Abstract

This document provides an overview of infrastructure orchestration, which delivers advanced template-driven design, provisioning, and ongoing operations for multi-node, multi-tier infrastructure services.
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Revision history

For supported operating systems, see the HP Insight Management Support Matrix.

<table>
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<th>Software version</th>
<th>Document edition</th>
<th>Publication date</th>
</tr>
</thead>
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<tr>
<td>5900-2270</td>
<td>7.1.0</td>
<td>2</td>
<td>November 2012</td>
</tr>
<tr>
<td>5900-2270</td>
<td>7.1.0</td>
<td>1</td>
<td>June 2012</td>
</tr>
<tr>
<td>5900-2029</td>
<td>7.0.0</td>
<td>1</td>
<td>February 2012</td>
</tr>
<tr>
<td>5900-1540</td>
<td>6.3.0</td>
<td>1</td>
<td>April 2011</td>
</tr>
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<td>5900-0861</td>
<td>6.2.0</td>
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</tr>
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<td>6.0.0</td>
<td>1</td>
<td>January 2010</td>
</tr>
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<td>1.0.2</td>
<td>1</td>
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1 Introduction

HP Matrix Operating Environment infrastructure orchestration extends HP Matrix Operating Environment to provide rapid provisioning and repurposing of infrastructure services from shared compute resource pools using a Self Service Portal. Matrix infrastructure orchestration delivers advanced template-driven design, provisioning, and ongoing operations for multi-node, multi-tier infrastructure services built around HP platforms:

- HP Insight Control, including HP Insight Control virtual machine management
- HP Virtual Connect Enterprise Manager
- HP Matrix Operating Environment

Matrix infrastructure orchestration provides lifecycle management for groups of physical and virtual servers, including:

- Design, resource management, and self service tools supporting the key roles of IT architect, administrator, and users of IT services
- A template design environment to define blueprints for provisioning servers in a service
- Multi-tenancy, which allows data center resources to be dynamically and securely shared among different organizations by providing each organization with a virtual infrastructure orchestration system
- Effective resource utilization enabled by automated resource allocation from resource pools assigned to users
- Automated provisioning of virtual and physical servers, including VM Hosts and clusters, blade hardware and virtual machine configuration, SAN boot support, operating system deployment, and operating system customization
- Customizable Operations Orchestration workflows to integrate existing IT processes for approvals, operating system deployment, and storage provisioning
- Ongoing management of provisioned infrastructure in order to grow, activate, and deactivate infrastructure services
- Integration with Matrix Operating Environment for monitoring and maintenance of provisioned and available infrastructure services

Matrix infrastructure orchestration can be used in the following scenarios:

- Template design to create a library of standardized infrastructure services
- Rapid provisioning and deprovisioning of complex infrastructure designs
- IT process integration to include existing automated and manual tasks within infrastructure orchestration automation
- Rapid project delivery
- Improved utilization of infrastructure resources through reservations, schedules, and lease periods on resources

Automated infrastructure design provisioning and management

Matrix infrastructure orchestration supports four main activities to automate the deployment of infrastructure services:

**Design**

An architect uses the graphical designer to create simple and complex infrastructure templates, that when tested, can be published for users to create infrastructure services.

**Provision**
A self service user or a self service user in an organization selects an existing template and then requests infrastructure provisioning from it, against an assigned pool of resources. A service provider administrator or organization administrator can approve or deny this request, and monitor its progress.

**Operate**

A service provider administrator or organization administrator manages compute resource, network, and storage pools, defines virtual machine images and software deployment jobs, performs manual provisioning tasks as part of the fulfillment of self service requests, and uses HP Insight Management to monitor the health and utilization of the managed environment.

**Integrate**

Architects and administrators integrate infrastructure orchestration with existing IT processes by modifying or creating Operations Orchestration workflows to customize the infrastructure orchestration automation. They can link to approval processes, extend operating system deployment and server configuration, and integrate the SAN management processes with server deployment.

**Matrix infrastructure orchestration and the Matrix Operating Environment solution**

Matrix infrastructure orchestration is part of the Matrix Operating Environment storage solution. Within infrastructure orchestration are three components which support the roles of architect, administrator, and user.

- The **designer** enables an architect to plan and design multi-server, multi-tier infrastructures using a drag-and-drop interface.
- The **console** enables a service provider administrator to deploy, manage and monitor the overall behavior of infrastructure orchestration and its users, templates, services and resources.
- The **organization administrator portal** enables an organization administrator to deploy, manage and monitor the behavior of an individual infrastructure orchestration organization and its users, templates, services and resources.
- The **self service portal** enables a user to create infrastructure services from published templates.
Matrix infrastructure orchestration users and groups

Matrix infrastructure orchestration is integrated with Active Directory, which allows Windows Users Groups, as well as individual local users, to be given access to resources. When infrastructure orchestration is installed, three local User Groups (HPIO_Administrators, HPIO_Architects and HPIO_Users) are created.

The Windows CMS administrator populates the service provider roles by adding local Windows users and Active Directory users or groups to HPIO_Administrators, HPIO_Architects and HPIO_Users. When an organization is created, two local Windows groups are created with descriptions indicating the organization’s name. These local groups have names of the form <organization_id>_Administrators and <organization_id>_Users.

Users can belong to more than one IO Windows group and therefore belong to multiple IO organizations. Such users can be simultaneously logged in to one or more of the organization administrator portals belonging to different organizations. If a user is removed from an organization, the removal takes effect after he is logged out from the organization administrator portal.

A group of users (for example, an Active Directory group) can be authorized to view and perform lifecycle operations in the same way that users are authorized. For example, a user that is part of a group can view server pools assigned to a group, assign a group to a server pool, and view templates assigned to a group. Server pools can be assigned to one or more groups.

A user in a group is authorized based on the group’s assignment to an IO role. A change in a user’s group reflects new group assignments on the next login by the user to infrastructure orchestration.

NOTE: It is possible to view and assign only explicitly named users and groups that are included in the HPIO_* Windows groups (described in “Matrix infrastructure orchestration roles” (page 16)). Users or subgroups within these named groups are not visible, nor can they be directly assigned to resources.

• Architect

Uses infrastructure orchestration designer (a graphical designer) to design and publish infrastructure service templates which capture the requirements to provision the infrastructure service. During development and design, the architect specifies attributes for the logical resources, such as minimum memory required, IP address allocation, and the software required on the boot disk. The architect can also author and attach Operations Orchestration workflows to a template to automate additional IT tasks during the provisioning and ongoing management of the infrastructure service.

• Administrator

Uses infrastructure orchestration console in HP Systems Insight Manager to manage the overall behavior of infrastructure orchestration including creating IO server pools, creating and managing organizations, managing the available networks and software inventory, approving user requests, and modifying user’s infrastructures service as required (for example to migrate logical servers between server blades to support maintenance activities on the physical environment). An administrator also performs manual tasks within a semi-automated operation.

• User

Uses the infrastructure orchestration self service portal to create infrastructure services from templates. The user initiates the creation of a new infrastructure service by selecting a template design, selecting one or more assigned server pools to use, specifying a lease period, specifying a service name, and (depending on the template) a hostname completion string. After the infrastructure service is allocated and provisioned, it is available to the user for the duration of the lease period. During this time, using the infrastructure orchestration self service portal, the user can update the service (for example, adding more servers or storage using infrastructure orchestration requests).
Matrix infrastructure orchestration supports a variety of mechanisms for operating system software deployment. Operating system software can be realized as an image derived from a virtual server, or as deployment software such as an Insight Control server deployment job, an Ignite-UX job, or an HP Server Automation (SA) job. Each subtype represents an approach for offering selectable software that can be installed on a physical or virtual server.

To simplify system software deployment, infrastructure orchestration utilizes virtual machine templates, physical server deployment jobs, and Operations Orchestration workflows.

During provisioning, infrastructure orchestration executes associated Operations Orchestration workflows at their respective execution points. After infrastructure orchestration processes the request, the resulting service is maintained on a user-by-user basis with a set of physical and virtual resources that reflects the original template design. Running infrastructure services can be modified in many ways, including adding servers and data disks.

**Operations Orchestration**

A limited version of Operations Orchestration is included with Matrix OE. This version of Operations Orchestration is licensed for limited uses.

**Functionality**

- Allows Matrix OE infrastructure orchestration to trigger Operations Orchestration workflows for pre- and post-provisioning tasks. Examples include:
  - Create Service/Add Server
    - Add new servers to cluster/load balancer
    - Add to backup service
    - Send approval notice
  - Standby Server/Service
    - Gracefully shutdown applications and OS
    - Remove from cluster/load balancer
    - Suspend monitoring
  - Resume Server/Service
    - Add to cluster/load balancer
    - Resume monitoring

Workflows in the limited version of Operations Orchestration included with Matrix OE may only be triggered from the Matrix OE infrastructure orchestration interface in relation to pre- and post-provisioning tasks. An upgrade to the full version of Operations Orchestration allows the launch of workflows from outside of the Matrix OE interface.

- The limited version of Operations Orchestration allows Matrix OE to be integrated with other management software. However, this requires additional services from HP consulting.
- The limited version of Operations Orchestration included within Matrix OE is licensed for one author. Upgrades to the full version of Operations Orchestration allow for multiple authors.
- The version of HP Operations Orchestration Central that is included in Matrix OE may only be used for flow troubleshooting. An upgrade to the full version of Operations Orchestration allows the use of Operations Orchestration Central to launch and schedule the launch of Operations Orchestration workflows from outside of Matrix OE/Insight Control.
Content
The content supplied with the limited version is a subset of the content that is available in the full version of Operations Orchestration and is related to Infrastructure-as-a-Service workflows. An upgrade to the full version of Operations Orchestration provides additional content.

API and CLI support
Matrix infrastructure orchestration supports an Application Programming Interface and a Command Line Interface (ioexec). For information about using these interfaces, see **HP CloudSystem Matrix/Matrix Operating Environment Integration Interfaces** at Matrix Operating Environment Information Library.

For each operation, the API call is specified in CamelCase, and the ioexec CLI is specified using separate words. For example, `getOrganization` is the API call, while `get organization` is the command.

In the SOAP API and ioexec CLI, a username and password must be supplied.
- If the presented username and password belongs to a Windows user in the Service Provider Administrator role, the API and CLI can operate on all services.
- For a username and password that belongs to a Windows user in the Organization Administrator role, the API and CLI can operate only on the services owned by that organization.
- For a username and password that belongs to a Windows user in the Architect or User roles, the API and CLI can operate only on the services owned by that particular user.


The infrastructure orchestration CLI can be invoked remotely. On the remote CMS command line, enter `ioexec --help` for more information.

Alternatively, perform the following steps to invoke the CLI from the remote CMS using default connection parameters:

1. **Copy the zip file from ..\Program Files\HP\Matrix infrastructure orchestration\cli to the CMS from which you want to run the CLI.**
2. **Copy sample-ioexec.properties to the user’s home directory (for example, C: \users\Administrator).**
3. **Rename sample-ioexec.properties to ioexec.properties.**
4. **Modify the file to specify a default host, username, and password, and other values, if desired.**
2 Installation and configuration

Installing infrastructure orchestration

Matrix infrastructure orchestration is installed through the HP Insight Management Installer. When using the installer, be sure to select all the required software and have the HP Insight Control and SMTP parameters available to use during installation. For more information, see HP Insight Management Installation and Configuration Guide on the HP Insight Management DVD. To locate the most current version of this document on the web, go to Matrix Operating Environment Information Library.

See the HP Insight Management Support Matrix located at Matrix Operating Environment Information Library for minimum hardware, firmware, and software requirements for installing and running HP Insight Management, including Matrix infrastructure orchestration.

HP Cloud Service Automation for Matrix can be installed cleanly on new installations of Matrix infrastructure orchestration. For information about installing or upgrading CSA for Matrix when you are upgrading Matrix infrastructure orchestration from an earlier version, refer to the HP Cloud Service Automation for Matrix Configuration Guide.

Upgrading infrastructure orchestration

For complete upgrade instructions, see the HP Insight Management Installation and Configuration Guide located on the HP Insight Management DVD. From the installer, select the Documentation tab, and then select HP Matrix Operating Environment in the left navigation pane. To locate the most current version of this document on the web, go to Matrix Operating Environment Information Library.

Uninstalling infrastructure orchestration

1. In the Windows control panel, go to Add or Remove Programs.
2. Select HP Matrix Operating Environment infrastructure orchestration.
3. Select the Remove option, and click Yes or No when the Remove the infrastructure orchestration database? message appears.
4. Click Yes when the Are you sure you want to remove HP Matrix Operating Environment infrastructure orchestration and all of its components? message appears to complete the removal process.

Licensing infrastructure orchestration

Applying the license for infrastructure orchestration is completed during the installation and configuration process using the Insight managed system setup wizard. For more information, see the HP Insight Management Installation and Configuration Guide located at Matrix Operating Environment Information Library.

Matrix infrastructure orchestration supports the unlicensing of Integrity servers from infrastructure orchestration. To free an infrastructure orchestration Integrity license, enter the vselicense command:

% vselicense -r hpio -n <nodename>

For more information, see the vselicense manpage.

To provision public cloud instances, obtain a Matrix OE Public Cloud Managed Instance license. This license allows you to manage one public cloud instance hosted at an HP-supported public cloud service provider for a term of one year from the date of registration. Multiple licenses can be used together under a concurrent use model. (For example, if you purchase 10 licenses, you can manage up to 10 public cloud instances at any one time.) Public cloud managed instance licenses are not tied to a particular service provider. You can use the same license to manage an
instance at one service provider today and at another tomorrow, as long as the license is not used for both instances at the same time.
For details on licensing, contact your HP sales representative.

Configuring infrastructure orchestration users in Windows

The Insight Management Installer adds the user who performed the installation to the HPIO_Administrators group.

To integrate Active Directory with Insight Management:

- Ensure that the server hosting the CMS belongs to the Active Directory domain (not a workgroup)
- Create a non-administrator user in Active Directory that will be used to run all Insight Management services
- Give that Active Directory user Admin privileges on the CMS
- Install the Insight Management DVD on the CMS as this Active Directory user
- To add local users to infrastructure orchestration user groups, use computer management or administrative tools. For example, in Windows Server 2008, select Start→Administrative Tools→Computer Management, and expand Local Users and Groups.
- To add Active Directory users and groups to infrastructure orchestration user groups, use computer management or administrative tools. For example, in Windows Server 2008, select Start→Programs→Administrative Tools, and expand Active Directory Users and Computers.

Matrix infrastructure orchestration roles

There are three infrastructure orchestration roles at the Service Provider level. These classes are represented as Windows user groups.

- **HPIO_Users**
  Can log into infrastructure orchestration self service portal (https://<cms-name-or-ip>:51443/hpio/portal), and initiate requests for provisioning using published templates. These requests require approval from an Administrator.

- **HPIO_Architects**
  Have the privileges of the HPIO_Users group, and can access the infrastructure orchestration designer (https://<cms-name-or-ip>:51443/hpio/designer) to create, modify, and publish templates.

- **HPIO_Administrators**
  Have the privileges of the HPIO_Architects group. Can initiate requests without requiring approval, modify infrastructure orchestration configuration items, configure networks and pools, grant users access to existing resources, and approve, reject, continue, or cancel requests.
  Can access the infrastructure orchestration console through Systems Insight Manager
  Can log into infrastructure orchestration designer and the infrastructure orchestration self service portal.
  Can log into the infrastructure orchestration organization administrator portal for any organization, and the infrastructure orchestration self service portal for any organization.
At the Organization level, there are two roles:

- **Organization Users**
  Have the privileges of `<organization_id>_ Users` group and have similar capabilities as the Service Provider HPIO_Users role.
  Can log into infrastructure orchestration self service portal (https://<cms-name-or-ip>:51443/ssp/<organization_name>).

- **Organization Administrators**
  Have the privileges of the `<organization_id>_ Administrators` group. Can initiate requests, create pools and assign users to them, approve or reject paused requests from organization users and customize the look of the organization administrator portal and the self service portal.
  Can log into infrastructure orchestration organization administrator portal (https://<cms>:51443/oap/<organization_name>).
  Can access the self service portal for that organization.

