled** property in the **NetFlow.properties** file to false.

Topology

Network Connection Passive Discovery



How to Discover Processes

This task describes how to discover processes.

This task includes the following steps:

1. Prerequisite - Set up protocol credentials

   To discover network connections, define the following protocols:

   - SNMP protocol
   - NTCMD protocol
   - SSH protocol
   - Telnet protocol
   - WMI protocol

   For credential information, see "Supported Protocols" in the *HPE UCMDB Discovery and Integrations Content Guide - Supported Content* document.

   > **Note:** None of these protocols is mandatory, but WMI alone does not retrieve network data.

2. Run the discovery

   Run the following jobs in the following order:

   - Run the **TCP Data by Shell** or **TCP Data by SNMP** job to populate the Probe's PostgreSQL database with TCP information gathered from the remote machine. For details, see "TCP Traffic Jobs" on the next page.
   - Run the **Network Connectivity Data Analyzer** job. For job details, see "Network Connectivity Data Analyzer Job" on page 1283.

TCP Traffic Jobs

The **TCP Data by Shell** and **TCP Data by SNMP** jobs enable you to collect information about TCP traffic. These jobs do not send CIs to the CMDB but run queries against existing data in the Data Flow Probe's database.

These jobs are enhanced with the following parameters that enable you to capture TCP data and to configure the time delay between captures:

Parameter	Description
CaptureProcessInformation	**true**: process information is captured and stored in the Data Flow Probe's database. No CIs are reported. Processes are captured with the same method as that used by the Host Resources and Applications job. For details on Host Resource jobs, see "Host Resources and Applications Discovery" in the *HPE UCMDB Discovery and Integrations Content Guide - Discovery Modules* document.
DelayBetweenTCPSnapshots	The number of seconds between TCP snapshot captures. The default is 5 seconds. It can be useful to take several TCP snapshots during a single job invocation, to retrieve more detailed data. For example, when running the **netstat -noa** command on a remote Windows system to gather TCP information, this parameter can capture process information at 5-second intervals during the command run.
NumberOfTCPSnapshots	The number of TCP snapshots to take.
lsofPath	The path to the `lsof` command that enables process communication discovery on UNIX machines. The default value is **/usr/local/bin/lsof,lsof,/bin/lsof**.
useLSOF	**true:** discovery tries to use **lsof** utility to discover port-to-process mappings on UNIX machines. **Default:** True
useNetstatOnly	Specifies whether or not to run additional commands (lsof and pfiles) or to use the netstat command only. **Default:** False

Network Connectivity Data Analyzer Job

This job allows users to capture TCP communication information from the IT Server infrastructure and model them inside the UCMDB. It can be configured to report customized topology. For details, see "TcpDiscoveryDescriptor.xml File" on page 1285.

Adapter

This job uses the Network_Connectivity_Data_Analyzer adapter.

- Adapter Parameters

Parameter (A-Z)	Description
acceptedServices	Lists the services to be reported (ssh, oracle, mysql, and so on). When the value is set to **known_services**, a server running software is reported only if the service it represents is configured as **discover="1"** in the **portNumberToPortName.xml** file. When the value is set to '*', all found services are reported.
discoveryDescriptorFile	The full path to a job configuration file used to define the analysis and reporting approach per IP range scope.
includeOutscopeClients	**True.** Enables reporting of outscope clients. **False.** Disables reporting of outscope clients.
includeOutscopeServers	**True.** Enables reporting of outscope servers. **False.** Disables reporting of outscope servers.
reportIpTrafficLink	**True.** Enables reporting of traffic link. **False.** Disables reporting of traffic link.
reportNodeDependencyLink	**True.** Enables reporting of dependency link. **False.** Disables reporting of dependency link.
reportServerRunningSoftware	**True.** Enables reporting of server running software. **False.** Disables reporting of server running software.

Discovered CITs

- Client-Server. DFM determines which machine is the server and which is the client:
  - If one end is discovered as a listening port, then this end is presumed to be a server.
  - If one end fits the minimal condition of **StatisticBasedApproach** (see server detection approaches section) it is presumed to be a server.
  - If both ends have just one connection to a port, DFM identifies whether the end is a server by checking the ports and the **portNumberToPortName.xml** file (Go to **Adapter Management > Resources** pane, click the **Find resource** button, enter **portNumberToPortName.xml** in the **Name** field, and then click the **Find Next** button).
- Composition
- Containment
- Dependency. Link is set between discovered client and server.
- IpAddress
- IpServiceEndpoint
- Node
- Traffic. Link is set between IP addresses.
- Usage

TcpDiscoveryDescriptor.xml File

The **TcpDiscoveryDescriptor.xml** file defines rules for analysis and reporting per IP range scope.

This section includes:

- "Server Detection Approaches" below
- "Filtering" on the next page
- "Reporting" on page 1287

Server Detection Approaches

The **serverDetectionApproach** tag contains a list of approaches used to resolve client server relation.

ListenPortsBasedApproach	Resolves a relation based on the **LISTEN** or **ESTABLISHED** connection state. It is necessary to run process-to-process discovery to be able to use that approach. If the port is opened for listening the host is resolved as server, so the second member of a connection is resolved as client automatically; and vice versa.
KnownPortsBasedApproach	Resolves a relation based on known a server port list defined in the **portNumberToPortName.xml** file.
StatisticBasedApproach	Resolves a relation based on a minimal condition. If the condition value is zero it is not taken in to account. Valid conditions are: • **minClients.** Minimum connections count to indicate host as a server. • **minPackets.** Minimum total packets count sent and received by a host to indicate it as a server. • **minOctets**. Minimum total octets count sent and received by a host to indicate it as a server.

> **Note:** An approach can be deactivated if its active attribute is set to **false** or the tag responsible for the approach is commented out or removed.

Filtering

The **Filtering** section defines filter rules applied to discovered clients and servers.

> **Note:** A host is filtered if at least one of the filters is applied to it.

The filter types are:

- "Range Filter" below
- "Service Filter" on the next page

Range Filter

The Range filter performs filtering on a per-IP-range basis.

Example:

range filter definition

```
<ranges>
    <include>
        <range>probe_ranges</range>
    </include>
    <exclude>
        <range>outscope_clients</range>
    </exclude>
</ranges>
```

Ranges that must be included in the final reporting topology should be defined in the **<include>** tag. Ranges that must be excluded should be defined in **<exclude>** tag. The following keywords should be used to define specific ranges:

Keyword	Description
probe_ranges	Includes all ranges defined using the Protocol Manager.
outscope_clients	Includes all client IPs that are out of Probe range scope.
outscope_servers	Includes all server IPs that are out of Probe range scope.
ddm_related_ connections	Includes the Probe IP. Allows user to filter DFM-related connections initiated during the discovery process.

Service Filter

The Service filter performs filtering of discovered servers according to the specified list of services. Mapping between service name and relevant port is done according to definitions in the **portNumberToPortName.xml** file.

Example:

range filter definition

```
<services>
    <include>
        <service name="*" />
    </include>
    <exclude>
        <service name="ssh" />
    </exclude>
</services>
```

Services that must be included in final reporting topology are defined in **<include>** tag. Services that must be excluded are defined in **<exclude>** tag. When the **service name** value is "*" (asterisk), all servers found.

> **Note:** A service can be deactivated if its active attribute is set to **false** or the tag responsible for the service is commented out or removed.