For more information about organization administrators and users, see “Overview of organizations” (page 151).

**NOTE:** When a new user is created and needs access to the Systems Insight Manager Audit Log, the system administrator must give the user authorization to view the log.

### Adding user accounts to groups

Add individual users to the appropriate Microsoft Windows groups according to their role, as described in the following steps.

**NOTE:** Ensure that all CMSs in a federated CMS environment have their user accounts synchronized by creating the same user accounts on primary and secondary CMSs.

1. Select **Start**→**Administrative Tools**→**Computer Management**.
2. Expand **Local Users and Groups**.
3. Add the following users using steps a through c.
   The following are examples of the user names for the different user groups.
   IOAdmin for HPIO Administrators
   IOArchitect for HPIO Architects
   IOUser for HPIO Users
   a. Right-click **Users**.
   b. Select **New User** and create the user IOAdmin.
   c. Repeat the above steps to create the users: IOArchitect and IOUser.

4. Add the users accounts to their respective groups:
   - IOAdmin to the HPIO_Administrators group
   - IOArchitect to the HPIO_Architects group
   - IOUser to the HPIO_Users group
   a. Select **Groups**.
   b. Right-click the **HPIO_Administrators** group, and select **Add to Group**.
   c. Add the desired users to these groups depending on the desired level of authorizations.

<table>
<thead>
<tr>
<th>Matrix infrastructure orchestration access</th>
<th>Group membership requirement¹</th>
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<tbody>
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<td>Console</td>
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Configuring infrastructure orchestration users in Windows
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¹ A user who is not a member of one of those groups is not authorized to use infrastructure orchestration regardless of the authorizations configured in Systems Insight Manager.

² The <organization_id> Administrator manages the Organization administrator portal.

Users added to Microsoft Windows groups do not need to be explicitly added to Systems Insight Manager. They are automatically added to Systems Insight Manager when they first log into Systems Insight Manager and are granted the authorizations assigned to the groups to which they belong. Users belonging to multiple groups in Systems Insight Manager receive the union of the authorizations assigned to the groups in which they are members.

### Removing Windows users with IO resource permissions

Before removing a Windows user from the CMS, first remove the Windows user from any infrastructure orchestration resources the user is allowed to use, and then remove the user from the HPIO_ groups to which the user is assigned.

1. **Resources**
   - Unassign the user from templates or remove the user from the group assigned to templates
   - Unassign the user from pools or remove the user from the group assigned to pools

2. **Groups**
   - Remove the Windows user from HPIO_Users group
   - Remove the Windows user from HPIO_Architect group
   - Remove the Windows user from HPIO_Administrators group

Once the Windows user is removed from all applicable resources and groups, remove the user from the CMS.

### Modifying the infrastructure orchestration properties file

Matrix infrastructure orchestration includes an administrator-modifiable properties file called hpio.properties. It is located (in the default location) at C:\Program Files\HP\Matrix infrastructure orchestration\conf.

The hpio.properties file contains features that can be enabled (and are disabled by default), and settings such as connection values, retry values, and timeout values.
NOTE: When infrastructure orchestration is upgraded to a new version, administrator modifications to individual properties in hpio.properties are migrated to the new version of the file unless the default value of the property changed in the new version. In that case, the value of the property is overwritten by the new default value included in hpio.properties.

For example, in an earlier version of infrastructure orchestration, the value of timeout.get.vmhost was 4 minutes, and in a later version, the default value is 10 minutes. If, in the earlier version of the file, the administrator set the value to 12 minutes, this value is overwritten in the later version by the new value of 10 minutes.

In general, administrator changes to hpio.properties require the HP Matrix infrastructure orchestration Windows service to be restarted. The properties that do not require a restart are:

- Default OS customization file: os.customization.default.file
- OS customization directory: os.customization.directory
- Template access restrictions: template.access.restricted
- Telnet console enablement: display.telnet.console.link
- Single-server services hostname suffix: single.server.services.have.hostname.suffix
- Global pattern for hostname suffixes: hostname.suffix.pattern

The preceding are hpio.properties entries that infrastructure orchestration self service portal, organization administrator portal, designer, and console read directly.

Configuring a federated CMS environment

A Matrix infrastructure orchestration federated CMS environment is an environment in which multiple management servers cooperatively share the responsibility for managing a larger number of resources than can be managed by a single server.

A new infrastructure orchestration installation is configured as a primary CMS, and is ready to control a federated CMS environment when secondary CMSs are installed and configured.

An infrastructure orchestration federated CMS environment:

- allows increased scalability for service catalog-based auto-provisioning (up to 12,000 ProLiant virtual machines and 6,000 HP Integrity virtual machines)
- contains one primary CMS running infrastructure orchestration, and one or more secondary CMSs running Matrix Operating Environment (infrastructure orchestration cannot be installed on secondary CMSs)

A federation can contain up to five CMSs. The recommended configuration is:

- one primary CMS with up to 1200 managed nodes
- up to four secondary CMSs with up to 2200 managed nodes each

The primary CMS manages the aggregated resources of all CMSs. Matrix infrastructure orchestration must be installed only on this server. A secondary CMS is a CMS that participates in the federation, where resources exist and provisioning from infrastructure orchestration may occur, but infrastructure orchestration does not run directly on secondary CMSs.

To execute infrastructure orchestration provisioning across multiple CMSs, infrastructure orchestration on the primary CMS uses the secondary CMSs logical server management, virtual machine management, and other supporting software layers.

For more information, see the HP Matrix Operating Environment Federated CMS Overview white paper at Matrix Operating Environment Information Library.
Manually enabling federated CMS in new installations

Federated CMS is enabled by default in new installations. However, during the installation procedure, if the CMS IP address is not resolved to the Fully Qualified Domain Name (FQDN), one of the following errors is displayed:

Failed to enable HP Insight Orchestration Federated mode.
HP Matrix OE infrastructure orchestration was successfully installed but the federated CMS feature was not enabled.

If you performed a new installation of Insight Management, and federated CMS was not successfully enabled during the installation, perform the following steps to configure a federated CMS environment.

⚠️ WARNING! Do not manually enable federated CMS if you are upgrading to Insight Management 7.1 from an earlier release. If your environment contains existing infrastructure orchestration services, enabling federated CMS after an upgrade will cause these existing services to fail.

Contact HP for information about enabling federated CMS after an upgrade to 7.1.

1. Set up and verify DNS on primary CMS and secondary CMSs

   In a federated environment, Domain Name Service (DNS) is used to resolve CMS hostnames to IP addresses.
   - On the primary CMS, forward and reverse DNS lookups must resolve for each secondary CMS using the FQDN of each system.
   - If the primary CMS is configured with a static IP address, configure the DNS suffix in the hostname.
     a. On a Windows system, edit Computer Properties (Change Settings)
     b. Change the Computer Name
     c. Click the More button
     d. Include the primary DNS suffix
        By default, the primary DNS suffix of a computer's FQDN is the same as the Active Directory domain to which the computer is joined.
     e. Save and restart the machine.

2. Enable federated CMS in the hpio.properties file

   a. On the primary CMS, in Windows Explorer, navigate to C:\Program Files\HP\Matrix infrastructure orchestration\conf
   b. Edit hpio.properties
   c. Change the federated.io property to federated.io=true and save the file.

3. Configure the Systems Insight Manager federated CMS list on the primary CMS

   a. On the primary CMS, in Systems Insight Manager, select Options→Federated CMS Configuration…
      The list of CMSs in the federation is displayed.
   b. If the primary CMS is not listed as part of the federation, add it by clicking Add CMS…, and follow instructions.
   c. On the primary CMS, in Systems Insight Manager, open a prompt dialog and enter:
      
      ```console
      ioexec add cms -C <CMS-primary-name-specified-in-previous-step>
      ```

Configuring a federation

The following steps are required to configure the federated CMS environment. Perform these steps:

- after federated CMS is enabled automatically during a new Insight Management 7.1 installation
• after federated CMS is enabled manually after a new Insight Management 7.1 installation that did not successfully enable federated CMS

1. **IMPORTANT:** In a federated CMS environment, the Fully Qualified Domain Name (FQDN) of any participating CMS cannot be changed.

If the IP address of the primary CMS is changed, reconfigure the trusted list of each secondary CMS (described in step 1 below).

**1. Configure secondary CMSs**

When complete, this step configures Systems Insight Manager’s federated CMS list on the primary CMS, exchanges certificates between the primary and secondary CMSs, configures the primary CMS as trusted on the secondary CMSs, and displays the newly added CMSs in Systems Insight Manager.

- **a.** On the primary CMS, in Systems Insight Manager, select **Options → Federated CMS Configuration…**
- **b.** Click **Add CMS…**
- **c.** In **CMS name**, enter the **secondary CMS** FQDN and click **Next**
- **d.** In **Verify Remote CMS Certificate**, after verifying the certificate, click **Next**
- **e.** In **Configure Remote CMS**, enter the Systems Insight Manager user name and password and click **Finish**
- **f.** Repeat steps b through e for each secondary CMS.

2. **Configure logical server management to increase memory allocation**

If a primary or a secondary CMS will manage more than 1000 nodes, increase the logical server management JVM heap size.

- **a.** On each CMS that is configured to manage more than 1000 nodes, in Windows Explorer, navigate to `..\Program Files\HP\Virtual Server Environment\conf\lsa`
- **b.** Edit **hp_lsa_service.conf**
- **c.** Change `wrapper.java.maxmemory=1024` to `wrapper.java.maxmemory=2048`, and save the file.

3. **Restart affected services on each secondary CMS**

- **a.** On the secondary CMS desktop, select **Start → Administrative Tools → Services**
- **b.** Select **HP Global Workload Manager Central Management Server**, then select **Action → Restart**
- **c.** Select **HP Logical Server Automation**, then select **Action → Restart**
- **d.** Repeat steps a through c for each secondary CMS.

4. **Inform infrastructure orchestration about the new CMSs added to the federation**

- **a.** On the primary CMS, open a prompt dialog
- **b.** For each CMS added to the federation, enter:
  ```bash
  ioexec add cms -C <cms-FQDN>
  ```
  where `<cms-FQDN>` is identical to the secondary CMS FQDN name specified in step 1c above.

5. **In a clustered High Availability (HA) federated CMS environment, uncomment and specify the wrapper.java.additional.15 property in hpio.conf.**

   In a clustered HA environment, there may be multiple IP addresses in each CMS, and the CMS name may be different than the computer name. Uncomment the following property and specify the FQDN or IP address of the CMS.

   For example, for a CMS named “CMS-blue.hp.com”, change:

   ```bash
   #wrapper.java.additional.15=-Dfed.cms.name=[FQDN or IP] to
   ```

---

**Configuring a federated CMS environment 21**
6. Verify hostname and primary CMS FQDN
   a. On the primary CMS, open a prompt dialog
   b. Enter `mxgethostname` and note the hostname that is returned
   c. In Systems Insight Manager, select Options→Federated CMS Configuration…. The name
      of the primary CMS should be the same as the one returned by `mxgethostname`.

Support for a rolling upgrade of a CMS federation

Matrix OE infrastructure orchestration 7.1 includes support for a rolling upgrade of a federated
CMS environment. A rolling upgrade temporarily allows a federation containing CMSs running
different versions of Matrix OE during the upgrade process.

During a rolling upgrade, a CMS running Matrix OE 7.1 supports basic operations against a
secondary CMS running 7.0. Not all 7.1 features are expected to work against a 7.0 CMS.

IMPORTANT: The primary CMS must be upgraded first.

The following new features in 7.1 are not supported during a rolling upgrade:

- Changing the memory size or number of CPUs of an existing virtual machine
- Some chargeback operations, including detection of changes made outside of Matrix OE
  (and directly in VMware, Hyper-V, OA, and so on)

Create user groups on secondary CMSs

On all secondary CMSs, manually create the IO user groups.

2. Expand Local Users and Groups.
3. Add the following user groups using steps a through c.
   a. Right-click Groups.
   b. Select New Group and create the HPIO_Administrators group.
   c. Repeat steps a and b to create the groups: HPIO_Architects and HPIO_Users.

NOTE: Ensure that all CMSs in a federated CMS environment have their user accounts
synchronized by creating the same user accounts on primary and secondary CMSs.

Configuring resources on the secondary CMSs

Matrix infrastructure orchestration provisioning is managed through the primary CMS and executed
across all CMSs in the federated CMS environment. The IO console is run on the primary CMS
and manages resources on the primary CMS. All cloud capacity pools must be configured only
on the primary CMS.

There are two types of resources that must be configured on the secondary CMSs:

- Every CMS in a federated CMS environment manages its own storage pool. You must create
  storage pool entries on each CMS for the portability groups the CMS is managing.
- For IO to deploy a service with Hyper-V virtual machines, you must create Insight Control
  virtual machine management templates for the Hyper-V virtual machine. This configuration
  must be done on the CMS that manages the Hyper-V VM Hosts. If the Hyper-V VM Hosts are
  managed by a secondary CMS, you must create the virtual machine management templates
  on the secondary CMS.

In the federated CMS environment, IO service templates and services are created and managed
on the primary CMS.
**IMPORTANT:** If you configured secondary CMSs for use in a federated CMS environment, ensure that each SAN storage volume is managed by only one HP Storage Provisioning Manager. (A storage array can be shared by multiple SPMs.)

HP recommends that you select the **HP Matrix Default Storage Template**, and optionally define additional attributes, when configuring physical storage in a service template.

Each CMS contains its own HP Matrix Default Storage Template, and these templates are independent of each other. The default storage template shown in infrastructure orchestration designer is the default storage template on the primary CMS. However, storage auto-provisioning is based on the template found on the CMS that deploys the template.

If you do not select the HP Matrix Default Storage Template and instead select a user-defined storage template, the same SPM Server is used for all volume definitions. If a SAN storage volume is managed by multiple SPMs or CMSs, unpredictable results can occur.

---

**Configuring HP Operations Orchestration**

The HP Operations Orchestration engine is embedded in Matrix Operating Environment. Using HP Operations Orchestration Studio, you can create custom workflow processes and attach them to infrastructure service templates at well defined points in the IO provisioning process, such as during pre- and post-provisioning of infrastructure components.

Matrix infrastructure orchestration defines integration points for Operations Orchestration workflows that run each time a specific operation is invoked, regardless of the template or infrastructure service involved in the operation. Matrix infrastructure orchestration provides basic or sample Operations Orchestration workflows for some of these operations; however, it also allows for the modification or creation of new workflows for these operations to allow the integration of infrastructure orchestration into the business processes.

Template architects can associate one or more Operations Orchestration workflows with a particular template. These workflows can run before or after a particular lifecycle operation allowing the corresponding adjustment of the target server.

For more information on Operations Orchestration, see the **HP Operations Orchestration Software Guide** at Matrix Operating Environment Information Library.

---

**Configuring Operations Orchestration system properties**

Operations Orchestration is installed automatically in new installations of Matrix Operating Environment, and in upgrades from Insight Dynamics 6.3 or higher to Matrix OE 7.1. If you are upgrading from Insight Dynamics 6.2 or earlier to Matrix OE 7.1, you must manually upgrade Operations Orchestration to v9.00. The ooconfig tool is included with Matrix OE to simplify the upgrade process.

See the **HP Insight Management Installation and Configuration Guide** at [www.hp.com/go/matrixoe/docs](http://www.hp.com/go/matrixoe/docs) for more information.

After an installation or upgrade, verify that all Operations Orchestration system properties are set correctly.

1. To launch Operations Orchestration, select **Start → All Programs → Hewlett-Packard → Operations Orchestration → HP Operations Orchestration Studio**.
   A login prompt appears.
2. Log in to the Operations Orchestration administrator account using the following credentials:
   - Username: admin
• Password: the Insight Management service account password specified during the installation

If the Insight Management service account password is subsequently changed using the Systems Insight Manager Reconfigure CMS Tools (mxreconfig), the changed Insight Management service account password is not reflected in Operations Orchestration Studio and database. Manually change the Operations Orchestration Studio and database passwords as described in the HP Systems Insight Manager User Guide at www.hp.com/go/foundationmgmt/docs, in the chapter about using the CMS Reconfigure Tools.