Reporting

The **Reporting** section is responsible for defining filter rules and lists of active reporters. The **configuration** tag defines default filtering rules for all the reporters. A reporter can override a filtering rule by defining the **<filtering>** tag in its body. Each reporter is responsible for the topology being reported.

> **Note:** A reporter can be deactivated if its active attribute is set to **false** or the tag responsible for the reporter is commented out or removed.

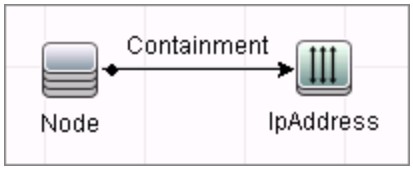
The following reporters are available:

- **Default**. For details, see "Default Reporter" on the next page.
- **clientProcess**. For details, see "Client Process Reporter" on page 1289.
- **clientServerLink.** For details, see "Client Server Link Reporter" on page 1290.

- **ipTrafficLink.** For details, see "IP Traffic Link Reporter" on page 1291.
- **nodeDependencyLink.** For details, see "Node Dependency Link Reporter" on page 1292.
- **serverProcess.** For details, see "Server Process Reporter" on page 1293.
- **serverRunningSoftware.** For details, see "Server Running Software Reporter" on page 1294.

Default Reporter

If no reporters are activated, the job returns the **IP** and **Node** CIs linked by the **containment** relationship only.



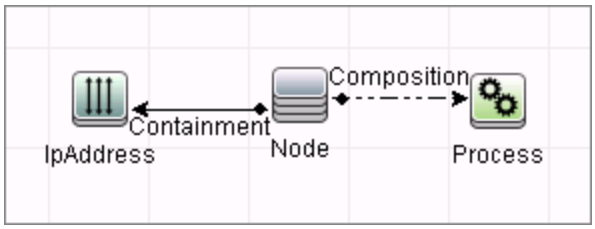
Client Process Reporter

This reporter reports client processes.

reporter definition

```
<reporting>
    <reporter name="clientProcess" active="true"/>
</reporting>
```

Topology



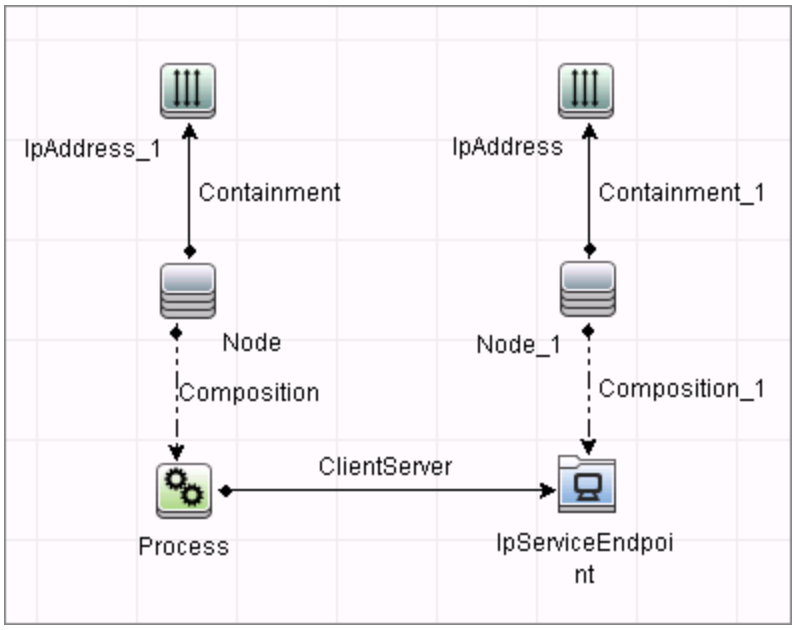
• Client Server Link Reporter

This reporter reports the client process communication endpoint and the client-server link between them (even if clientProcess active="false").

reporter definition

```
<reporting>
    <reporter name="clientServerLink" active="true"/>
</reporting>
```

Topology



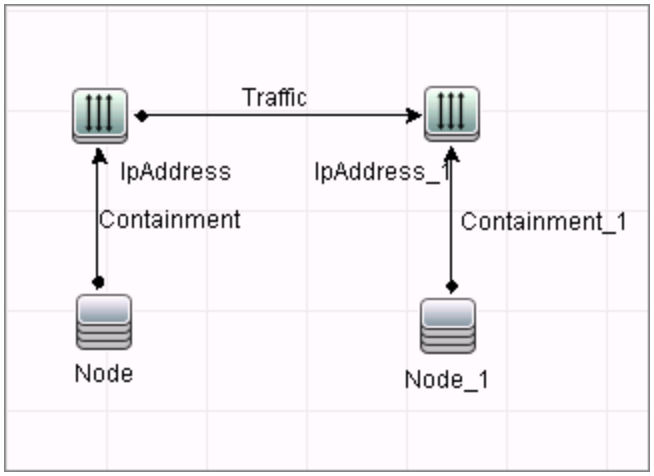
• IP Traffic Link Reporter

This reporter the traffic link between IPs. The **reportTrafficDetails** attribute indicates whether the job should report the **octetCount**, **packetCount** and **portset** attributes of the link.

reporter definition

```
<reporting>
    <reporter name="ipTrafficLink" active="true" reportTrafficDetails="true"/>
</reporting>
```

Topology



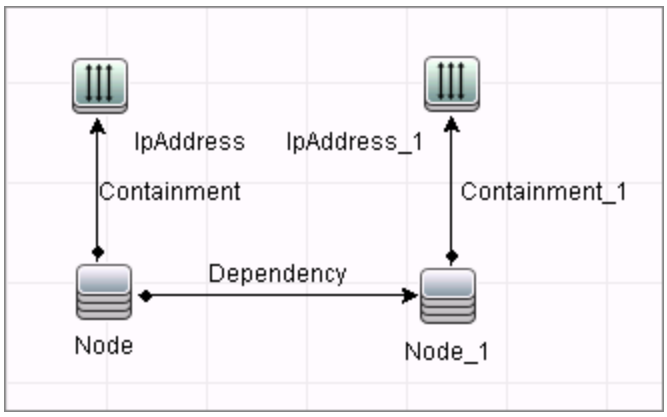
• Node Dependency Link Reporter

This reporter reports the dependency link between discovered nodes.

reporter definition

```
<reporting>
    <reporter name="nodeDependencyLink" active="true"/>
</reporting>
```

Topology



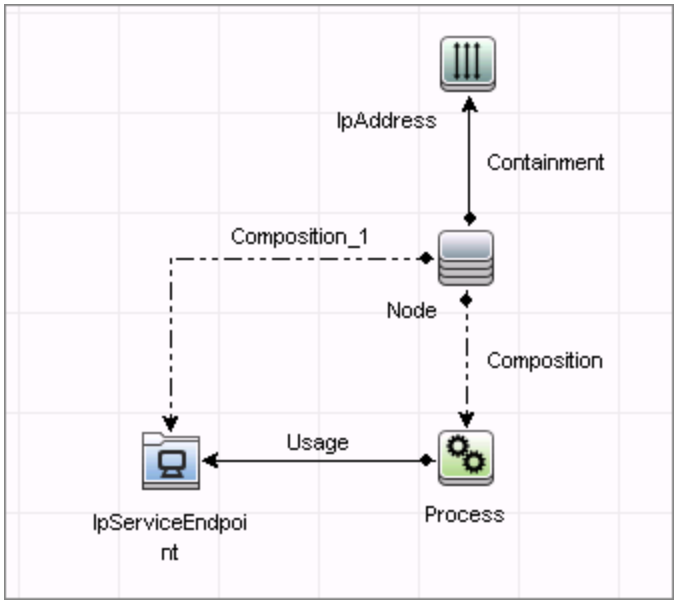
• Server Process Reporter

This reporter reports the server process. The **linkWithCommunicationEndpoint** attribute indicates whether the reporter should link the process with the discovered communication endpoint (with 'usage' link).

reporter definition

```
<reporting>
    <reporter name="serverProcess" active="true" linkWithCommunicationEndpoint="true"/>
</reporting>
```

Topology



- ## Server Running Software Reporter

  This reporter reports server running software linked with communication endpoint (with 'usage' link) and server process. The **linkWithProcess** attribute indicates whether the reporter should link the discovered running software with the server process (with '**dependency**' link).