3. After you log in, a tree appears in the left panel. Expand Configuration, and then expand System Properties.

4. Double click any of the system properties. This shows the details of the selected system property. To display a table with all System Properties, click the blue link named System Properties. Use this view to see and modify all Operation Orchestration system properties.

Verify that the HpioCmsIP property is set to the IP address or the Fully Qualified Domain Name (FQDN) of the CMS. If the IP address or FQDN is not set or is incorrect, double-click in the value area for HpioCmsIP and enter the correct IP address or FQDN.

5. (Optional) Configure email addresses.

During the Insight Management installation process, you are able to specify one or more email addresses in the From and To email address fields for all email messages. The Operations Orchestration system properties screen displays all the classes of email sent by infrastructure orchestration (Hpio*Sender and Hpio*Recipients). You can configure each to go to a different
address. If you specify more than one address, use the semi-colon (;) as an address separator. Do not use a final semi-colon. For example, if you are configuring only one email address, specify email@address.com. If you configure more than one address, specify email1@address.com;email2@address.com.

6. See “Specifying SMTP credentials and system properties” (page 25) for information about additional Operations Orchestration requirements.

7. Click Save, and then click Check In before exiting Operations Orchestration.

Specifying SMTP credentials and system properties

Operations Orchestration Studio requires an SMTP server. Matrix infrastructure orchestration uses Operations Orchestration during the execution of infrastructure orchestration requests notifying users about the progress of infrastructure orchestration processes including approval, manual operating system deployment, manual storage provisioning, disk scrubbing, storage removal and notifications. To send these notifications, configure the Operations Orchestration workflows to send email.

NOTE: Before infrastructure orchestration can send an email notification, an SMTP server must be installed and configured either on the CMS where infrastructure orchestration and Operations Orchestration are installed, or on a server that is accessible to the CMS.

SMTP credentials specified during Insight Management installation are added to the HpioSmtpCredentials property. If these credentials are not supplied, the username field contains the string “username” and the password field is empty.

If the SMTP server requires authentication, the username and password in HpioSmtpCredentials are used. If the SMTP server does not require authentication, the username and password are ignored. The SMTP username is required (it cannot be empty), even if the SMTP server does not require authentication.

In Operations Orchestration on the CMS, set the following Operations Orchestration system properties with the appropriate SMTP values:

<table>
<thead>
<tr>
<th>Name</th>
<th>Example Value</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>HpioSmtpHost</td>
<td>127.0.0.1</td>
<td>If SMTP is on another server, replace 127.0.0.1 with the server’s IP address</td>
</tr>
<tr>
<td>HpioSmtpPort</td>
<td>25</td>
<td>If the SMTP port is different than 25, replace 25 with SMTP’s port</td>
</tr>
<tr>
<td>HpioSmtpCredentials</td>
<td>Administrator/password</td>
<td>By default, the SMTP credentials supplied during installation are used. If these values are not supplied, the username field contains the string “username” and the password field is empty.</td>
</tr>
</tbody>
</table>

If SMTP credentials were not specified during Insight Management installation, enter them in OO Studio. Select the System Accounts folder and select HpioSmtpCredentials. Click the lock icon to check out the account for editing. Enter a username and an optional password for the SMTP server account. Click the lock icon a second time to check in the change.
Approval emails sent to the infrastructure orchestration administrator include a URL to be followed for approval. The URL can be followed only once. However, to avoid running an Operations Orchestration workflow when approval is required, modify the `\Program Files\HP\Matrix infrastructure orchestration\conf\hpio.properties` file and change `oo.service.approval.action.enabled=true` to `oo.service.approval.action.enabled=false`. To change the contents of the approval email, for example, to remove the URL, modify the “Approval/Email/Send Approval Email” workflow. Change the “body” field in the node “Send Approval Email” to contain the desired contents of the email.

**Accessing Operations Orchestration**

You can download the Operations Orchestration Studio from the Workflow tab of infrastructure orchestration designer and access Operations Orchestration from your desktop with the username of “admin” and the password entered during the infrastructure orchestration portion of the Insight Management installation.

To access Operations Orchestration Studio, click the Windows Start button and select Programs → Hewlett-Packard → Operations Orchestration → HP Operations Orchestration Studio.

**NOTE:** Operations Orchestration cannot be accessed from within infrastructure orchestration. Access Operations Orchestration from the desktop. Only one Operations Orchestration user can connect at a time.
Configuring a remote instance of Operations Orchestration Studio

You can download Operations Orchestration Studio from a CMS where infrastructure orchestration and Operations Orchestration Central are installed, and then install Operations Orchestration Studio on another computer.

**NOTE:** Only one instance of Operations Orchestration Studio can connect to the Operations Orchestration CMS at any time.

### Downloading Operations Orchestration Studio

To download Operations Orchestration Studio:

1. Log in to infrastructure orchestration designer.
2. Select a template from the Existing Templates area in the left navigation pane.
3. Click **Workflows**.
4. In the Workflows dialog, click the gear icon in the upper right corner to start the Operations Orchestration Studio download.

**NOTE:** The correct version of Operations Orchestration Studio is installed on the CMS based on the OS type (32-bit or 64-bit) during the installation of infrastructure orchestration. Clicking the gear icon in the **Workflows** tab downloads only the 32-bit version of Operations Orchestration Studio. If you have a 64-bit CMS, install the 64-bit version of Operations Orchestration Studio available on the HP Insight Management DVD #2, in the `/matrixio` folder.

5. Select the **Save file** radio button, then click **Save File** to save the file to your hard drive.

### Installing a remote instance of Operations Orchestration Studio

To install Operations Orchestration Studio on a remote computer:

1. Navigate to the directory where the application was saved and double-click **EmbeddedStudioInstaller-9.00.exe** to launch the installer.
2. On the Welcome dialog, click **Next** to begin the installation.
3. On the License Agreement dialog, ensure that **I accept the agreement** is selected, then click **Next**.
4. Browse to the location where you wish to install Operations Orchestration Studio, then click **Next**.
5. Specify Operations Orchestration information as described below, then click **Next** to complete the installation.

- In the **Host Name or IP Address** field, enter the IP address of the Operations Orchestration CMS machine from which Operations Orchestration Studio was downloaded.
- In the **HTTP Port Number (usually 80 or 8080)** field, change the value to 16080.
- In the **HTTPS Port Number (usually 443 or 8443)** field, change the value to 16443.

### Updating a remote instance of Operations Orchestration Studio to the latest version

To update Operations Orchestration Studio installed on a remote computer to the latest version (with Matrix OE 7.1, this is 9.02.0002):

1. Close Operations Orchestration Studio on the remote computer if it is running.
2. Copy the `studio.jar` file installed on the CMS (``Program Files\HP\Operations Orchestration\Studio\lib\studio.jar``) to the same path on the remote Operations Orchestration Studio computer, overwriting the existing instance of that file.
3. Copy the `content-plugins.jar` file installed on the CMS (``Program Files\HP\Operations Orchestration\Studio\plugins\content-plugins.jar``) to the same path on the remote Operations Orchestration Studio computer, overwriting the existing instance of that file.
4. Copy the `dharma-commons.jar` file installed on the CMS (``Program Files\HP\Operations Orchestration\Studio\thirdparty\dharma-commons.jar``) to the same path on the remote Operations Orchestration Studio computer, overwriting the existing instance of that file.
5. Copy the `updates` folder installed on the CMS (``Program Files\HP\Operations Orchestration\Studio\updates``) to the same path on the remote Operations Orchestration Studio computer, overwriting the existing folder if it already exists.

### Configuring Operations Orchestration Studio on a remote computer

To configure Operations Orchestration Studio on a remote computer:

1. Make a backup of the `rc_keystore` file on the CMS.
2. Copy the `rc_keystore` file installed on the CMS (``Program Files\HP\Operations Orchestration\Central\conf\rc_keystore``) to the same path on the remote Operations Orchestration Studio system (``Program Files\HP\Operations Orchestration\Central\conf\rc_keystore``).
Orchestration\Studio\conf\rc_keystore), overwriting the existing instance of that file.
4. In that same directory, open studio.properties and change the value in dharma.studio.ui.input.constant.max.chars to 65536.
5. When launching Operations Orchestration Studio, enter “admin” as the user name and enter your CMS password.

Copying keystore file after upgrading Operations Orchestration

After upgrading Operations Orchestration from version 7.51 to 9.0, Operations Orchestration Central and Studio have different certificate keys. Operations Orchestration Studio cannot access the URL https://<cms-name-or-ip>:16443.

1. Make a backup of the rc_keystore file on the CMS.
2. Copy the rc_keystore file installed on the CMS (..\Program Files\HP\Operations Orchestration\Central\conf\rc_keystore) to the same path on the remote or upgraded Operations Orchestration Studio system (..\Program Files\HP\Operations Orchestration\Studio\conf\rc_keystore).

Pruning history data for Operations Orchestration Central systems

The Operations Orchestration Central database stores information about every flow execution step. This data is used for OO reporting purposes. The database administrator can prune historical data from the database to keep the database at a reasonable size. Regular database pruning will minimize the disruption of disk space depletion or pruning large databases. Note that data about the flows that is deleted from the database will no longer be visible in any reports.

SQL query based scripts allow the database administrator to specify how many days of run history to be kept in the database.

For more information, see Purging OO Run Histories from MSSQL Databases (HP Passport required).

Configuring deployment servers

Matrix infrastructure orchestration supports the following server deployment platforms for provisioning:
- Insight Control server deployment (physical provisioning)
- Ignite-UX (physical and virtual provisioning)
- HP Server Automation (SA) (physical and virtual provisioning)

Registering deployment servers

The host IP address and credentials for the deployment servers used by infrastructure orchestration must be entered during infrastructure orchestration installation.

The Insight Management Installer does not allow selection of both Insight Control server deployment and HP Server Automation (SA) when configuring infrastructure orchestration with server deployment options. However, infrastructure orchestration can be configured to use both deployment servers, but this configuration must be done after installation is complete.

If you want to add a deployment server after infrastructure orchestration is installed, enter the following commands on the CMS.
### Configuring Insight Control server deployment

**Creating server deployment job folders**

Create Insight Control server deployment job folders for each operating system that infrastructure orchestration uses to deploy physical servers.

1. Create a top-level Insight Control server deployment job folder for each operating system. Right-click in the empty space of the Jobs panel and select **New Folder** from the list.
2. Rename the new folder, for example, `HPIO RHEL54 BL BFS`.
3. Copy the **Deploy ProLiant System Configuration (BL BFS)** job from the **HP Deployment Toolbox/2 → Hardware Configuration** folder, and paste it into the new folder.
4. OS jobs can be found under **OS Installation → Hardware Configuration** (or under **HP Deployment Toolbox/3B → OS Imaging** if customized OS images were already captured); HP management agent jobs can be found under **HP Deployment Toolbox/4 → Software** which should be installed after the OS is deployed.

For example, in the HPIO RHEL54 BL BFS job folder highlighted in the following figure, enter 01 in front of the first job, Deploy ProLiant System Configuration (BL BFS); enter 02 in front of the second job, DeployRHEL 5.4 x64 (EN-US); enter 03 in front of the third job, Install HP Management Agents for RHEL 5 x64.

For Direct-Attached Storage (DAS) OS deployment, do **not** include the Deploy ProLiant System Configuration (BL BFS) job in the job folder.
5. To create a job folder for each required operating system, repeat this procedure.

6. To enable adding computers to the domain during provisioning, configure the Insight Control server deployment domain authorization using Tools→Options→Domain Accounts.

   Enclosures are discovered by Systems Insight Manager through the iLO IP address of the enclosure. Be sure to use the iLO credentials of the Onboard Administrator enclosure as the WBEM credentials.

7. In Matrix Operating Environment, create storage pool entries for automated SAN boot provisioning. It’s important to know the storage array port WWN/LUN (World Wide Name/Logical Unit Number) when creating the entries. If these settings are unknown, modify them after creating storage LUNs and zones. See “Manually creating SAN-backed storage in Matrix OE visualization” (page 138).

8. Manually configure storage LUN presentation and zoning using the virtual HBA WWN in VC profiles used when creating the storage pool entries. HP recommends creating a spreadsheet to track storage mapping.

   During provisioning, the server blade should see a SAN volume when booting. If it does not, check the storage configuration settings.

**Modifying the Erase ProLiant Hardware job**

After installing Insight Control server deployment software, modify the default Erase ProLiant Hardware job. To modify the job, do the following:

1. Save a copy of the default Erase job:
a. Right-click the **Erase ProLiant Hardware** job under the **HP Deployment Toolbox → Hardware Configuration** folder, and then select **Copy** from the menu.
b. Right-click the HP Deployment Toolbox → Hardware Configuration folder, and then select Paste from the menu.

2. Delete tasks 1, 3, 4, and 6 from the default Erase job:
   a. Double-click the Erase ProLiant Hardware job. The Job Properties window appears.
   b. In the Job Properties window, keep the Ctrl key pressed while selecting tasks 1, 3, 4, and 6 (the tasks become highlighted as shown), then click Delete.

3. Modify the Power Control task to shutdown instead of reboot in the default Erase job:
a. Select the **Power Control** task, and then click **Modify**.

![Job Properties](Image)

b. Select the **Shut down (if available)** option, and then click **Finish**.

![Power Control Options](Image)
c. In the **Job Properties** window, make sure that the modified **Erase ProLiant Hardware** job displays, then click **OK** to close the window.

---

### Configuring Ignite-UX

Matrix infrastructure orchestration supports Ignite-UX version C.7.11.439 (HP-UX 11.31 1009) or later for HP-UX 11iv3 deployment. (HP-UX 11iv3 0709 or later is required for Integrity VM.)

The Ignite server must have NFS configured and the tftp and bootps services enabled in `/etc/inetd.conf`.

- **a.** To set up NFS and export the directories Ignite needs, run:
  ```bash
  /opt/ignite/lbin/setup_server -n
  ```

- **b.** To enable tftp and bootps services, edit `/etc/inetd/conf`, and uncomment the "tftp" and "bootps" lines and then run:
  ```bash
  inetd -c
  ```

Depending on the client being installed (for example, if the client has a graphics card or keyboard attached), the system may prompt to identify the keyboard language. To avoid this, edit `/var/opt/ignite/config.local` by adding the following line:

```
_hp_keyboard="USB_PS2_DIN_US_English"
```

**NOTE:** Only HP-UX release 11.31 1003 or later can be installed on the following Integrity blades: BL860c i2, BL870c i2, BL890, BL890c i2.

The complete list of documentation for Ignite-UX is available at [http://hp.com/go/ignite-ux](http://hp.com/go/ignite-ux).

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### Discovering the Ignite-UX deployment server

Matrix infrastructure orchestration provisioning requires that the Ignite-UX deployment server is discovered or rediscovered.

To discover a Ignite-UX deployment server in Systems Insight Manager:

1. Select **Options** → **Discovery**.
2. Create or edit a group (for example, Deployment Servers).
3. In **Ping inclusion ranges, system (hosts) names, and/or hosts files**, enter the IP address or FQDN.
4. In **Credentials...**, specify the username and password, and then confirm the password.
5. Click **Save**.
6. In Discovery, click **Run Now**.

**Integrity VM Guest Kit installation**

The HP-UX vPars and Integrity VM Guest Kit must be set up on the Ignite-UX server to properly ignite an HP-UX guest. Create a “golden image” that includes both the appropriate operating environment and Integrity VM Guest Kit software. Creating a “golden image” ensures you have a properly ignited VM as part of the automatic provisioning process with infrastructure orchestration.

For more detailed information on Integrity VM, see **HP-UX vPars and Integrity VM Administrator Guide** and **HP-UX vPars and Integrity VM Release Notes**.

**Configuring HP Server Automation**

HP Server Automation software provides lifecycle management for enterprise servers, and automates the deployment of applications. Matrix infrastructure orchestration 7.1 supports HP Server Automation version 9.0.x and 9.1.x by default. If an SA core and credentials are identified during CMS installation, the file opswclient.jar is copied from the SA core to the CMS to ensure version compatibility.