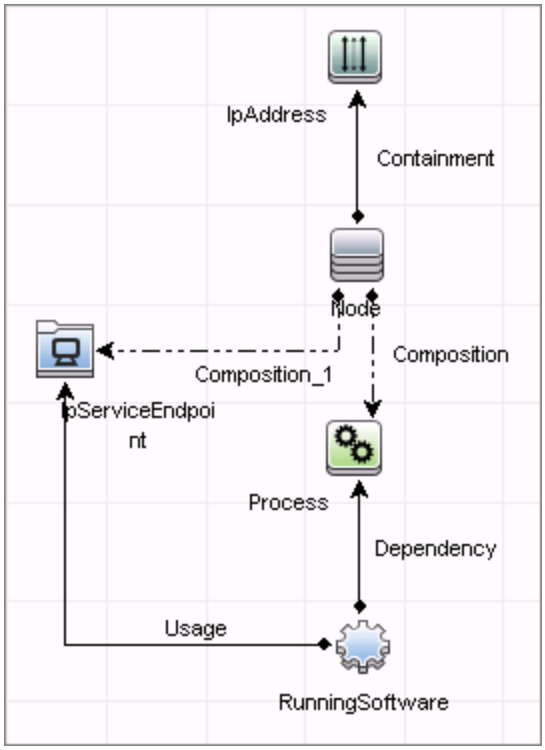
  The reporting of server running software is dependent on the **acceptedServices** parameter:

  - If set to **known_services**, a server running software is reported only if the service it represents is configured as **discover="1"** in the **portNumberToPortName.xml** file.
  - If set to '*', all found services are reported.
  - If it contains any TCP ports or service names, the job reports only the running software that works with these ports.

  reporter definition

```
<reporting>
    <reporter name="serverRunningSoftware" active="true" linkWithProcess="true"/>
</reporting>
```

  Topology



Part 16: Tools and Samples > Discovery Samples

Chapter 86: Dynamic Credential Sample Job

This section includes details about the job.

Introduction

This job serves as a sample of how to dynamically create and use credentials for connecting to remote machines.

Trigger TQL

None

Adapter Information

This job uses the **Dynamic Credential Sample** adapter.

Adapter Type

Jython

Input CIT

Node

Input TQL

Used Scripts

DynamicCredentialSample.py

Chapter 87: Config Parser Adapter

This adapter serves as a sample of how to get and parse the configuration file of a running software and report an IP address.

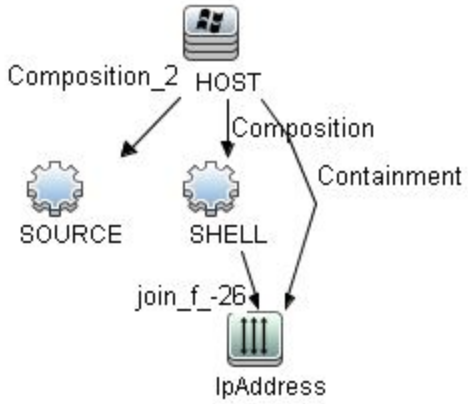
Adapter Type

Jython

Input CIT

RunningSoftware

Input TQL



Triggered CI Data

Name	Value
Protocol	${SHELL.root_class}
credentialsId	${SHELL.credentials_id}
host_ips	${IpAddress.name}
ip_address	${SHELL.application_ip}

Name	Value
product_name	${SOURCE.discovered_product_name}
version	${SOURCE.version}

Used Scripts

Config_Parser_Main.py

Required Permissions

Permission	Operation	Usage Description	Objects and Parameters
Shell	exec	Any command	Windows/UNIX: Any command -l

Required Discovery Protocols

- NTCMD Protocol
- SSH Protocol
- Telnet Protocol
- Universal Discovery Protocol

Discovered CITs

IpAddress

Global Configuration Files

globalSettings.xml

Adapter Parameters

Name	Value
configFileLocation	C:\configuration.txt
groupOfMatchResult	1

Name	Value
productName	Dataflow Probe
regexMatcher	^IP=(.*)$

Chapter 88: Execute Command Adapter

This adapter serves as a sample of how to execute commands on a host.

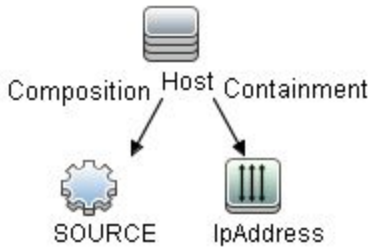
Adapter Type

Jython

Input CIT

Shell

Input TQL



Triggered CI Data

Name	Value
Protocol	${SOURCE.root_class}
connected_os_credentials_id	${SOURCE.connected_os_credentials_id:NA}
credentialsId	${SOURCE.credentials_id}
hostId	${SOURCE.root_container}
host_ips	${IpAddress.name}
ip_address	${SOURCE.application_ip}
language	${SOURCE.language:NA}

Used Scripts

Execute_Command_Main.py

Required Permissions

Permission	Operation	Usage Description	Objects and Parameters
Shell	exec	Any command	Windows/UNIX: Any command -l

Required Discovery Protocols

- NTCMD Protocol
- SSH Protocol
- Telnet Protocol
- Universal Discovery Protocol

Discovered CITs

Node

Global Configuration Files

globalSettings.xml

Adapter Parameters

Name	Value
remoteCommandUNIX	echo "UNIX testing"
remoteCommandWin	echo "Windows testing"
storeToAttribute	data_note

Part 17: Tools and Samples > Discovery Tools

Chapter 89: File Monitor by Shell Job

This section includes details about the File Monitor by Shell job.

Trigger Query

None

Job Parameters

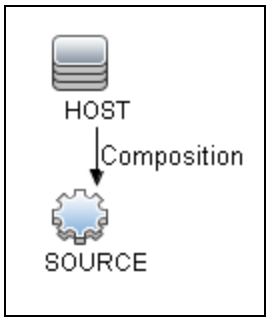
Parameters are not overridden by default and use values from the adapter.

Adapter Information

This job uses the **FILE_Mon** adapter.