Enter the SA core server credentials during the Insight Management installation using its IP address. If the Fully Qualified Domain Name (FQDN) is entered instead of the IP address, the SA server must be discovered in Systems Insight Manager after installation.

**NOTE:** Beginning in Matrix infrastructure orchestration 7.1, manually setting PXE boot in Virtual Connect server blades is no longer needed for an SA deployment. By default, the PXE NIC is moved into the first position of the Standard Boot Order (IPL).

For more information about SA, see **HP Server Automation complements HP Insight Control to manage HP BladeSystem servers** and **Integrating HP Server Automation with HP BladeSystem Matrix/Insight Dynamics Instructions for integration** at **Matrix Operating Environment Information Library**.

**Provisioning Hyper-V linked clone VM guests patch kit**

Using SA 9.0 or SA 9.10 on Red Hat Enterprise Linux 6 or SUSE Linux Enterprise Server 10 platforms to provision Hyper-V linked clone VM guests requires installation of the following version-specific core patches and hotfixes for each SA version.

For SA 9.0, download and install:

- SA 9.05 core patch from [http://support.openview.hp.com/selfsolve/patches](http://support.openview.hp.com/selfsolve/patches)

For SA 9.1, download and install:

- SA 9.11 core patch from [http://support.openview.hp.com/selfsolve/patches](http://support.openview.hp.com/selfsolve/patches)

Licensing and registration within Systems Insight Manager are not required for deployment servers, including SA. See “Registering deployment servers” (page 29) for more information about adding an SA deployment server after infrastructure orchestration is installed.

Infrastructure orchestration requires the SA **OS Build Plan Management** permissions to be enabled. If these permissions are not set, IO will not retrieve the SA software list.

Enable **OS Build Plan** permissions in SA:

1. Log in to the SA web client as Admin.
2. In the SA user interface, select **By Folder**.
3. Right click on the **OS Provisioning** folder name.
4. Ensure that the **Execute Objects Within Folder** permission is selected.
5. Select **Users & Groups** from the Navigation panel.
6. Select the IO user for SA (typically hpiosa).
7. Click **Edit** in the upper right corner.
8. Select the **Client Features** tab.
9. Scroll to the section **OS Build Plan Management**.
10. Set the radio button **Manage OS Build Plan** to **Read**.
11. Set the radio button **Allow Execute OS Build Plan** to **Yes**.
12. Click **Save** at the top of the page.

To make the **OS Build Plan** available for infrastructure users (for example: hpiosa), create the following custom attributes on each of the OS Build Plans:

1. Set **OSType** to any one of the following values:
   - Windows Server 2003
   - Windows Server 2003 x64
   - Windows Server 2008
   - Windows Server 2008 x64
   - Windows Server 2008 R2 x64
   - Red Hat Enterprise Linux Server 5
   - Red Hat Enterprise Linux Server 5 X86_64
   - Red Hat Enterprise Linux Server 6
   - Red Hat Enterprise Linux Server 6 X86_64

2. Set **archType** to one of the following values:
   - x86 (for 32-bit systems)
   - x64 (for 64-bit systems)

See the Application Automation section in the **HP Server Automation User Guide** for more information about creating custom attributes.

Communication between infrastructure orchestration and SA is done through the SA core. The core then directs the satellite(s) to deploy software. This occurs automatically, and requires only that a network is selected that has been configured to use SA.

To configure a network to use an SA deployment server:

1. From the infrastructure orchestration console, select the **Networks** tab.
2. Select a network from the list, and click **Edit**.
3. From the **Deployment Server** list, select an SA satellite (for example, 10.0.0.10 (SA)).
4. In **Boot Network**, select **Yes**, and save the configuration.
5. In infrastructure orchestration designer, create or edit a template, and edit the network configuration to select the network from step 2.

**Default memory setting**

The default minimum memory setting for templates that use the SA server to deploy software is 512 MB. This value can be changed in the `\Program Files\HP\Matrix infrastructure orchestration\conf\hpio.properties` file. Search for the following lines:

```
# Template Config minimum MB "Memory size:" for SA agent install
sa.minimum.memory=512
```

**Configuring an environment for virtual provisioning**

Virtual provisioning requires a correctly configured and licensed virtual machine host that is discovered and visible in Systems Insight Manager. Run either ESX or Hyper-V on the virtual machine host. You can also manage Integrity VM using infrastructure orchestration (see “Setting up an Integrity virtual machine network” (page 39)).
For more information, see the *HP BladeSystem Matrix How-To Guide: ESX Host Provisioning* at Matrix Operating Environment Information Library.

For virtual logical server provisioning to perform correctly, infrastructure orchestration limits the number of virtual logical servers that are sent concurrently to hypervisors for provisioning. The limit is determined by the value of the corresponding hypervisor `max.concurrent.requests` attribute in the `hpio.properties` file located in `..\Program Files\HP\Matrix infrastructure orchestration\conf`.

The following table shows the default values for each hypervisor type. Increasing the default values for ESX and Integrity VM might cause virtual logical server provisioning to fail unexpectedly.

<table>
<thead>
<tr>
<th>Hypervisor</th>
<th>Default number of virtual maximum concurrent requests</th>
<th>Can this value be safely increased?</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESX</td>
<td>esx.max.concurrent.requests=10</td>
<td>No</td>
</tr>
<tr>
<td>Hyper-V</td>
<td>hyperv.max.concurrent.requests=5</td>
<td>Yes, if SCVMM is not used.¹</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increase this value to 10 to improve performance.</td>
</tr>
<tr>
<td>Integrity VM</td>
<td>integrityvm.max.concurrent.requests=5</td>
<td>No</td>
</tr>
</tbody>
</table>

¹ If Microsoft SCVMM templates are used to provision operating systems to Hyper-V VMs, this default value should remain at 5.

For each virtual logical server, infrastructure orchestration supports up to 14 private disks or 15 shared disks.

### Provisioning a Linux VM on Hyper-V

Matrix infrastructure orchestration supports provisioning a Linux VM on Hyper-V, but IO does not personalize the VM. IO does not set the hostname, or configure the NICs for DHCP or static IP. After provisioning, you must personalize the Linux VM.

To enable provisioning Linux VMs on Hyper-V, perform the following steps:

1. Set the following line to `true` in the `hpio.properties` file located in `..\Program Files\HP\Matrix infrastructure orchestration\conf`. The property is set to `false` by default.

   ```
   skip.linux.on.hyperv.template.personalization=true
   ```

2. After provisioning, personalize the Linux VM. To do so, you can write Operations Orchestration workflows, or you can use open source PowerShell scripts.

   If you provision a Linux VM on Hyper-V and do not personalize it, and the base template is configured with a static IP address, duplicate IP addresses may result. Without personalization, if you configured the base OS VM with DHCP, you will not get an expected static IP address.

See the *HP Insight Management Support Matrix* at [http://www.hp.com/go/matrixoe/docs](http://www.hp.com/go/matrixoe/docs) for supported Linux guest operating systems.

### Setting up virtual machine networks

Network names are correlated across hypervisor and Virtual Connect technologies to allow an infrastructure service to be provisioned with logical servers of different types configured on the same network.

VMware vDS (vNetwork Distributed Switch) is supported in infrastructure orchestration.

- IO can provision logical servers to ESX hosts that are preconfigured with connectivity to a vDS switch.
- Port groups configured on the vDS switch are visible on the infrastructure orchestration console *Networks* tab as virtual networks.
When vDS networks are discovered into the IO inventory, they can be selected and used when provisioning a service with one or more virtual servers. All additional configuration of vDS occurs outside of IO using vCenter, including configuring virtual machine rate limiting, security, and monitoring of the port runtime states.

**NOTE:** Do not rename a network that is in use by IO services. If a network is renamed using a tool outside of IO, services shown by IO will appear to be using the old network. The old network will remain in the network inventory, but will no longer have a physical or virtual source and cannot be used to provision new services.

### Setting up an ESX virtual machine network

To add a network for use by the virtual machines provisioned through infrastructure orchestration:

1. Open VMware Infrastructure Client, enter the IP and credentials of the vCenter Server, and then click **Login**.
2. For each ESX/ESXi virtual machine host in the ESX cluster, do the following:
   a. In the left navigation pane, select the virtual machine host.
   b. Select the **Configuration** tab.
   c. Click **Networking**.
   d. Click **Add Networking**.
   e. For connection type, select **Virtual Machine**, then click **Next**.
   f. Depending on the network configuration of the virtual machine host, either select an existing virtual switch or select **Create a virtual switch**, and then click **Next**.
   g. In **Port group properties**, enter a name for the network in **Network Label**, and depending on the network configuration of the virtual machine host, enter a VLAN ID.
   h. Click **Next**.
3. Click **Finish**.
   Repeat the process for each network.

### Setting up an Integrity virtual machine network

To create an Integrity VM vSwitch, use the `hpvmnet` command on the Integrity VM Host.

**NOTE:** Matrix infrastructure orchestration uses only Accelerated Virtual I/O (AVIO) network devices for Integrity VM.

An Integrity VM cannot be configured with a connection to a local virtual network through infrastructure orchestration. Only vSwitches connected to a physical NIC are recognized by infrastructure orchestration.

Matrix infrastructure orchestration identifies Integrity VM virtual networks using vSwitch names, which are limited to eight characters. Network names are correlated across hypervisor and VC technologies to allow an infrastructure service to be provisioned with logical servers of different types configured on the same network. Employing this capability requires the eight-character limit to be extended to the other hypervisor and VC configurations in the managed environment.

For more detailed information on Integrity VM, see [HP-UX vPars and Integrity VM Administrator Guide](#) and [HP-UX vPars and Integrity VM Release Notes](#).

### Setting up a Hyper-V virtual machine network

To add a network for use by the virtual machines provisioned through infrastructure orchestration, perform the following steps for each Hyper-V VM Host.

See “Configuring trunk and VLAN networks to enable support for Hyper-V VLAN tagging” (page 66) for information about the new method to support VLAN tagging in this release.

1. Connect to the Hyper-V host using Remote Desktop.
2. Open Hyper-V Manager and choose the server to be connected.
   1. In the Actions list on the right side of the panel, select Virtual Network Manager.
   2. Select New Virtual Network.
   3. Under Connection Type, select External to configure a physical network.
   4. Click Add.
   5. In the Name field, enter the name of the network.
   6. Under Connection Type, select the network interface from the External drop-down list.

   **NOTE:** To use this network on the management system, select Allow management operation system to share the network adapter.

   7. Select OK.

**Insight Control virtual machine management templates**

Matrix infrastructure orchestration uses VMware templates as deployment targets for ESX. For information about creating VMware templates, see the VMware documentation at [http://www.vmware.com/support/pubs/vs_pages/vsp_pubs_esxi41_i_vc41.html](http://www.vmware.com/support/pubs/vs_pages/vsp_pubs_esxi41_i_vc41.html).

**NOTE:** VM template-based provisioning is not available for Integrity VM.

To create virtual machine management templates from virtual machines, use Systems Insight Manager to do the following:

1. Power off the virtual machine to be used in the virtual machine management template. It is good practice to cleanly power off the virtual machine by accessing the virtual machine and performing an operating system shutdown rather than using a hypervisor power off command. If the virtual machine is in a suspended state when used to create the template, provisioning will fail during customization with the error message VM must be powered off for customization.


3. Select a virtual machine from the list, and then click Next. The Step 2: Select VM Template Repository Host screen appears.

4. Select the host for the new virtual machine management template, and then click Next. The Step 3: Specify the Template Name and select VM Template Repository Folder screen appears.

5. In Template Name, enter a name for the template and specify a location for the template.

6. To store the virtual machine management template, in the target folder, select Browse and select a virtual machine host datastore folder, or click Next to select the default choice.

7. Click Next. The Step 4: Confirm Details screen appears.

8. Click Run Now. The task results appear.

Insight Control virtual machine management template creation might take from 5 minutes up to 30 minutes to complete.

The resulting ESX VM template is discovered and displayed in the Software tab in the infrastructure orchestration console, and can be selected as the software when configuring a server group in an IO template in infrastructure orchestration designer.

When configuring an IO template and specifying a VM template as the software, changes made to the VM template after the IO template is created are not reflected in the IO template. If a service is created from that (outdated) IO template, the service uses information from the updated VM template. Therefore, the resulting service may not reflect the values in the IO template. To avoid this issue, if the VM template is changed, create a new IO template and select the updated VM template as the software before deploying the service.
Viewing VM templates with data disks

VM templates that have data disks defined appear on the infrastructure orchestration console Software tab and can be used in infrastructure orchestration templates. If a VMware or Hyper-V VM template is selected on the Software tab, and that VM template has more than one data disk, a pie chart is displayed. The pie chart shows the relative sizes of the disk definitions in the VM template.

The following example shows the pie chart for a VMware template named Linux5DiskTemplate, which contains six VM data disks.

This information is also shown in the VM Template Disks tab in the infrastructure orchestration designer Configure Virtual Storage screen, and in the Details pane of the infrastructure orchestration console Services tab.

In a template in infrastructure orchestration designer, the notation boot+ is used to show that the disk includes one or more data disks.

Hyper-V virtual machine management templates

A Hyper-V VM template is not automatically discovered. Hyper-V templates must be imported into HP Insight Control virtual machine management before they appear in IO on the Software tab as VM templates.

Matrix infrastructure orchestration uses a Hyper-V virtual machine as the source material for a Hyper-V virtual machine management template without any additional steps. However, to provision recoverable logical servers, deploy the Hyper-V virtual machine host in a Windows cluster.

When using Hyper-V, do not use a Hyper-V virtual machine management template created from a virtual machine with Snapshot. VM templates created from a virtual machine with Snapshot do
not display on the Software tab of the infrastructure orchestration console, preventing the successful creation of an IO template.

Microsoft System Center Virtual Machine Manager (SCVMM) templates

Matrix infrastructure orchestration enables the deployment of services using the Microsoft System Center Virtual Machine Manager (SCVMM) template library. This is accomplished by selecting an SCVMM Hyper-V template on the Software tab in an infrastructure orchestration service template.

SCVMM templates are displayed on the infrastructure orchestration console Software tab after SCVMM is successfully registered in Insight Control virtual machine management. To register SCVMM:

1. Discover the SCVMM server in Systems Insight Manager.
2. Enter valid SCVMM credentials on the VME tab. Select the Systems Insight Manager Options→VME Options→Add or Edit VME Credentials.
   Or, from the SCVMM server’s system properties, select the Tools & Links tab, then click Add or Edit VME Credentials.

The SCVMM server itself is not representative of a server pool, nor is it licensed as a target for deployment.

SCVMM is not a required component for Hyper-V deployment. SCVMM template deployment is an option that coexists with deployments of HP Insight Control virtual machine management Hyper-V templates.

The following constraints apply when using SCVMM templates.

- Microsoft SCVMM 2008 R2 is required for this integration
- A subset of SCVMM templates are included in the IO inventory:
  - Hyper-V templates with a single VM are included
  - ESX and other hypervisor types are excluded
  - Multi-server (SCVMM service) templates are excluded
  - No explicit indication is given when a template is filtered from view
- Create SCVMM templates with the “No Customization Required” option. IO overwrites the SCVMM customization parameters with its own customization, and some SCVMM customization parameters could persist after IO customization, potentially creating a confusing result.
- VMs deployed using SCVMM in a Hyper-V cluster environment are enabled for high availability (HA) by default, even when the IO template specifies a non-HA VM. If the VM is later deactivated and reactivated, it will continue to be enabled for high availability.

Configuring ESX memory oversubscription

When Matrix infrastructure orchestration is used to provision services with ESX virtual machines, by default it uses memory oversubscription techniques to allow a larger number of virtual machines to be provisioned to an ESX host.

The ESX virtual machines created by IO do not use memory reservation, and IO has a low requirement for free memory in the ESX host when it checks if a virtual machine fits in a specific host. (The default value is 2% of the virtual machine memory.) For example, if a service contains a virtual machine that requires 4GB of RAM, IO requires a VM Host to have approximately 82MB of available memory (2% of 4GB). Therefore, any VM Host with at least 82MB of available memory passes the memory check in the allocation phase of service provisioning.