Input CIT

Shell



Triggered CI Data

Name	Value
codepage	${SOURCE.codepage:NA}
connected_os_credentials_id	${SOURCE.connected_os_credentials_id:NA}

Name	Value
credentialsId	${SOURCE.credentials_id}
hostId	${HOST.root_id}
ip_address	${SOURCE.application_ip}
language	${SOURCE.language:NA}
Protocol	${SOURCE.root_class}

Used Scripts

- file_ver_lib.py
- file_mon_utils.py
- file_mon.py

Discovered CITs

- Composition
- ConfigurationDocument

Adapter Parameters

Name	Default Value	Description
binary_file_extensions	exe, bin, dat	This parameter defines what type of files are binary so that content is not read from those files.
discoverUnixHiddenFiles	false	This flag determines whether to discover hidden files on Unix-like systems. If **true** then all hidden files are discovered. This parameter is not dependent on the values assigned to the extensions parameter.
extensions	cfg, conf, txt, xml, exe, bin, dat	This parameter defines the files extensions that the discovery looks for.
folders	C:\temp,D:\temp	A list of folders from which to gather files.
recursively	false	This flag determines whether to scan folders recursively.

Global Configuration File

globalSettings.xml

Troubleshooting and Limitations

This section describes troubleshooting and limitations for file discovery, when running the **File Monitor by Shell** job.

- The **File Monitor by Shell** does not trigger automatically. This is because there is no trigger TQL query for this job: an automatic trigger on all destinations may cause an out-of-memory error on the Data Flow Probe. To solve this problem, add the triggered CI manually.
- When running the **File Monitor by Shell** job, discovering files of more than 2Mb may cause an out-of-memory error.

Chapter 90: HPE Serviceguard and Oracle RAC Discovery

This chapter includes:

Overview 1307

Supported Versions 1307

How to Run the Link DB DataFiles and Clustered FS Job 1307

Link DB Datafiles With Clustered FileSystem Adapter 1308

Link DB DataFiles and Clustered FS Job 1310

Overview

This job is a part of the support for HPE Serviceguard and Oracle RAC. The introduced mechanism allows reporting of an indirect link between an Oracle database instance and the HPE Serviceguard package through FS resources.

Supported Versions

This job supports HP-UX 10 and HP-UX 11 with Oracle RAC 10i.

How to Run the Link DB DataFiles and Clustered FS Job

1. Prerequisites

   The job does not require any credentials, because it is simply a complex enrichment. Therefore, the only prerequisite is that the particular topology should be present in UCMDB to make the job trigger.

2. Run the discovery

   Run the following jobs:

   a. Run the **Range IPs by ICMP** job.

   b. Run the **Host Connection by Shell** job.

   c. Run the **Host Resources by Shell** and **Host Applications by Shell** jobs.

   d. Run the **Service Guard Cluster Topology** job.

   e. Run the **Oracle Topology by SQL** job.

   f. Run the **Link DB DataFiles And Clustered FS** job.

      For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide.*

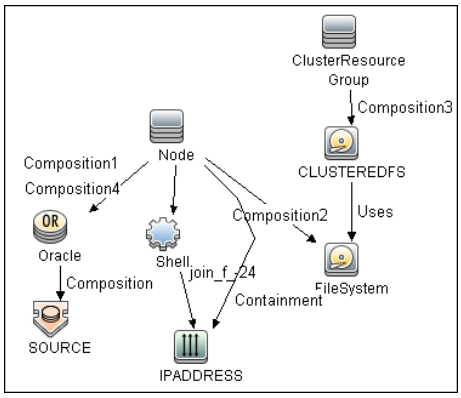
Link DB Datafiles With Clustered FileSystem Adapter

This section includes details about the adapter.

Input CIT

DB Data File

Input Query



Triggered CI Data

Name	Value
dbFileId	${SOURCE.root_id}
dbFilePath	${SOURCE.name}
fsId	${CLUSTEREDFS.root_id}
mountPoints	${CLUSTEREDFS.mount_point}

Used Script

- linkDbDatafileAndFs.py

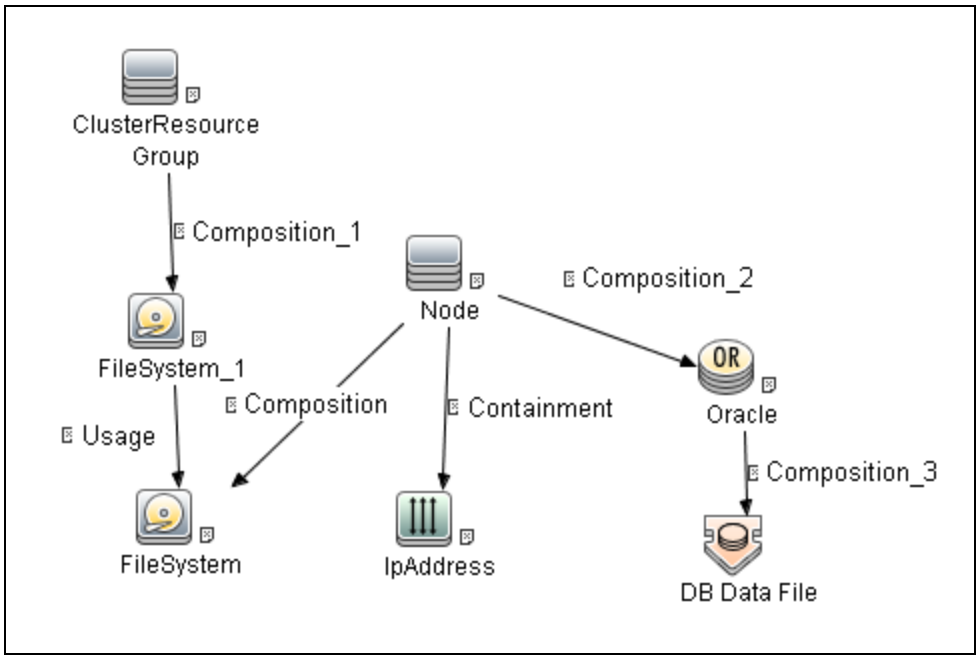
Discovered CITs

- DB Data File
- FileSystem
- Node
- Usage

Link DB DataFiles and Clustered FS Job

This section includes details about the job.

Trigger Query



Discovery Flow

The approach for linking DB Data File and File System is as follows:

1. The **Service Guard Cluster Topology by TTY** job reports File System Objects that are mount points of the Serviceguard package. So, these are File System package resources.
2. The **Oracle Topology by SQL** job reports Oracle DB and DB Data Files.
3. Where there is a topology in which ClusteredResource Groups has FS resources, and on at least one node of this cluster there is a running Oracle database with discovered DB Data Files, the **Link DB DataFiles and Clustered FS** job looks at all mount point and DB Data Files. The job finds valid relationships between them, if any, and reports each as a new link.

Chapter 91: Merge Clustered Software

This chapter includes:

Overview 1312

Supported Software 1312

How to Merge Clustered Software 1312

Merge Clustered Software Job 1313

Troubleshooting and Limitations – Merge Clustered Software 1316

Overview

This document describes the usage and functionality of the **Merge_Clustered_software** discovery package. The package makes it possible to merge CIs which show the presence of a particular RunningSoftware on a cluster Node with a Clustered Service.

Supported Software

This discovery package supports the discovery of:

- HPE ServiceGuard Cluster with:
  - Oracle Database
  - Oracle TNS Listener
  - Oracle iAS
- Microsoft Cluster Server (MSCS) with:
  - Microsoft SQL Server

How to Merge Clustered Software

Activate the discovery job.

For details on running jobs, see "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide*.

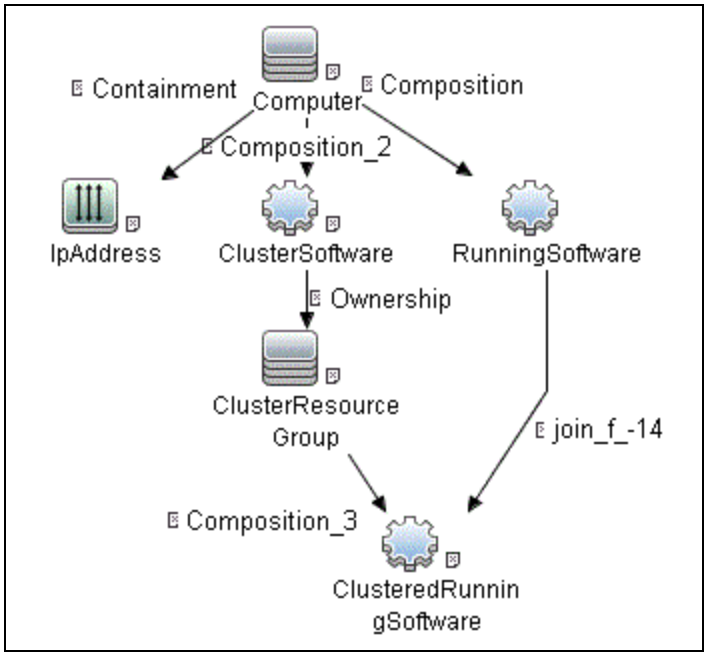
> **Note:** To widen the scope of the discovery, the user should update the Trigger TQL Query and the Input TQL Query by adding the appropriate CIT names to the parameters. No additional changes are required.

Merge Clustered Software Job

This section includes details about the job.

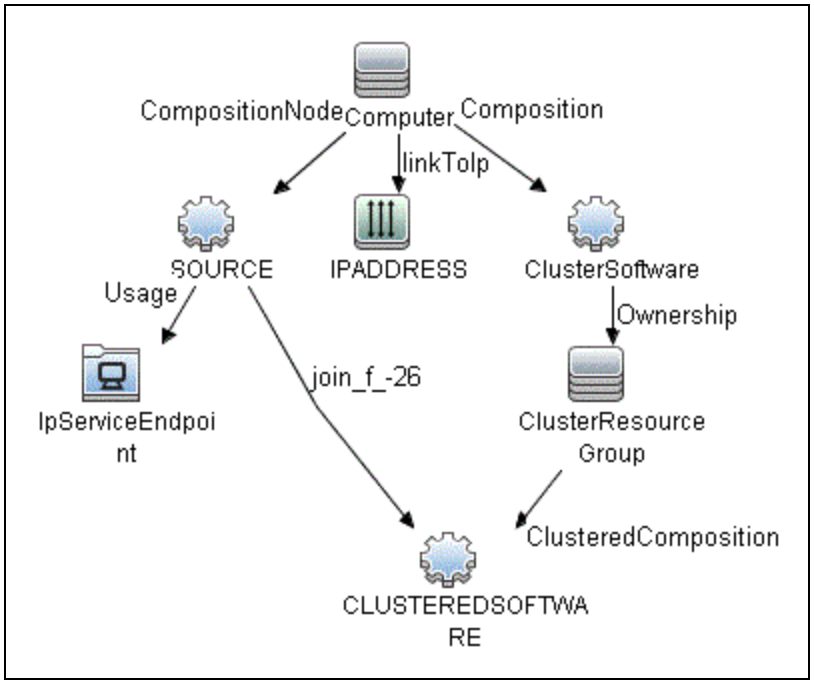
Trigger TQL Query

The following graphic shows the Trigger TQL Query for merging clustered software.



Input TQL Query

The following graphic shows an Input TQL Query for merging clustered software.



Triggered CI Data

Name	Value
className	${SOURCE.root_class}
clusteredContainer	${ClusterResourceGroup.root_id}
clusteredUcmdbIds	${CLUSTEREDSOFTWARE.root_id}
discProdName	${CLUSTEREDSOFTWARE.root_id}
ipServiceEndpointIds	${IpServiceEndpoint.root_id:}
localHostId	${SOURCE.root_container}
localSoftwareId	${SOURCE.root_id}
productName	${SOURCE.product_name:NA}
remoteSoftwareName	${CLUSTEREDSOFTWARE.name}
softwareName	${SOURCE.name}

Discovered CITs

- Node
- RunningSoftware

Used Script

- mergeClusteredSoftware.py

reated/Changed Entities

Entity Name	Type	Description
mergeClusteredSoftware.py	Script	Discovery Script
Merge_Clustered_Software.xml	Pattern	Discovery Pattern
Merge Clustered Software.xml	Job	Discovery Job
mergeDiscClusteredSoft.xml	TQL Query	Trigger TQL Query

Troubleshooting and Limitations – Merge Clustered Software

This section describes troubleshooting and limitations for Merge Clustered Software Discovery.

Problem: Some duplicate Clustered Software instances occur after users run the **Merge Clustered Software** job.

Possible Cause: The **MSSQL Topology by SQL** job incorrectly reports MS Clusters as SQL Server instances. This issue was fixed in UCMDB 10.22 or later by adding a new parameter **reconciliation.prefer.crg.container** to the **setSettingValue** JMX method in the **UCMDB:service=Settings Services** category. By default, this parameter is **false**. If **true**, Cluster Resource Group (CRG) is selected as the **root_container**.

Solution: To solve this problem, do the following:

1. Go to **JMX Console > UCMDB:service=Settings Services > setSettingValue**.
2. In the **name** field, enter **reconciliation.prefer.crg.container**.
3. In the **value** field, enter **true**.
4. Click **Invoke**.
5. Clear the Data Flow Probe result cache and rerun the **Merge Clustered Software** job.

Chapter 92: TCP/UDP Ports Discovery by Nmap

This chapter includes:

Overview 1318

Supported Versions 1318

How to Discover TCP/UDP Ports by Nmap 1318

TCP Ports Job 1319

Overview

This discovery allows you to discover, on a particular host, the open TCP or UDP ports of the known server ports.

Supported Versions

This discovery supports Nmap version 6.25 and later.

How to Discover TCP/UDP Ports by Nmap

1. Prerequisites - Set up the Data Flow Probe machine

   Perform the following procedure on every Data Flow Probe machine that is to run the TCP Ports job.

   a. Run **nmap-6.25-setup.exe** from **C:\hp\UCMDB\DataFlowProbe\tools**.

   b. Accept the terms of the license and click **I agree**. The **Choose Components** dialog box opens.

   c. Select **Nmap Core Files**, **Register Nmap Path**, and **WinPcap 4.1.2**.

   d. Click **Next**.

      The **Choose Install Location** dialog box opens.

   e. Accept the default location or enter another location. Click **Install**.

      Nmap is installed. The WinPcap installation dialog box opens immediately after the Nmap installation is complete.

   f. Accept the terms of the license and click **Next**. The **Choose Install Location** dialog box opens.

   g. Accept the default location or enter another location. Click **Install**.

      The Finished dialog box opens.

   h. Click **Finish**. The WinPcap Options dialog box opens.

   i. Clear the check boxes and click **Next**.

j. Click **Finish**.

The following software is added to the Data Flow Probe machine:

- Nmap 6.25
- winpcap-nmap 4.1.2
- Microsoft Visual C++ Redistributable - x86 2010

To verify, access the **Add/Remove Programs** window.

2. Run the discovery

Run the following jobs:

a. **Range IPs by ICMP** or **Range IPs by nmap** to discover which of the machines in the IP range are up.

b. **TCP Ports** job.

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide.*

TCP Ports Job

This section includes details about the job.