This strategy allows a larger number of virtual machines to be provisioned to an ESX host, but in some situations it might result in degradation of the virtual machine performance. This can happen
when there are too many virtual machines in a specific VM Host, and the VM Host starts swapping
the host memory to disk.
If a more conservative memory oversubscription approach is desired, IO can be configured to use
a more restrictive check of the available memory in the ESX host before provisioning a virtual
machine. The default value of 2% for the required available host memory can be increased.
Increasing this value might cause IO to fail in the resource allocation step when provisioning a
service with ESX virtual machines. This will happen whenever IO is not able to find an ESX host
with the required amount of available memory.
Increasing this configuration to 50% allows IO to be more conservative when provisioning ESX
virtual machines, while still allowing some level of memory oversubscription. To change this
configuration, edit hpio.properties in the default location at ..\Program Files\HP\Matrix infrastructure orchestration\conf. Locate the property
esx.vm.requested.memory.max.percent and change the property to
esx.vm.requested.memory.max.percent=50.0.
After changing this value, restart the Matrix infrastructure orchestration service for the new
configuration to take effect. Changing this configuration does not affect services already provisioned.
The following table shows some examples of how changing this configuration will affect the minimum
available memory required in ESX VM Hosts.

<table>
<thead>
<tr>
<th>Memory Max Percent Configuration</th>
<th>VM with 2GB of RAM (*)</th>
<th>VM with 4GB of RAM (*)</th>
<th>VM with 8GB of RAM (*)</th>
<th>VM with 16GB of RAM (*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2%</td>
<td>~41 MB</td>
<td>~82 MB</td>
<td>~164 MB</td>
<td>~328 MB</td>
</tr>
<tr>
<td>5%</td>
<td>~102 MB</td>
<td>~205 MB</td>
<td>~410 MB</td>
<td>~819 MB</td>
</tr>
<tr>
<td>10%</td>
<td>~205 MB</td>
<td>~410 MB</td>
<td>~819 MB</td>
<td>~1.5 GB</td>
</tr>
<tr>
<td>20%</td>
<td>~410 MB</td>
<td>~819 MB</td>
<td>~1.6 GB</td>
<td>~3.2 GB</td>
</tr>
<tr>
<td>50%</td>
<td>~4 GB</td>
<td>~8 GB</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(*) VM Host must have at least this amount of memory for a VM to be successfully provisioned to that host.

Using Sysprep to customize Windows systems
Matrix infrastructure orchestration relies on Windows Sysprep to enable customization of Microsoft
Windows systems. Customization includes operations such as changing the hostname, applying
the Windows license key on first boot, and setting the IP address. To automate Windows system
deployments and apply the Windows license key automatically, you must edit the Matrix OE-supplied
Sysprep.inf file. This edit enables Matrix OE to provision new Windows systems with no manual
interaction. Without this edit, a newly provisioned system halts during first boot waiting for a key.
Matrix infrastructure orchestration customizes the Windows OS for each Windows VM it provisions
by combining two sources of information and passing them to virtual machine management, which
passes the information to ESX and Hyper-V for customization. This information includes:

- Specific attributes from the service template, such as hostname.
- The contents of the infrastructure orchestration Sysprep.inf file, a template for which is
  located at ..\Program Files\HP\Matrix infrastructure orchestration\conf\sysprep\Sysprep_sample.inf.

An administrator creates the new Sysprep.inf file and can edit Sysprep files based on the
sample file to specify additional customizations for Windows virtual machines, such as the Windows
license key. You can then use these files while creating IO templates with corresponding Windows
VMs.

**NOTE:** Do not delete or rename the Sysprep_sample.inf file.
Create one Sysprep file for each version of Microsoft Windows, for example:

- Copy `Sysprep_sample.inf` to `Sysprep_w2k3_32bit.inf`
- Copy `Sysprep_sample.inf` to `Sysprep_w2k3_64bit.inf`
- Copy `Sysprep_sample.inf` to `Sysprep_w2k8.inf`
- Copy `Sysprep_sample.inf` to `Sysprep_w2k8r2.inf`
- Edit the product key and any other needed customization in the file.
- To cause IO to automatically join new virtual machines to a Windows domain, add the domain administrator credentials in clear text to the `Sysprep.inf` file. If the credentials are not provided in the `Sysprep.inf` file, select “None” or “Workgroup” in the Edit Network dialog box. After deployment completes, a domain administrator can manually join the system to the domain.

When defining networks in IO, set the **MS Domain Type** to “Domain” in the **Windows Settings** tab of the infrastructure orchestration console **Edit Network** dialog box.

### Installing Microsoft Sysprep tools

Install the Microsoft Sysprep tools only if you are provisioning Windows Server 2003 or earlier guests.

**NOTE:** Provisioning the following does not require installation of Sysprep tools:

- Windows 2008 and higher VM guests
- Linux VM guests

<table>
<thead>
<tr>
<th>To enable customization on:</th>
<th>Do the following:</th>
</tr>
</thead>
<tbody>
<tr>
<td>VMware vCenter 4.x VMware vCenter 5.0</td>
<td>Install the Microsoft Sysprep tools on the vCenter management server.</td>
</tr>
<tr>
<td></td>
<td>- If vCenter Server is installed on Windows Server 2008 or higher, and you are provisioning Windows 2003 or earlier guests, install the Sysprep tools in <code>C:\ProgramData\VMware\VMware VirtualCenter\Sysprep\&lt;OS&gt;</code>. Note: <code>C:\ProgramData</code> may be a hidden folder.</td>
</tr>
<tr>
<td></td>
<td>- If vCenter Server is installed on an earlier Windows operating system, install the tools in <code>C:\Documents and Settings\All Users\Application Data\VMware\VMware VirtualCenter\Sysprep\&lt;OS&gt;</code> where <code>&lt;OS&gt;</code> is the Windows guest operating system. Valid values are <code>svr2003</code> and <code>svr2003-64</code>.</td>
</tr>
<tr>
<td>Microsoft HyperV (Windows 2003 VM guests)</td>
<td>Install the Microsoft Sysprep tools on the CMS in the folder <code>C:\Program Files\HP\Insight Control virtual machine management\Sysprep\&lt;OS&gt;</code> where <code>&lt;OS&gt;</code> is the Windows guest operating system. Valid values are <code>svr2003</code> and <code>svr2003-64</code>.</td>
</tr>
</tbody>
</table>

For more information, see the VMware vCenter and **Installing the Microsoft Sysprep Tools** article in the VMware Infrastructure Online Library and the **Updated System Preparation tool for Windows Server 2003 SP2** article at the Microsoft support website. The contents of Microsoft ...\Support\Tools\Deploy.cab (not the .cab file) must be placed in the directories mentioned previously.

### Configuring a disaster recovery (DR) service

Matrix recovery management is a component of the HP Matrix Operating Environment that provides disaster recovery protection (DR protection) for logical servers.

When Matrix recovery management and IO are installed on a CMS and recoverable services have been configured, you can create DR protected IO services Recovery Groups using the Matrix recovery management UI. For more information about using Matrix recovery management to

The file dr.properties (installed in the default location at ..\Program Files\HP\Matrix infrastructure orchestration\conf) is used for mapping resources between the Primary and Replica sites. The Matrix recovery management administrator sets the properties in this file.

To configure a recoverable IO service, check the Recoverable checkbox in the IO service template in infrastructure orchestration designer.

A template containing these server group types can be marked recoverable:
- ESX and Hyper-V (with manual and automatic OS deployment, private and shared disks)
- ESX and Hyper-V linked servers

A template containing these server group types cannot be marked recoverable:
- Integrity VM virtual server groups
- Cloud server groups
- Physical server groups

In the infrastructure orchestration console Templates tab, the recoverable template will be marked Enabled in the Recoverable column.

After creation or modification of a DR protected service, the Operations Orchestration workflow engine notifies the DR administrator with instructions about the configuration tasks to be done in Matrix recovery management.
Operations Orchestration workflows provide system administrators with automatic email notification when operations are performed on recoverable IO services. Set the HPIODRServiceActionRecipients property in Operations Orchestration Studio with the email address(es) of administrators who will receive this notification. See “Configuring Operations Orchestration system properties” (page 23) for more information.
Configuring an environment for cloud provisioning

In addition to provisioning with on-premise resources, Matrix OE infrastructure orchestration supports provisioning virtual servers to the following public cloud providers: HP Cloud Services, Savvis, and Amazon EC2.

Public cloud bursting is a feature of Matrix infrastructure orchestration that enables enterprises to seamlessly provision public and private infrastructure resources. Combined with powerful private cloud management capabilities, the ability to “burst” beyond the private cloud environment and to leverage infrastructure resources offered by external cloud service providers creates a virtually unlimited pool of hybrid cloud resources for Matrix infrastructure orchestration users to draw upon for cloud service delivery.

Before you can create a template containing a virtual server that can be provisioned at a cloud service provider, you must configure your environment for cloud provisioning. For detailed configuration steps for provisioning to HP Cloud Services and Amazon EC2, see the Cloud bursting with HP CloudSystem Matrix infrastructure orchestration and HP Cloud Services or Amazon EC2 white paper. For detailed configuration steps for provisioning to Savvis, see the Cloud bursting with HP CloudSystem Matrix infrastructure orchestration and Savvis white paper. Both white papers are available at http://www.hp.com/go/matrixoe.

NOTE: To provision public cloud instances, obtain a Matrix OE Public Cloud Managed Instance license. This license allows you to manage one public cloud instance hosted at an HP-supported public cloud service provider for a term of one year from the date of registration. Multiple licenses can be used together under a concurrent use model. (For example, if you purchase 10 licenses, you can manage up to 10 public cloud instances at any one time.) Public cloud managed instance licenses are not tied to a particular service provider. You can use the same license to manage an instance at one service provider today and at another tomorrow, as long as the license is not used for both instances at the same time.

For details on licensing, contact your HP sales representative.

Configuring a firewall (security group)

Configuring a firewall for server groups deployed to a cloud service provider allows you to permit or restrict inbound network traffic based on a set of rules. A firewall is also known as a security group.

NOTE: All server groups deployed to a cloud service provider have a firewall that blocks all inbound traffic by default.

To allow inbound traffic, create a rule on the Firewall tab in infrastructure orchestration designer that describes that traffic. The Firewall tab is enabled only for virtual server group templates that have checked Require in Cloud, which deploys the server group to a cloud provider such as HP Cloud Services and Amazon EC2. (The Require in Cloud checkbox is visible only after your environment is configured for cloud provisioning. See the Cloud bursting with HP CloudSystem Matrix infrastructure orchestration and HP Cloud Services or Amazon EC2 white paper at http://www.hp.com/go/matrixoe for more information.)

Only firewall rules that affect incoming network traffic can be defined and modified.

For example, to allow SSH connections to a server, select the TCP protocol, specify a Start Port and an End Port of 22 and IP Sources of 0.0.0.0/0 and click Add.
A firewall is created as part of the Create Service operation and is uniquely associated with a single cloud server group within a service. An IO user can only change the rules for the firewalls associated with services that they own.

**Viewing the details of a firewall**

Details of a firewall associated with a template and service are shown on the Firewall Details pane at the bottom of the infrastructure orchestration console Templates and Services tabs. Select a service or template and click Details, then select the Firewall Details tab.

In the following template, the firewall configured for the template allows inbound traffic over the TCP protocol on ports 2 through 4 from locations defined by CIDR IP notation 10.0.0.0/24. Inbound traffic is also allowed over the UDP, ICMP, and TCP protocols, with the details shown below.
Configuring a load balancer

A load balancer distributes network traffic and enables optimal resource utilization across servers in a virtual or physical server group.

Before beginning the configuration described in the following sections, the system administrator installs and configures a load balancer. A hardware load balancer is installed in an enclosure, and a software load balancer is installed on a physical server or virtual machine. The registration information about the load balancer is stored on the CMS, in the infrastructure orchestration inventory.

To use a load balancer with Matrix infrastructure orchestration, Operations Orchestration workflows are required. By default, Operations Orchestration workflows for the HAProxy and F5 BIG-IP Local Traffic Manager load balancers are included for use with infrastructure orchestration. The F5 BIG-IP Local Traffic Manager load balancer supports high availability and multi-tenancy.
Optionally, a load balancer expert can customize the packaged Operations Orchestration workflows or develop new OO workflows for additional types of load balancers and add them to the OO repository. An administrator can then configure one or more of these load balancers and add them to the inventory (described in “Registering a load balancer” (page 50)).

With customized Operations Orchestration workflows, Matrix infrastructure orchestration supports:

- software and hardware based load balancers
- full-featured and baseline load balancers
- single and multi-use load balancers

Operations Orchestration workflow implementations for the HAProxy and F5 BIG-IP Local Traffic Manager load balancers are provided with infrastructure orchestration in /Library/Hewlett-Packard/Infrastructure orchestration/Load Balancers/[LB Model]/[LB Version]/. A mock (sample) load balancer is also provided.

Registering a load balancer

After a load balancer is installed on the CMS, an IO administrator registers the load balancer in IO. The load balancer is not automatically discovered. To register the load balancer, which adds it to the infrastructure orchestration inventory, you can use:

- the infrastructure orchestration SOAP API
- the `ioexec` command line interface (a client using the SOAP API)

Following are the `ioexec` register load balancer commands.

Table 1 ioexec register load balancer commands

<table>
<thead>
<tr>
<th>ioexec command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>list loadbalancers</td>
<td>Gets a list of load balancer resources</td>
</tr>
<tr>
<td>add loadbalancer</td>
<td>Adds a load balancer to the IO inventory</td>
</tr>
<tr>
<td>modify loadbalancer</td>
<td>Modifies the definition of a load balancer in the IO inventory</td>
</tr>
<tr>
<td>remove loadbalancer</td>
<td>Removes a load balancer from the IO inventory</td>
</tr>
<tr>
<td>addcert loadbalancer</td>
<td>Adds a certificate for a load balancer</td>
</tr>
<tr>
<td>removecert loadbalancer</td>
<td>Removes a certificate for a load balancer</td>
</tr>
<tr>
<td>setpassword loadbalancer</td>
<td>Sets the password for a load balancer</td>
</tr>
<tr>
<td>unsetpassword loadbalancer</td>
<td>Unsets the password for a load balancer</td>
</tr>
</tbody>
</table>

Registering a load balancer into the IO inventory requires associating management credentials with it. When adding or modifying a load balancer, the administrator must define a password ID.
and/or a certificate ID. These IDs are the keys to an actual password or certificate that is stored in IO. This allows more than one load balancer to use a common password or certificate. The IO administrator can manage passwords and certificates in IO using ioexec commands and the SOAP API.

Typically, a load balancer has access to a private and a public network, and has an IP address on a management network.

Following are examples of commands that add an HAProxy load balancer to the CMS, and set the password for a load balancer.

In the following examples, the administrator can add `-w administrator-password` to each command. If this option is not supplied, ioexec will prompt for the password, if it is not defined in the default configuration file.

```plaintext
C:\> ioexec add loadbalancer -l haproxy-load-balancer -m HAProxy -v 1.4.18 -s example-private-network,example-public-network -a 192.100.100.10 -p 22 -U root -W haproxy-password-id --maxgrps 10 -t example-tag1,example-tag2 -u administrator

C:\> ioexec setpassword loadbalancer -W haproxy-password-id -p example-password -u administrator
```

where:
- `-l haproxy-load-balancer` Load balancer ID, selected by the administrator as a name for the load balancer
- `-m HAProxy` Model of the load balancer
- `-v 1.4.18` Version of the load balancer
- `-s example-private-network,example-public-network` Networks visible to the load balancer
- `-a 192.100.100.10` Management IP address to connect to the load balancer
- `-p 22` Management port on which to connect the load balancer
- `-U root` Management username for the load balancer
- `-W haproxy-password-id` Password ID of the load balancer
- `--maxgrps 10` Maximum number of groups supported by the load balancer
- `-t example-tag1,example-tag2` Tag names by which this load balancer can be referenced in infrastructure orchestration designer
- `-u administrator` Username for the ioexec CLI

For more information, see the HP CloudSystem Matrix/Matrix Operating Environment Integration Interfaces API and CLI Operations Reference Guide at http://www.hp.com/go/matrixoe/docs.

### Requesting a load balancer for a service

Load balancing servers in one or more server groups is done by selecting the **Load Balance** tab in each server group configuration screen in infrastructure orchestration designer. Only one load balancer can be specified per server group. The **Load Balance** tab allows the IO architect to specify features of a load balancer that are desired in the service.

Optional tags can be specified to ensure that a particular load balancer is used. If tags are included, infrastructure orchestration searches the inventory for a load balancer that meets the requirements and has matching tags. Leaving the **Tags** field empty expands the selection of a load balancer for the server group.
At least one network must be selected. All networks in the server group are displayed. Only a load balancer that has access to the selected networks will be allocated.

The attributes of a load balancer that you can select for a server group are as follows:

**High Availability**
Requests a load balancer in a redundant configuration. This means that there are two or more load balancers that back up and monitor each other. If one load balancer fails, another takes control so that users do not notice any disruption of service.

**SSL Capable**
Requests a load balancer on which an SSL certificate is installed, which allows un-encrypted HTTP to be used over the local network between the load balancer and the servers. This improves performance on the servers.

**Cookie Based Session Persistence**
Requests a load balancer with cookie based session persistence. Persistence ensures that requests from a single user are always distributed to the server from which they started. Cookie based session persistence provides a stateless solution for session persistence by storing all session data in a cookie in the user’s browser.

**Source Address Session Persistence**
Requests a load balancer with source address session persistence, or simple session persistence, which directs session requests to the same server based on the source IP address of a packet.

### Requesting a load balancer for an organization

Load balancers can be “reserved” for use by a particular organization or user by:

- Specifying a tag in the `ioexec add loadbalancer` command, and specifying that tag on the **Load Balance** tab in infrastructure orchestration designer
- Ensuring that all networks visible to a load balancer are assigned to a specific organization. In a template that has a logical network \( N \) that is visible to a load balancer, the actual load balancer selected is determined by the network allocated to \( N \) by IO.

### Creating and deleting a logical load balancer group

After a service has been deployed, IO administrators or an IO user can use the following `ioexec` commands to create, manage, and delete logical load balancer groups.
Table 2 ioexec create and delete load balancer group commands

<table>
<thead>
<tr>
<th>ioexec command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>creategroup logicalloadbalancer</td>
<td>Creates a group in a logical load balancer. A group describes a service to load balance</td>
</tr>
<tr>
<td>deletegroup logicalloadbalancer</td>
<td>Deletes a group from a logical load balancer, and removes all group members</td>
</tr>
</tbody>
</table>

**NOTE:** The create logical load balancer operation using the SOAP API or the ioexec CLI requires administrator approval. The administrator is notified and the operation is paused until the administrator clicks **Approved** on the infrastructure orchestration console **Requests** tab.

Other load balancer operations, such as deleting a load balancer group and adding or removing group members, appear on the **Requests** tab but do not require administrator approval. These operations do, however, require that a username and password are supplied on the command line.

The following figure shows an HAProxy load balancer configured to load balance the network traffic between two servers in the Petclinic server group.

Following are examples of commands that create and delete a logical load balancer group.

When creating a logical load balancer group, a service IP address is usually on a public network.

C:\> ioexec creategroup logicalloadbalancer -s example-io-service -l LogicalLoadBalancer:00000000-0000-0000-0000-000000000000 -g http-group -P http -a 10.1.100.10 -p 80 -H example-website -U "/" -t 6000 -O JSESSIONID -u administrator

C:\> ioexec deletegroup logicalloadbalancer -s example-io-service -l LogicalLoadBalancer:00000000-0000-0000-0000-000000000000 -g http-group -u administrator

where:
-s example-io-service  
IO service name in which to add the logical load balancer group

-l LogicalLoadBalancer:00000000-0000-0000-0000-000000000000  
Logical load balancer ID, located on the on the Services tab. To view the ID, select a service and click Details, then select the Load Balance tab

-g http-group  
Name of the group to be added to the load balancer. This is an arbitrary name specified by an administrator for easy recognition

-P http  
Type of protocol the application service will use

-a 10.1.100.10  
IP address to be used for incoming requests

-p 80  
Port on which the load balancer listens

-H example-host.com  
Host name of the application service to be load balanced

-U "/"  
URI path of the service to be load balanced. Specifying "/" (the root path) does not restrict access. To restrict access, specify a path such as "/mystore". In this case, a request to http://host/ will not succeed, but a request to http://host/mystore/mydepartment will succeed

-t 6000  
Session timeout, in seconds

-O JSESSIONID  
Name or ID of an http(s) cookie to store session information

-u administrator  
Username for the ioexec CLI

**NOTE:** The SSL certificate for an https create load balancer group request must be an X.509 certificate in DER format, with the private key included. The administrator generates this certificate and ensures that it is signed.

F5 SSL Certificate

Adding and removing group members from a logical load balancer group

After deploying a service and creating a logical load balancer group, IO administrators can use the following ioexec commands to add and remove servers from a logical load balancer group.

**Table 3 ioexec add and remove load balancer group commands**

<table>
<thead>
<tr>
<th>ioexec command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>addgroupmember logicalloadbalancer</td>
<td>Adds a member to a logical load balancer group</td>
</tr>
<tr>
<td>removegroupmemger logicalloadbalancer</td>
<td>Removes a member from a logical load balancer group</td>
</tr>
</tbody>
</table>

In the following examples, the `ioexec addgroupmember logicalloadbalancer` command adds one server to the load balancer. The options are similar to the options in the `creategroup` command, except for the IP address (`-a` option). Note that each `addgroupmember` command specifies a different IP address.

A logical load balancer group should have at least two members.

```
C:\> ioexec addgroupmember logicalloadbalancer -s example-io-service
-l LogicalLoadBalancer:00000000-0000-0000-0000-000000000000 -g http-group
-a 192.168.200.10 -p 8080 -u administrator

C:\> ioexec addgroupmember logicalloadbalancer -s example-io-service
-l LogicalLoadBalancer:00000000-0000-0000-0000-000000000000 -g http-group
-a 192.168.200.20 -p 8080 -u administrator
```

Following is an example of removing a logical load balancer from a group.
C:\> ioexec removegroupmember logicalloadbalancer -s example-io-service -l LogicalLoadBalancer:00000000-0000-0000-0000-000000000000 -g http-group -a 192.168.200.10 -u administrator

Viewing details of a load balancer

Details of a load balancer associated with a service are shown on the Services tab of the infrastructure orchestration console, self service portal, and organization administrator portal. Select a service and click Details, then select the Load Balance tab.

<table>
<thead>
<tr>
<th>Load Balance tab</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Name</td>
<td>Name of the logical load balancer group, which is an abstract concept that describes a service that is to be load balanced. A load balancer group contains members, which are added to the group after the group is defined.</td>
</tr>
<tr>
<td>Service URI</td>
<td>Service that will be load balanced. This is typically a URI typed in a web browser. The URI contains a protocol, hostname (or IP address), listening port of a load balancer, and a path.</td>
</tr>
<tr>
<td>Hostname</td>
<td>Hostname or DNS name of the service.</td>
</tr>
</tbody>
</table>
### Table 4 Load Balance tab details (continued)

<table>
<thead>
<tr>
<th>Load Balance tab</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP Address</td>
<td>Virtual (external) IP address associated with the DNS name of the service.</td>
</tr>
<tr>
<td>Members</td>
<td>A comma separated list of IP address and port pairs. Each pair describes a server that serves the actual content of the service (website, ftp site, database, and so on). These are IP addresses of the servers in the server group.</td>
</tr>
</tbody>
</table>

## Configuring an environment for ESXi cluster provisioning

Matrix infrastructure orchestration enables the deployment of a configured VMware ESXi VM Host or a collection of VM Hosts in a VM cluster. The VM Host or VM cluster includes servers, storage, and network configuration.

Using infrastructure orchestration designer, an architect creates a service template containing one or more VM Hosts with configured shared storage and networking. Deploying the template results in a complete, functioning VM cluster that is ready to have VM guests deployed.

In a federated CMS environment, a VM cluster can be deployed only to the primary CMS.

For detailed configuration steps and for information about creating a template to provision to a VM cluster, see the **HP CloudSystem Matrix How-To Guide: ESXi Cluster Provisioning** white paper at [Matrix Operating Environment Information Library](#).

## Configuring an environment for physical provisioning

For physical provisioning to perform correctly, set the following attributes in the `\Program Files\HP\Matrix infrastructure orchestration\conf\hpio.properties` file.

- Set `physical.max.concurrent.requests=10` to limit the number of concurrent physical logical servers provisioned. If the attribute is set to a value greater than 10, physical logical server provisioning might fail.

- Set `npiv.integrity.enabled=true` to enable multi-initiator N-Port ID Virtualization (m-NPIV) support on Integrity servers. Auto provisioning of storage that includes both private and shared disks requires m-NPIV support. The `npiv.integrity.enabled` property is disabled by default.

m-NPIV is supported on Integrity server blades using the QLogic FC controller with the HP-UX 11i v3 Update 8 (March 2011) and later release.

Physical provisioning requires:

- Available VC domain groups in HP Virtual Connect Enterprise Manager (VCEM)
- Configuring server deployment platforms including Insight Control server deployment, Ignite-UX, or HP Server Automation (SA)
- Creating SAN-backed storage

See “Matrix infrastructure orchestration storage management” (page 135) for more information.

- Creating job folders (this is specific to Insight Control server deployment; see “Creating server deployment job folders” (page 30)).

## Verifying VC domain groups

Matrix infrastructure orchestration requires Virtual Connect domain groups. To create a VC domain group or verify an existing group, see the **HP Virtual Connect Enterprise Manager User Guide** at [Matrix Operating Environment Information Library](#).
Configuring infrastructure orchestration resources in Systems Insight Manager

After installing infrastructure orchestration, a member of the HPIO_Administrators Windows group can log in to the infrastructure orchestration console through Systems Insight Manager. HPIO_Administrators can then set up resources to allow provisioning. To log in to the infrastructure orchestration console, in Systems Insight Manager, select **Tools→Infrastructure orchestration**.

After a short loading screen, the infrastructure orchestration console appears.

The infrastructure orchestration console initially displays the **Home** tab with summary information.

**NOTE:** When the **Requests** tab is first displayed, no requests are displayed until an administrator or user has submitted a request and the request is in-progress or completed.
Before using infrastructure orchestration, set up server pools and networks, and verify the Users and Software tabs using the infrastructure orchestration console.

**Viewing and configuring networks**

The following types of networks are discovered in infrastructure orchestration:

- Networks defined in Virtual Connect
- Networks defined in a hypervisor
  - VMware: port groups
  - Hyper-V: virtual switches
  - Integrity VM: virtual switches connected to a physical NIC
- Networks defined by the infrastructure orchestration administrator that identify VLANs carried on a VC tunneled trunk

See “Setting up virtual machine networks” (page 38) for additional information.

When two or more hosts have the same network name, only one is shown in the infrastructure orchestration console Networks tab. Subnets with the same name are collapsed into a single subnet in IO. In the network details Associations tab, the Cluster/VC Domain Group shows the VCDG and the cluster or the host (if not in a cluster) where the network is visible.

To view and configure physical and virtual networks, the infrastructure orchestration administrator must perform the following steps.

1. In the infrastructure orchestration console, select the Networks tab.

Matrix OE provides information about configured networks to infrastructure orchestration. For each network to be used with infrastructure orchestration, add DHCP and/or static address ranges. If networks do not appear correctly, see “Troubleshooting” (page 159).

2. Select a network, and then click View/Edit.
Add information about the network and available IP resources on the Edit Networks page. Depending on your configuration, not all fields are required. The user interface helps guide you through the process.

**NOTE:** Matrix infrastructure orchestration supports IPv6 with the following restrictions.

- Physical or virtual servers can be automatically provisioned using DHCP address pools. Automatic IPv6 address configuration using static assignment or an address range is not supported. This restriction applies only to network interfaces directly provisioned by IO using IO managed address pools.
- Automated (PXE based) OS deployment through IO is not supported on an IPv6 network.

3. On the DNS tab, enter the DNS Domain (required), DNS Servers, and DNS Search Suffixes (optional.)

On the Windows Settings tab, enter optional Windows information such as domain and WINS information.
4. After adding the appropriate information to the tabbed areas of the **Edit Networks** screen, add the IP ranges for use by infrastructure orchestration.

- To add DHCP address space, click the up arrow in the **DHCP Addresses** area, or enter the number of DHCP addresses to make available to infrastructure orchestration.
- To add static address space, click **New**. A dialog appears for the range. Enter a **Start** and **End** address (inclusive), and then click **OK**.

5. When finished setting up a network, click **Save**. The network is now ready to use with infrastructure orchestration.

### Trunk and VLAN networks

Cloud deployment environments and multi-tenancy environments require segmented networks for customer data separation. VLAN tags in network packets can be used for network segmentation for data separation. This enables a single wire to carry network packets from separate network broadcast domains that are efficiently managed by switching technology in the data center infrastructure and in virtualization hypervisors such as ESX and Hyper-V.

In Matrix infrastructure orchestration:

- A trunk is a physical or virtual subnet that carries traffic with multiple tags. It requires a trunk or tunnel connection at the switch port level, and a VLAN-aware network connection within the server OS. A trunk network cannot be a VLAN network.

A trunk in infrastructure orchestration designer is a VLAN trunk representing a network connection that carries multiple VLANs to a blade. How that is satisfied during a provisioning request depends on the available resources to the candidate blades. For example, a trunk in the designer may be configured on the target blade using either Virtual Connect networks mapped to a single port on the blade or a Virtual Connect tunneled trunk network that was defined in IO as carrying the desired networks.

Port aggregations/teaming cannot be explicitly defined in infrastructure orchestration designer. Port aggregation/teaming is primarily a operating system configuration action (for example,
add the NICs to a vSwitch). This is best accomplished through naming conventions and customized Operations Orchestration workflow scripts to configure the OS networking.

- A VLAN is carried by one or more Virtual Connect tunnel networks or other trunk networks in the environment. A VLAN cannot be a trunk network.

Matrix infrastructure orchestration contains VLAN tagged network support to meet the following objectives:

- Enable IO to be used to deploy a VM Host with a multi-network trunk connected to a server blade network port
  - Allow an IO administrator to manage and present trunk networks to be used in IO physical provisioning
  - Allow an architect to create a physical service template that designates a trunk network
  - Provision physical server blades with a trunk connected to at least one of the available NIC ports
- Enable Hyper-V VM provisioning to a Hyper-V server with a VLAN tagged virtual network switch
  - Provide the VLAN ID when creating a Hyper-V VM on a VLAN tagged virtual switch

Matrix infrastructure orchestration adds the ability to detail trunk networks and create templates that represent a trunk network connected to a Virtual Connect server blade. From these definitions IO is then able to orchestrate the creation of Virtual Connect profile with a trunk connection.

With properly configured networks, the service request contains sufficient information to enable HP Operations Orchestration workflows scripts to configure the Virtual Connect server blade for trunk aware applications, primarily VM Host clusters.

For information about configuring a trunk or VLAN in the infrastructure orchestration console, see “Configuring trunk and VLAN networks” (page 64).

For information about specifying a trunk or VLAN in a VM Host or cluster service template, see “Creating a template with a physical VM Host or ESXi VM cluster” (page 108).

Virtual Connect tunneled trunk configuration

HP Virtual Connect provides two types of network configurations to present a VLAN trunk to a VC server blade. The HP Virtual Connect Ethernet Cookbook illustrates these two configurations in scenarios 1:6 (mapped trunk) and 2:4 (tunneled trunk).

A Virtual Connect tunneled trunk configuration passes tagged traffic through to the target interface unrestricted. The definitions of the VLANs can only be found on the LAN-side switch and configured in the host-side network stack. VC does not maintain any information on the VLANs.

Configuration of the host requires knowledge of the VLANs to use. The definition of the VLANs must be supplied by the administrator in the infrastructure orchestration console or designer, and potentially from external sources, such as LAN management tools.
Following is an example of a Virtual Connect tunnel trunk configuration.