Adapter

This job uses the **TCP Ports Discovery** adapter.

Trigger Query

Node Conditions

Node Name	Condition
IpAddress	`NOT IP Probe Name Is null`

Job Parameters

Name	Default Value	Description
checkIfIpIsReachable	true	This flag indicates whether the job should check if the discovered IP is reachable before the job starts to check availability of the host's ports.
checkOnlyKnownPorts	true	This flag indicates whether the job should discover only known ports. This flag does not cancel the **ports** or **UDPports** parameters. Setting this flag to **false** is applicable only with a real port range in the **ports** or **UDPports** parameter.
connectTimeOut	5000	The timeout (in milliseconds) when connecting to an IP and port.
nmapPath		The full path to the nmap executable file (for example: **C:\Program Files (x86)\Nmap\nmap.exe**).
pingTimeOut	2000	The ICMP ping timeout (in milliseconds).
ports	**For JEE TCP Ports job:** • weblogic, weblogicSSL, websphere_jmx, rmi **For Databases TCP Ports job:** • oracle, db2, sybase, sql, mysql **For SAP TCP Ports job:** • sap, sap_jmx, sap_http, sap_https	This parameter contains a list of TCP ports on which discovery is performed. This list can include ranges, separate port numbers, and known protocol names (such as http, ftp, etc.) and must be comma separated. If this list is empty or contains the value *, discovery is performed only on all known TCP ports. If a port range is entered (such as 1000-1100), discovery is performed only on all known ports in that range if **checkOnlyKnownPorts=true**.

Name	Default Value	Description
	For SAP TCP Ports job: no default value	
scanUDP	false	This flag indicates whether or not to scan UDP ports. **Note:** UDP scanning is supported only if **useNMap=true** (see below).
UDPports		This parameter contains a list of UDP ports on which discovery is performed. This list can include ranges, separate port numbers, and known protocol names (such as http, ftp, etc.) and must be comma separated. If this list is empty or contains the value *****, discovery is performed only on all known UDP ports. If a port range is entered (such as 1000-1100), discovery is performed only on all known ports in that range if **checkOnlyKnownPorts=true**.
useNMap	**For Databases TCP Ports and JEE TCP Ports jobs:** false **For SAP TCP Ports and TCP Ports jobs:** true	This flag indicates whether or not to use nmap during port scanning. **Note:** If no path is specified for **nmapPath** (see above), the nmap from the system path is used.

Note: Only ports on which a port name has been assigned to it in the **ports** or **UDPports** parameters and which are marked as 'discoverable' (**isDiscovered=1**) in the **portNumberToPortName.xml** configuration file are discovered.

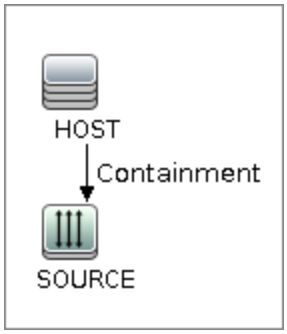
Adapter Information

This adapter discovers TCP ports.

Input CIT

IpAddress

Input Query



Triggered CI Data

Name	Value
ip_address	${SOURCE.name}
ip_domain	${SOURCE.routing_domain}

Used Scripts

- TcpPortScanner.py
- nmap.py

Global Configuration File

portNumberToPortName.xml

Discovered CITs

- Composition
- Containment
- IpAddress
- IpServiceEndpoint
- Node

Chapter 93: Thin Clients MAC-based Detection Job

This section includes details about the job.

Introduction

This job discovers Wyse thin client devices.

The nature of this job is to report a Node CI when you have a MAC address from switches or routers that belongs to the Client IP range and the MAC address contains the prefix **008064** (which means that is the Wyse thin client). This job is created to cover the gap between DDMI and Universal Discovery.

This job runs on top of data present in the Data Flow Probe database. The precondition is that the input data are only IP addresses of the Client range type. The **IP MAC Harvesting by SNMP** job must run before the **Thin Clients MAC-based Detection** job in order to take effect.

Trigger Query

Adapter Information

This job uses the **Thin Clients MAC-based Detection** adapter.

Adapter Type

Jython

Input CIT

Discovery Probe Gateway

Input Query

Used Scripts

- thin_client_mac_detection.py

Discovered CITs

- Containment
- IpAddress
- Node

Part 18: Tools and Samples > SSL Certificate Discovery

Chapter 94: SSL Certificate Discovery

This chapter includes:

Overview 1327

Supported Versions 1327

Topology 1327

Discovery Mechanism 1327

How to Discover SSL Certificates 1328

SSL Certificate Discovery by HTTPS Job 1329

SSL Certificate Discovery Adapter 1330

Additional Information 1331

Troubleshooting and Limitations – SSL Certificate Discovery 1331

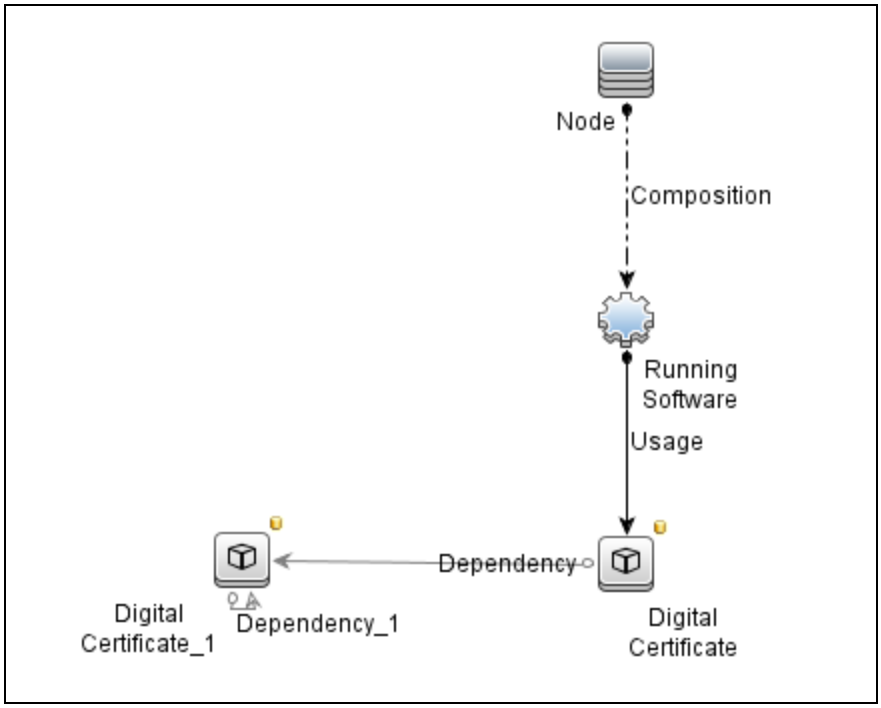
Overview

This discovery allows you to discover the SSL certificates used by any RunningSoftware CI which is reported as using the HTTPS protocol.

Supported Versions

This discovery supports the discovery of only those SSL certificates that comply with the X.509 standard for public key infrastructure and Privilege Management Infrastructure.

Topology



Discovery Mechanism

The discovery flow includes the following steps:

1. Connect to the host.
2. Perform SSL handshake.
3. Retrieve certificate information.

How to Discover SSL Certificates

1. Prerequisites

   For the discovery to succeed, there must be an **IpServiceEndpoint** CI that has a **IpServiceName** or **ServiceNames** attribute value of **https**.

2. Run the discovery

   - Run the following jobs in quick mode:

     > **Note:** Quick mode discovers only known ports that are described in portNumberToPortName.xml. You can also run a more thorough discovery (see instructions below) that finds non-default ports that are discovered by application related jobs.

     i. **Range IPs by ICMP** job, to discover the target IPs.
     ii. Either **Web Server Detection using TCP Ports** job or **TCP Ports** job.
     iii. **SSL Certificate Discovery by HTTPS** job.

   - **Optional:** For a more thorough discovery, run the following jobs:

     i. **Host Connection by Shell** job, to discover the target host and shell connectivity to it.
     ii. **Host Applications by Shell** job, to discover applications of the target host.
     iii. **Optional:** Run any of the following jobs (according to the application you want to discover).

     - **Apache Tomcat by Shell**
     - **JEE Glassfish by Shell**
     - **JEE JBoss by Shell**
     - **JEE Weblogic by Shell**
     - **JEE WebSphere by Shell**

- **Web Server by Shell**
- **IIS Applications by NTCMD or UDA**

iv. Run the **SSL Certificate Discovery by HTTPS** job.

For details on running jobs, refer to "Module/Job-Based Discovery" in the *HPE Universal CMDB Data Flow Management Guide.*

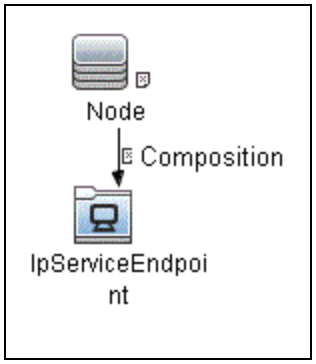
SSL Certificate Discovery by HTTPS Job

This section includes details about the job.

Adapter

This job uses the **SSL Certificate Discovery** adapter.

Trigger TQL



Node Name	Condition
Node	None
IpServiceEndpoint	IpServiceName Equal https OR ServiceNames Contains https

Parameters

None

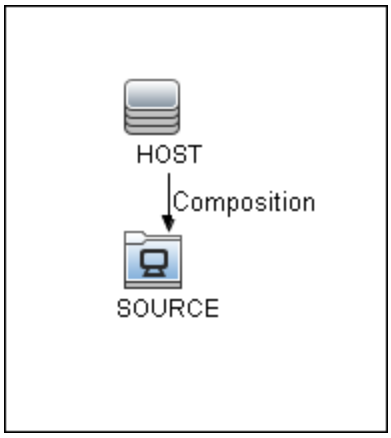
SSL Certificate Discovery Adapter

This section includes details about the adapter.

Input CIT

IpServiceEndpoint

Input TQL Query



Triggered CI Data

Name	Value
host_id	${HOST.root_id}
https_port	${SOURCE.network_port_number}
ip	${SOURCE.bound_to_ip_address}

Used Scripts

- ssl_cert.py
- ssl_cert_discoverer.py
- ssl_cert_discovery_by_https.py
- distinguished_name.py

Discovered CITs

- Dependency
- Digital Certificate
- IpServiceEndpoint
- RunningSoftware
- Usage

Parameters

None

Additional Information

The following jobs discover the name of a port. If this port is an https port, it can be used to trigger SSL Certificate Discovery:

- IIS Discovery by Shell
- Apache TomCat Discovery by Shel
- Apache Discovery by Shell
- GlassFish Discovery
- JBoss discovery
- Weblogic discovery
- WebSphere discovery
- SAP Discovery

Troubleshooting and Limitations – SSL Certificate Discovery

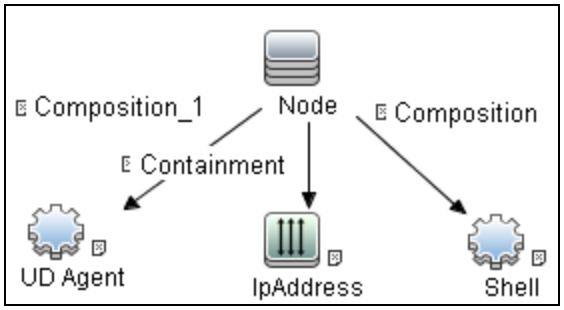
This job cannot retrieve the Certificate Authority for a certificate that is automatically trusted by the browser. In such cases, some root certificates do not appear in UCMDB.

Part 19: Tools and Samples > UD Agent Management

Chapter 95: Install UD Agent Job

This section includes details about the Install UD Agent job.

Trigger Query



Job Parameters

By default, job parameters do not override adapter parameters.

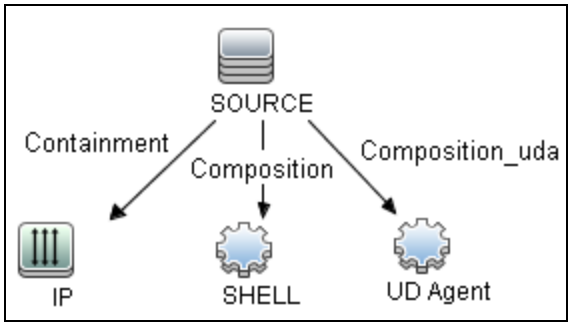
Adapter Information

This job uses the **InstallUDAgent** adapter.

Input CIT

Node

Input Query



Triggered CI Data

Name	Value
ProtocolList	${SHELL.root_class}
codepage	${SHELL.codepage:NA}
connected_os_credentials_id	${SHELL.connected_os_credentials_id:NA}
credentialsId	${SHELL.credentials_id}
hostId	${SOURCE.root_id}
ipTaggingList	${IP.ip_lease_time:NA}
ip_address	${SHELL.application_ip}
macList	${SHELL.arp_mac:NA}
nodeIpList	${IP.name:NA}
nodeMacList	${IP.arp_mac:NA}
shellId	${SHELL.root_id}

Discovered CITs

- Composition
- Node
- UDA

Adapter Parameters

Name	Default Value	Description
CallhomeFrequency	3	Specifies the frequency of the Call Home request in days.
EnableSoftwareUtilization	false	Determines whether Software Utilization is enabled.
PrimaryCallhomeProbeAddress		Defines the primary Call Home Probe Address. Use one of the following formats: • IPAddress

Name	Default Value	Description
		• HostName • HostNameOrIPv4Address:1977 • [IPv6Address]:1977 For example: • 10.11.12.13 • probehost • probehost:1977 • [2010:836b:4179::836b:4179]:1977
RunUDAgentUnderRootAccount	true	Determines if the UD Agent runs under root account on Unix machines. The UD Agent runs under the installing user account if this parameter is false.
SecondaryCallhomeProbeAddress		Specifies the secondary Call Home Probe Address. Use one of the formats as in PrimaryCallhomeProbeAddress.
SoftwareUtilizationPeriod	365	Software utilization data shows the number of days that an application was used (as a percentage) over the specified period.
UdAgentInstallCredentialId		Specifies the UD Agent credential ID to be used to install the UD Agent. The installation process tries all IDs if this parameter is empty.

Global Configuration File

AgentsConfigurationByPlatform.xml

AgentsLifeCycleSettings.xml

Chapter 96: Migrate DDMI Agent Job

The **Migrate DDMI Agent** job is no longer supported starting with CP23. If you need DDMI migration, use UCMDB 10.31 and CP22 instead.

Chapter 97: UDA Status Collector Job

This section includes details about the UDA Status Collector job.

Trigger Query

Job Parameters

By default, job parameters do not override adapter parameters.