Physical networks discovered from Virtual Connect are represented as a subnet whether they are a single network or a tunneled trunk network carrying multiple subnets.

Matrix infrastructure orchestration represents Virtual Connect networks based on the VC network configuration. Following are characteristics of tunneled trunk Virtual Connect networks:

- Subnets can be designated as a tunneled trunk
- Set of subnets carried on the tunneled trunk can be defined
- Tunneled trunks are designated as "Tunnel VLAN tags" in the network configuration
- All traffic from an uplink port is tunneled through VC to the downlink port without modifying VLAN tags
• Cannot be mapped to a multi-network VC profile NIC port
• Cannot be part of a shared uplink set

**Virtual Connect mapped trunk configuration**

A Virtual Connect mapped trunk configuration enables VC to play a more active role managing traffic on the VLANs, including designating one of the VLANs to handle untagged packets from the VM Host. This constitutes hybrid support for both tagged and untagged networks on the VM Host.

Shared uplink sets (SUS) are commonly used in this configuration to provide a set of VLANs associated with the trunk. As in the tunneled VLAN trunk case, the list of VLANs must be supplied by the administrator in the infrastructure orchestration console or designer, a defined SUS, or from an external LAN management tool.

Matrix infrastructure orchestration represents Virtual Connect networks based on the VC network configuration. Virtual Connect networks capable of being mapped are:

- Always single network subnets
- Multiple mapped subnets that an be assigned to a single VC server blade NIC port creating a per-VC profile trunk

For mapped trunks, each Virtual Connect network defined in the shared uplink set is discovered by Matrix infrastructure orchestration. The mapped trunk to the VC server blade is created as a multi-network containing a subset of the defined networks when the VC profile is created.

**NOTE:** In releases earlier than Virtual Connect 3.30, a VC module can be in "Map VLAN Tags" mode or "Tunnel VLAN Tags" mode. Beginning with Virtual Connect 3.30, modules are always in map mode, but a non-shared uplink set network can tunnel VLAN tags from an uplink port through to a downlink port.

**VLAN carving**

VLAN carving enables a service request to be paused when a network allocation cannot be satisfied. For example:

- There are no more IP addresses available for the subnet
- There are no IO networks or networks assigned to an organization in the inventory that satisfy the “Allocation name Hint” with a attribute based network allocation
While a request is paused, the administrator can make the necessary modifications to the environment to make the network available for allocation. When the request continues, another attempt is made to allocate the network. The service request continues only when the network resources are available.

VLAN carving allows a single template definition to be used by multiple organizations, each having its own VLAN that may not yet be defined until the request is submitted.

For example, a subset of the organizations in the datacenter may want to use a network named org-prod-Y-<org name> network:

- A defined IO template with an attribute-based network with “Allocation name Hint” = “org-prod-Y-” is made available to potentially all organizations.
- The organization “Marketing” creates a service from this template. The request is unable to find an “org-prod-Y-” network in the organization network pool, and the service request pauses.
- The administrator is notified of the pause, and creates a “org-prod-Y-Marketing” subnet and assigns this network to the organization network pool.
- The administrator resumes the service request.
- The service request attempts to allocate networks and finds the newly defined network in the organization network pool and allocates it to the service.
- Subsequent service request using “org-prod-Y-" will use the “org-prod-Y-Marketing” network.
- Only organizations that create the service with the “org-prod-Y-" IO template will have subnets created for them.

VLAN carving is also used when the available IPs for a subnet are exhausted. Any subsequent request for that network will pause while the administrator adds additional IPs to the subnet.

Configuring trunk and VLAN networks

To define trunk and VLAN networks, perform the following steps. For information about support for Hyper-V VLAN tagging, see “Configuring trunk and VLAN networks to enable support for Hyper-V VLAN tagging” (page 66).

1. Define Virtual Connect networks using Virtual Connect Manager.
   - Tunnel mode: Define each tunnel trunk in VC, which passes tagged packets unmodified. (There is no need to inform VC which VLANs are carried by the tunnel.)
   - Map mode: Define all networks in VC. Each VLAN carried by an uplink is explicitly defined as a VC network. No VC network carries packets from multiple VLANs.

2. Discover Virtual Connect networks by refreshing the infrastructure orchestration console Networks tab.
   - VC networks are displayed as “Physical” in the Type column.
   - VC networks that are configured as “tunnel VLAN tags” are displayed as “Trunk, Physical” in the Type column.
3. Define the VLANs that can be carried by one physical network.
   a. In the infrastructure orchestration console Networks tab, click Create Network.
   b. Specify a VLAN ID, and set Network Address, Network Mask, Default Gateway, MS Domain, and WINS Servers for that VLAN ID by clicking the appropriate tab and filling in the information.

   In a multi-home scenario where there are multiple default gateway options, IO determines the default gateway from the network connected to the NIC that is declared as primary.

   - Each Physical network that carries one or more VLANs is a “Trunk, Physical” network.
   - Newly defined VLANs appear in Networks table with “VLAN” displayed in the Type Column.

   A VLAN that is carried by a physical trunk is not a physical network and cannot be connected to a physical server group. A network that has a “VLAN” type can be connected only to a virtual server group.

   - One trunk per VLAN implies that a trunk carries either all possible VLANs to every cluster, or networks (such as a deployment network) cannot be shared between trunks in different clusters.
Configuring trunk and VLAN networks to enable support for Hyper-V VLAN tagging

VLAN tagging is the practice of inserting a VLAN ID into network data to identify the VLAN to which the data belongs.

⚠️ **CAUTION:** Combining tagged and untagged Hyper-V virtual machines on the same virtual network results in network failures. HP recommends that you maintain a homogenous network environment among cooperating Hyper-V VM Hosts. To achieve this, for all uses of a named virtual switch, use a tagged network on all hosts or use an untagged network on all hosts.

If your environment is configured to use HP NCU to create vNICs for each VLAN on Hyper-V VM Hosts (the supported method for VLAN tagging in previous releases), and you upgrade infrastructure orchestration to 7.0 or higher, network failures may occur on the Hyper-V VM guests if you attempt to use the new method of VLAN tagging described in the following procedure.

The property `promiscuous.switch.compatibility` is included in `hpio.properties`, located in the default location at `..\Program Files\HP\Matrix infrastructure orchestration\conf`. This property allows administrators who have configured their environment for VLAN tagging using HP NCU created vNICs to continue to use this method without reconfiguring their Hyper-V systems.

### Table 5 VLAN tagging support using `promiscuous.switch.compatibility`

<table>
<thead>
<tr>
<th>Default value of <code>promiscuous.switch.compatibility</code></th>
<th>Set if...</th>
<th>Method of VLAN tagging support used by IO with this setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRUE</td>
<td>IO is upgraded to 7.0 or higher and the previous release implemented Hyper-V VLAN tagging support</td>
<td>HP NCU is used to create vNICs for each VLAN (6.2/6.3 method)</td>
</tr>
<tr>
<td>FALSE</td>
<td>IO is upgraded to 7.0 or higher and the previous release did not implement Hyper-V VLAN tagging support</td>
<td>Hyper-V VLAN discovered vSwitch is marked as trunk in IO; VLANs carried by the Hyper-V virtual trunk are defined with VLAN IDs (7.0 or higher method)</td>
</tr>
<tr>
<td>FALSE</td>
<td>IO 7.0 or higher is a new installation</td>
<td>Hyper-V VLAN discovered vSwitch is marked as trunk in IO; VLANs carried by the Hyper-V virtual trunk are defined with VLAN IDs (7.0 or higher method)</td>
</tr>
</tbody>
</table>

### Configuring networks for Hyper-V VLAN tagging: 7.0 and higher method

Perform the following steps in the infrastructure orchestration console to enable support for VLAN tagging. This is the 7.0 or higher method.

1. Discover virtual networks by refreshing the infrastructure orchestration console `Networks` tab.
2. On the `Networks` tab, select the 802.1Q network carrying multiple VLAN IDs and click `Edit Network`.
3. Select the `Trunk` tab.
4. Check the `Trunk` checkbox, and click `Save`.
5. Define the VLANs that can be carried by the Hyper-V virtual trunk network.
   a. On the `Networks` tab, click `Create Network`, or `Edit Network` to edit an existing network.
   b. Specify a VLAN ID, and set Network Address, Network Mask, Default Gateway, MS Domain, and WINS Servers for that VLAN ID by clicking the appropriate tab and filling in the information.
   c. Click `Save`.

### Migrating networks for Hyper-V VLAN tagging: 6.3 method to the 7.0 and higher method

Perform the one of the following procedures to migrate VLAN tagged Hyper-V VM Hosts configured using the 6.3 method to the new 7.0 or higher method.
Non-disruptive (workaround) method

The non-disruptive method is a workaround that does not disrupt your existing configuration or existing VM guests. You can continue to use existing vNics created with HP Network Configuration Utility (NCU). (This is intended as a temporary workaround until you can migrate your environment using the disruptive method below.)

1. On the HyperV VM Host, rename each virtual switch associated with the VLAN tagging vNics to a name that is different than the VLAN name discovered in infrastructure orchestration. (The switch is actually a promiscuous switch that carries only one VLAN.)
2. Discover virtual networks by refreshing the infrastructure orchestration console Networks tab.
3. On the Networks tab, select the new network for the virtual switch, then click Edit Network.
   a. Select the Trunk tab.
   b. Check Trunk next to the newly renamed virtual switch to mark it as a trunk.
   c. Check VLANs Carried By This Trunk next to the IO network with the old virtual switch name to mark it as a child of the new virtual switch trunk. There should be only one VLAN for each of the renamed virtual switches.
   d. Click Save.

Disruptive method

The disruptive method creates one “promiscuous mode” vSwitch that supports multiple VLANs. This is the intended way for Hyper-V VLAN tagging to be configured in infrastructure orchestration 7.0 and higher.

1. Use NCU to delete the vNics created for VLAN tagging.
2. Delete the HyperV virtual switch from the VM Host associated with the deleted vNics.
3. Attach the multi-VLAN interface to a “promiscuous” Hyper-V switch. (The multi-VLAN interface is likely a NCU interface that is teaming two interfaces.)
4. If any existing VMs were using the deleted vNics, redefine the networks for each VM to connect to the promiscuous switch with the appropriate VLAN ID.

Configuring pools

Pools are groups of resources used to submit requests to create new infrastructure services or add to existing infrastructure services. A new pool must be created and users must be assigned to it before initiating any requests.

The infrastructure orchestration console Servers tab displays the following types of resources, depending on the selection in the Display list.

- **Pools and Compute Resources**
  Summary of all pools and resources (default)

- **Compute Resources**
  Summary of all physical servers, VM Hosts, ESX resource pools, and cloud resources

- **Pools**
  Summary of all server pools (physical, VM Host, or combined), ESX resource pools, and cloud resources

ESX resource pools and cloud capacity pools

In addition to physical servers and VM Hosts, infrastructure orchestration includes the following types of provisionable resources:

- **ESX resource pools**
  ESX resource pools are a type of compute resource created using VMware vCenter or the virtual machine management CLI, and are discovered by infrastructure orchestration. ESX
Resource pools are available for infrastructure orchestration to use to provision virtual machines on a standalone VM Host or in a cluster. They enable a cluster to be divided into logical pools of memory and CPU resources above the level of individual VM Hosts.

ESX resource pools allow a VM Host or an ESXi cluster to be shared by multiple organizations. ESX resource pools are displayed in the infrastructure orchestration console under the Servers tab and are labeled as “ESX Resource Pools” in the Type column. The parent of an ESX resource pool is shown in the Servers tab Group column. ESX Resource Pools can be selected when creating a new pool, and used for capacity assignments to users, groups, and organizations.

Because an ESX resource pool is a compute resource, it must be added to a pool in order to be used in a provisioning request. A pool containing an ESX resource pool must be homogeneous and cannot contain any other type of compute resource. A provisioning request can specify the use of mixed multiple pools, as long as any pool containing an ESX resource pool is homogeneous.

Virtual machines can be allocated into ESX resource pools. Virtual machines cannot be allocated to VM Hosts and clusters where the resource pools are defined. However, virtual machines can be allocated to VM Hosts where resource pools are not defined or are not applicable.

The parent ESX Host (or all VM Hosts in the parent cluster) must be licensed for virtual machine management and infrastructure orchestration. ESX resource pools that are parented by unlicensed hosts are ignored.

Cloud resources

Cloud resources represent an external resource or capacity offered by a cloud service provider such as HP Cloud Services.

Cloud resources are manually configured resources, not discovered resources, and require special configuration for use within infrastructure orchestration.

Because a cloud resource is a compute resource, it must be added to a pool in order to be used in a provisioning request. A pool containing a cloud resource must be homogeneous and cannot contain any other type of compute resource. A provisioning request can specify the use of mixed multiple pools, as long as any pool containing a cloud resource is homogeneous.

Contact an HP representative for more information, or see the Cloud bursting with HP CloudSystem Matrix infrastructure orchestration and HP Cloud Services or Amazon EC2 and Cloud bursting with HP CloudSystem Matrix infrastructure orchestration and Savvis white papers. Both white papers are available at http://www.hp.com/go/matrixoe.

The following server pools are automatically generated and cannot be used for infrastructure service creation.

- **Unassigned** pool contains all resources previously discovered by HP Matrix Operating Environment. You can move resources from the Unassigned pool to another pool only after the resource is licensed for use by infrastructure orchestration.

Matrix infrastructure orchestration automatically populates the Unassigned pool after installation with the resources identified by Systems Insight Manager. Matrix infrastructure orchestration updates the information each hour. After updating the available resources, click Refresh to see the updates immediately.

- **Maintenance** pool contains resources that have failed or require administrative attention. When physical servers fail to provision, they are automatically moved to the maintenance pool. You can also manually move any compute resource into the maintenance pool.

- **Other Organizations** pool shows all of the compute resources that have been assigned to organizations. This pool is displayed only when compute resources have been assigned to organizations. Click on the particular compute resource to see the organization to which it belongs.
Resources in Virtual Connect Domain Groups

Physical resources are only displayed on the console Servers tab and made available after a Virtual Connect Domain Group is created in VCEM.

If you have more than one Virtual Connect Domain Group in your environment, as a best practice, make sure that all servers in a server group belong to the same VCDG.

VM Hosts deployed on server blades

A physical server blade appears as a compute resource in a resource pool. If a VM Host is deployed on that server blade, the VM Host appears as a separate compute resource. Therefore, for managed server blades that are also VM Hosts, there are two entries, once with the server serial number and once with the host name.

Details for the server blade show “Deployed as VM Host <name> at <IP address>.”

Creating a pool

1. To create a new pool, click **Create Pool** on the **Servers** tab.

2. In **New pool name**, enter a descriptive name.
   Select servers from any pool. Remember, during initial infrastructure orchestration configuration, only the **Unassigned** pool displays resources.

   1. **IMPORTANT**: To be assigned to an organization, a compute resource must be in the service provider Unassigned pool, and cannot be in use.
3. To add a server to a pool, select a server in the list on the left, and then click the >> button. The server moves to the list on the right.

**NOTE:** Unlicensed server blades or virtual machine hosts cannot be moved from the Unassigned pool.

Resources can be moved to a pool only after the resource is licensed for use by infrastructure orchestration. For more information, see “Licensing infrastructure orchestration” (page 15).

4. After selecting the resources for the pool, click **Save**.

The pool now appears on the **Servers** tab. Selecting the pool displays the allocated resources.
5. Assign users to the pool so that infrastructure orchestration can use the new pool. To assign users, select the pool in the list, and then click **Modify Users**. The **Modify Pool Users** page appears.
6. Select the user in the **Unassigned Users/Groups** list and then click >>. Repeat this process for each user. Click **Save**. The **Servers** page reappears.

To verify that the users are assigned to the pool, select the pool. A list of the assigned users and groups appears at the bottom of the screen.

### Verifying infrastructure orchestration users and groups

The **Users** tab contains a list of all users and groups authorized to use infrastructure orchestration. If the users that you expect are not listed, return to “Configuring infrastructure orchestration users in Windows” and verify that every user and group to be granted infrastructure orchestration access is a member of the appropriate user group in Windows: HPIO_Administrators, HPIO_Architects, HPIO_Users. No settings can be modified on this tab.