Adapter Information

This job uses the **UDAStatusCollector** adapter.

Input CIT

IpAddress

Input Query

None

Triggered CI Data

Name	Value
domain_name	$(SOURCE.routing_domain:DefaultDomain)
ip_address	${SOURCE.name:NA}

Used Scripts

- icmp_utils.py
- UDAStatusCollector.py

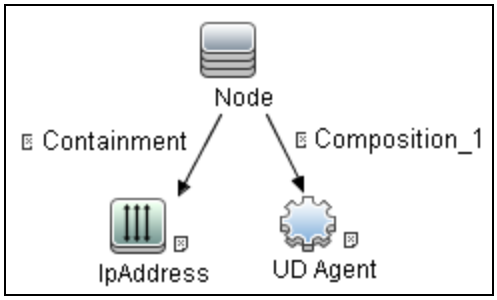
Adapter Parameters

Name	Default Value	Description
excludePatternsList		This parameter specifies a semicolon-separated (;) list of wildcard patterns. IP addresses that match any of the patterns are skipped. Pattern may include numbers, dots, * (matches zero or more characters) or ? (matches exactly one character).
isCreateUDA	false	This flag determines if the UDA CI is returned.
isIPv4PingEnabled	true	This flag determines whether to ping all IPv4 addresses within the defined ranges.
isIPv6PingEnabled	true	This flag determines whether to ping all IPv6 addresses within the defined ranges.
pingProtocol	1	This parameter specifies one of the PING protocol: • ICMP (1) • ECHO PORT (2) • Both ICMP and ECHO PORT (3)
range	NA	This parameter specifies a range of IPs to ping. Ranges are separated by semicolon. For example, 1.2.3.0-1.2.3.10;1.2.3.50-1.2.3.60
retryDiscover	2	This parameter specifies the retry times for an unsuccessful ping.
threadPoolSize	10	This parameter specifies the number of threads in pool that performs port 7 echoing.
timeoutDiscover	3000	This parameter specifies the ping time-out in ms.
virtualModeDiscover	false	This flag determines whether to discover the virtual IPs.

Chapter 98: Uninstall UD Agent Job

This section includes details about the Uninstall UD Agent job.

Trigger Query



Job Parameters

By default, job parameters do not override adapter parameters.

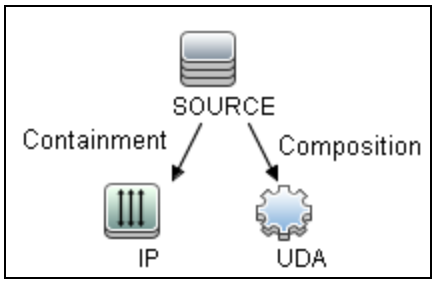
Adapter Information

This job uses the **UninstallUDAgent** adapter.

Input CIT

Node

Input Query



Triggered CI Data

Name	Value
ProtocolList	${UDA.root_class}
agentId	${UDA.root_id}
codepage	${UDA.codepage:NA}
connected_os_credentials_id	${UDA.connected_os_credentials_id:NA}
credentialsId	${UDA.credentials_id:NA}
hostId	${SOURCE.root_id}
ipTaggingList	${IP.ip_lease_time:NA}
ip_address	${UDA.application_ip}
macList	${UDA.arp_mac:NA}
nodeGUID	${SOURCE.ud_unique_id:NA}
nodeIpList	${IP.name:NA}
nodeMacList	${IP.arp_mac:NA}

Discovered CITs

- Composition
- NTCMD
- Node
- SSH
- Telnet

Adapter Parameters

Name	Default Value	Description
RemoveAgentData	false	This flag determines whether the Agent data is removed from the remote host after the Agent is uninstalled. For example, log file, utilization data.

Global Configuration File

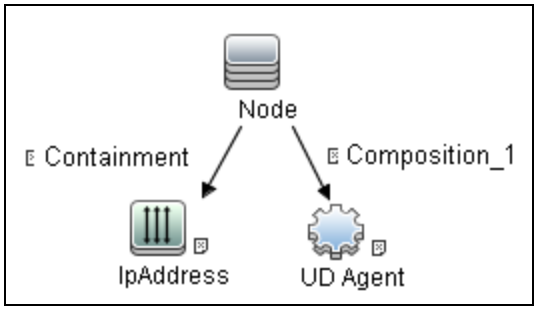
AgentsConfigurationByPlatform.xml

AgentsLifeCycleSettings.xml

Chapter 99: Update UD Agent Job

This section includes details about the Update UD Agent job.

Trigger Query



Job Parameters

By default, job parameters do not override adapter parameters.

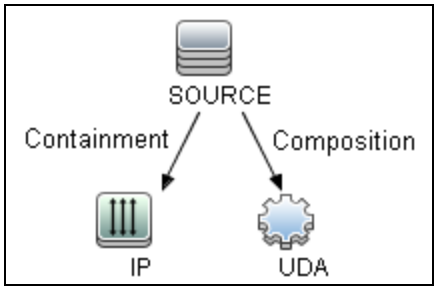
Adapter Information

This job uses the **UpdateUDAgent** adapter.

Input CIT

Node

Input Query



Triggered CI Data

Name	Value
ProtocolList	${UDA.root_class}
agentId	${UDA.root_id}
architecture	${UDA.architecture:NA}
codepage	${UDA.codepage:NA}
connected_os_credentials_id	${UDA.connected_os_credentials_id:NA}
credentialsId	${UDA.credentials_id:NA}
hostId	${SOURCE.root_id}
ipTaggingList	${IP.ip_lease_time:NA}
ip_address	${UDA.application_ip}
macList	${UDA.arp_mac:NA}
nodeIpList	${IP.name:NA}
nodeMacList	${IP.arp_mac:NA}
platform	${UDA.platform:NA}

Discovered CITs

- Composition
- Node
- UDA

Adapter Parameters

Name	Default Value	Description
CallhomeFrequency	3	Specifies the frequency of the Call Home request in days.
EnableSoftwareUtilization	false	Determines whether Software Utilization is enabled.

Name	Default Value	Description
PrimaryCallhomeProbeAddress		Defines the primary Call Home Probe Address. Use one of the following formats: • IPAddress • HostName • HostNameOrIPv4Address:1977 • [IPv6Address]:1977 For example: • 10.11.12.13 • probehost • probehost:1977 • [2010:836b:4179::836b:4179]:1977
RunUDAgentUnderRootAccount	true	Determines if the UD Agent runs under root account on Unix machines. The UD Agent runs under the installing user account if this parameter is false.
SecondaryCallhomeProbeAddress		Specifies the secondary Call Home Probe Address. Use one of the formats as in PrimaryCallhomeProbeAddress.
SoftwareUtilizationPeriod	365	Software utilization data shows the number of days that an application was used (as a percentage) over the specified period.
UdAgentInstallCredentialId		Specifies the UD Agent credential ID to be used to install the UD Agent. The installation process tries all IDs if this parameter is empty.
UpgradeAgent	true	Determines if the agent will be upgraded. When this parameter is false, only the agent configuration will be updated.

Global Configuration File

AgentsConfigurationByPlatform.xml

AgentsLifeCycleSettings.xml

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Feedback on Discovery and Integrations Content Guide - Discovery Modules (Universal CMDB Content Pack 24.00 (CP24))

Just add your feedback to the email and click send.

If no email client is available, copy the information above to a new message in a web mail client, and send your feedback to cms-doc@hpe.com.

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