### Configuring infrastructure orchestration to list heterogeneous hardware

To integrate with non-HP based servers or HP rack mount servers, HP recommends the use of the ESA (Extensible Server Adapter) bundled with HP Matrix Operating Environment for use with the logical server capabilities of Matrix OE visualization. ESA includes integration with the Matrix OE embedded Operations Orchestration engine, and enables the definition and execution of workflows for loading server inventory and for performing basic power control.

See the **HP Matrix Operating Environment Logical Server Management User Guide** at [http://www.hp.com/go/matrixoe/docs](http://www.hp.com/go/matrixoe/docs) for more information about using ESA in Matrix OE.

Several server types and configurations may integrate into infrastructure orchestration using ESA in Matrix OE:

- **HP rack mount servers**
- **HP c-Class blades** (not managed by Virtual Connect)

For each of the server types referenced above, the following storage configurations are supported:

- **Boot Disk**
  - A SAN (Fibre Channel) attached disk
  - A local (direct attached) disk. If using an on-board RAID controller, only a single logical volume is supported.

- **Data Disk(s)**
  - One or more SAN (Fibre Channel) attached disks

The included reference workflow for controlling server power supports the following server management processors:

- ProLiant iLO2
- Integrity iLO2
NOTE: The Operations Orchestration workflow authoring tool (OO Studio) may be used to extend the functionality of the reference workflow to support additional management processors as required.

Configuring ESA password in Matrix OE visualization

Modify ..\Program Files\HP\Virtual Server Environment\conf\esa.properties to include the Operations Orchestration 'Admin' password:

esa.oo.admin.password=<your-oo-admin-password>

After making the changes to the esa.properties file, restart the HP Extensible Storage & Server Adapter Windows service for the changes to take effect.

Using the heterogeneous server reference workflows with infrastructure orchestration

This is a basic overview of how Operations Orchestration and ESA are used to provide inventory and power control access for non-Virtual Connect managed servers. The reference implementation may be used as is, or it may be replaced by extending the workflows to obtain the server inventory from another source within the data center. In addition, the power control workflows may be extended to other server management processor types.

The reference workflows are driven by three data files in ..\Program Files\HP\Matrix infrastructure orchestration\esa_extensions\server.

inventoryList.xml

The file ..\Program Files\HP\Matrix infrastructure orchestration\esa_extensions\server\inventoryList.xml contains a high level listing of all servers that are inventoried through ESA. The following example of a single server entry shows the format. In this case, a UUID is used for both the <handle/> and the <uuid/> elements. This is the recommended form. Typically, the UUID is directly extracted from the managed server or from a centralized configuration management database (CMDB) within the data center.


In this case, a UUID is used for both the <handle/> and the <uuid/> elements. This is the recommended form. Typically, the UUID is directly extracted from the managed server or from a centralized configuration management database (CMDB) within the data center.

The following screen in OO Studio shows the reference workflow which reads the "inventoryList.xml" file:
The “inventoryList.xml” file is read from the file system and its contents are then sent directly to the ESA web service. The ESA web service processes the returned XML document and hands it back to logical server management (LSM), which functions as the upper level inventory manager. LSM then makes a second workflow call for each server.

**serverInfo.xml**

The file ..\Program Files\HP\Matrix infrastructure orchestration\esa_extensions\server\serverInfo.xml contains a detailed definition for each of the servers declared in the inventoryList.xml file. The following example is a definition for an HP rack mount server. The `<handle/>` and `<uuid/>` elements tie this entry back to the inventoryList.xml file and must match.

The `<localStorageList/>` element is used to declare a single direct attach boot disk that is 68 GB in size.

The `<networkInterfaceList/>` element is used to declare the set of one or more NICs for the server. It is critical that both the `<macAddress/>` and the `<networkInterfaceName/>` be correctly specified. Specifically, the `<networkInterfaceName/>` corresponds to a named network from the infrastructure orchestration **Networks** tab. This declares which named network the NIC is attached to within the data center.

```xml
<ooServers>
  <handle>38313933-3533-5355-4538-32304E334151</handle>
  <uuid>38313933-3533-5355-4538-32304E334151</uuid>
  <serialNumber>USE820N3AQ</serialNumber>
  <serverName>MyDLRackMount</serverName>
</ooServers>
```
The following screen in OO Studio shows the reference workflow that reads and processes the serverInfo.xml file:

![Workflow Diagram]

Configuring infrastructure orchestration to list heterogeneous hardware
For each server in the inventoryList.xml file, the “Get Server Info” workflow is invoked. The workflow extracts the detailed server definition from serverInfo.xml, and then uses the server’s management processor to determine the current power state. The server management processor operations are invoked through additional workflows. The persisted power state is updated if required and the resulting server record is returned as an XML document to the ESA web service. The ESA web service processes the returned XML document and hands it back to logical server management that functions as the upper level inventory manager. The logical server software layer then updates the persisted inventory record for the server thereby enabling infrastructure orchestration to include the server as a part of its inventory. As the servers are processed, they become visible in the infrastructure orchestration console Servers tab.

uuidHostMapper.xml

The file ..\Program Files\HP\Matrix infrastructure orchestration\esa_extensions\server\uuidHostMapper.xml is the final XML file used in the reference implementation. It provides a mapping between the server records and the IP address at which the server’s management processor resides. The workflows that query and control power for the server require this mapping file to be in place for each server.

The workflow called when a power operation (power-on or power-off) is initiated through ESA receives the server’s identity and examines the uuidHostMapper.xml file to determine which management processor to communicate with and perform the power operation. The workflow also
makes use of the serverInfo.xml record to determine the server’s model so that the correct power operation is performed. The same call back pattern is used. At the completion of the workflow, the terminal state of the operation and status information is returned to the ESA web service.

Configure management credentials for power control

An additional step is required to configure the management credentials for power control. The reference implementation ships with built-in system accounts. OO Studio selects and configures the username and password for each of these accounts. The credentials are stored in an encrypted form within Operations Orchestration.

Within OO Studio, select the System Accounts folder and then select the appropriate account (in this case “ILOUser”). Then select the lock icon to check out the account for editing. Assign the required user name and password that is to be used for the iLO account. When finished, click the lock icon a second time to check in the account change.

Finally, declare any new server models to be managed in infrastructure orchestration. Do this by adding the <ServerModel/> string supplied in the serverInfo.xml file above to ..\Program Files\HP\Matrix infrastructure orchestration\conf\blade_models.properties.
a. Edit \Program Files\HP\Matrix infrastructure orchestration\conf\blade_models.properties file.

b. Add the new server model. The server model string is the string entered in the serverInfo.xml file.

After making the changes to the blade_models.properties file, restart the HP Matrix infrastructure orchestration Windows service for the changes to take effect.

For more information on Operations Orchestration, see the HP Operations Orchestration Software Concepts Guide at Matrix Operating Environment Information Library.
3 Using Matrix infrastructure orchestration applications

Overview

Matrix infrastructure orchestration applications support the roles of architect, service provider administrator, organization administrator, and user.

- The **designer** enables an architect to plan and design multi-server, multi-tier infrastructures using a drag-and-drop interface.
- The **console** enables a service provider administrator to deploy, manage and monitor the overall behavior of infrastructure orchestration and its users, templates, services and resources.
- The **organization administrator portal** enables an organization administrator to control the organization’s virtual IO system by creating pools, adding users, adding servers and disks to existing services, submitting, approving, and rejecting requests, and customizing the title and logo of the organization administrator portal and the self service portal.
- The **self service portal** enables a user to create infrastructure services from published templates.

Matrix OE infrastructure orchestration designer

Matrix OE infrastructure orchestration designer enables an architect to plan and design multi-server, multi-tier infrastructures using a drag-and-drop interface. The infrastructure can include virtual servers, physical servers, ESX resource pools, and cloud resources. Matrix infrastructure orchestration users can provision services using infrastructure orchestration templates.

An architect creates and maintains standardized infrastructure templates, working with the system administrator to ensure templates are compatible with existing resources and business needs enabling quick response to changing requirements in the business-defined set of standard templates.

In general, architectural tasks include:

- Designing both simple and multi-tier, multi-node service templates
- Capturing requirements for server, storage, and networks
- Publishing templates to the infrastructure orchestration self service portal for service creation
- Specifying costs and resources to support tracking and reporting of resources

To accomplish these tasks:

1. Research the requirements necessary to meet operational and business unit objectives
2. Create infrastructure service templates to meet the business requirements
3. Produce a bill of materials for each template, including the resources required to provision each template
4. Publish the templates for use by the business units

Architects can use infrastructure orchestration designer to create or modify service templates, which can then be published for others to use.

Matrix infrastructure orchestration designer provides a graphical canvas to drag-and-drop logical resource objects representing servers, disks, and networks. Architects connect these resource objects together to define the desired networking and storage relationships for each group of servers.

Each logical object on the canvas specifies the requirements for the object; the requirements drive the provisioning and ongoing maintenance operations that infrastructure orchestration supports. Matrix infrastructure orchestration designer uses validation rules to provide continuous feedback regarding which objects in the design are not valid, and how to correct validation errors and warnings.
Matrix infrastructure orchestration designer maintains a secure cache in the browser of changes made during a design session. If a session times out or the browser is closed, changes are preserved and are available the next time the architect launches infrastructure orchestration designer.

Importing and exporting templates

Matrix infrastructure orchestration designer allows you to import and export service templates. Templates can be exported as an XML file, a JPG image, a PNG image, or as an Excel spreadsheet. Templates can be imported in XML format only.

**IMPORTANT:** Editing XML templates outside of infrastructure orchestration designer is unsupported and undocumented. The XML schema is not part of the public interface specification; HP may change the XML schema without notice. Users who modify XML templates, or who create their own XML templates, do so at their own risk. Use of an invalid template may cause provisioning failures. HP may require the user to reproduce an issue using an unmodified, IO-generated template before offering support.

Accessing infrastructure orchestration designer

To access infrastructure orchestration designer, you must:
- Have appropriate authorizations to use Matrix infrastructure orchestration on the CMS.
- Be a member of the HPIO_Architects or HPIO_Administrators group on a Windows system.

Access infrastructure orchestration designer from the desktop or a browser. To access infrastructure orchestration designer from the desktop, do the following:
2. From the desktop, double-click the infrastructure orchestration designer icon.
Designer interface overview

The template editor window contains three major frames:

- The **Components** frame displays the icons for the logical objects used to design a template.
- The **Existing Templates** frame provides a list of available templates.
- The right hand frame is a template design area used to build the template by dragging and dropping components on to it.

When saving a template, specify a name using letters (A-Z, a-z), numbers (0-9), space, period, underscore, and hyphen.

For more information on using infrastructure orchestration designer, see the infrastructure orchestration designer online-help system by clicking the ? button in the upper-right portion of the infrastructure orchestration designer window.

Matrix OE infrastructure orchestration console

The infrastructure orchestration console enables an administrator to deploy, manage, and monitor the overall behavior of infrastructure orchestration and its users, templates, services and resources. Administrators also interact with the architects to ensure templates are compatible with existing resources and business needs as requests are fulfilled or denied. For example, administrators can:

- View status, progress, and details of completed and executing requests
- View available resources
- Approve or reject requests
Perform pool management
Create and manage organizations

To accomplish these tasks the service provider administrator must:

Create resource pools for hosting services based on standardized templates and the business forecast.
Collaborate with the business units to register user accounts for access to the infrastructure orchestration self service portal.
Create an organization before an organization administrator can log in to the infrastructure orchestration organization administrator portal.
Assign one or more resource pools to organizations and each self service user, authorizing the user to deploy service templates using a given pool of hardware resources.

Accessing the console

After installing infrastructure orchestration, launch infrastructure orchestration console through Systems Insight Manager by selecting **Tools → Infrastructure orchestration**.

To use the infrastructure orchestration console, you must be a member of the HPIO_Administrators Windows group.

Console interface overview

The infrastructure orchestration console displays the following tabs:

- **Home**
Displays an overview of infrastructure orchestration operations providing statistics, resource usage, and links to access infrastructure orchestration tasks.

- **Templates**
  Displays all the available templates and enables you to view the details of a template, edit a template, create a new template, delete a template, submit a template for provisioning, and assign users to a template. Displays the organizations to which the template has been assigned.

- **Requests**
  Displays a list of user-generated requests, and enables you to review request history, approve or reject requests, cancel requests, review the details of a request, review details of the service, and continue a request. Request messages show the organization of the user who submits the request.

- **Services**
  Displays a list of active services, and enables you to view the details of a service, including the organization to which it is assigned, add additional storage and servers to a service, activate or deactivate servers, modify lease periods, and delete a service.

- **Servers**
  Displays a list of available server resources, and enables you to view server details and manage server resources, create new pools, and manage the users of a pool. Shows the servers that have been assigned to other organizations, but does not display the organization pools to which they belong. The server details for a particular server shows the organization to which the server is assigned.

- **Storage**
  Displays a list of available storage resources, and enables you to view storage details and storage resources.

- **Organization**
  Displays details about the organizations in the environment, and allows you to create and modify an organization, and assign resources, users and administrators to an organization. See “Creating an organization” (page 154) and “Adding resources to an organization” (page 156) for more information.

- **Users**
  Displays a list of current users and groups, the resources assigned to each user and group, and role.

- **Networks**
  Displays the available networks and enables you to configure these networks.

- **Software**
  Enables you to view all software and annotate available server deployment folders.

- **Calendar**
  Enables you to search for and view utilization information for users, services, and templates, graphically displaying usage and conflicts.

For more information on using infrastructure orchestration console, see the infrastructure orchestration console online-help system by clicking the ? button in the upper-right portion of the console window.
Console access to deployed servers

Matrix infrastructure orchestration supports console access to deployed servers from the infrastructure orchestration console and infrastructure orchestration self service portal. Supported console types include Remote Desktop (RDP) and telnet.

RDP and telnet access depend on network connectivity from the client to deployed servers. Servers deployed to non-routable networks cannot be accessed by RDP and telnet. In addition, for deployed servers that use DHCP, the server hostname must be resolvable for a console connection to succeed.

To change the screen size for all clients that initiate an RDP session through an instance of IO, change the defaults for desktopwidth and desktopheight in the file ..\Program Files\HP\Matrix infrastructure orchestration\conf\console\rdpSession.template.

RDP console access is supported for all Windows clients. Telnet console access has the following limitations.

**NOTE:** VM console access is no longer available in infrastructure orchestration. VMware removed support for the MKS console plugin, which enabled VM console access from the infrastructure orchestration Services tab in previous releases.

Enabling telnet for Internet Explorer 7 or later

Microsoft removed support for telnet in Internet Explorer 7, as described in Release Notes for Internet Explorer 7.

HP does not recommend the use of telnet in IE7. However, if you want to continue to use telnet to access deployed servers, perform the following steps to enable telnet support in IE7.

1. Copy the following registry file contents into a file called telnet.reg and save the file.

   Windows Registry Editor Version 5.00
   \[HKLM\SOFTWARE\Microsoft\Internet Explorer\Main\FeatureControl\FEATURE_DISABLE_TELNET_PROTOCOL\]
   "iexplore.exe"=dword:00000000

2. Execute the file by double-clicking it, which enables IE execution of the telnet protocol on the client.

3. Restart IE if it is already running.

Enabling telnet for Firefox

Telnet console is supported for Firefox clients running on Linux and Windows 2008.

Clicking the telnet link in Firefox may display a prompt to launch an external application. If this occurs, check the box for Remember my choice for all links of this type, then click Launch Application.

Matrix infrastructure orchestration organization administrator portal

Multi-tenancy allows data center resources to be securely shared among different organizations by providing each organization with a virtual infrastructure orchestration system.

An organization administrator has control over the organization’s virtual IO system using the infrastructure orchestration organization administrator portal, which can be used to:

- Create pools and assign users to them
- Add servers and disks to existing services
- Submit requests
- Approve or reject requests from organization users
- Customize the title and logo of the infrastructure orchestration organization administrator portal and the infrastructure orchestration self service portal

See “Multi-tenancy in Matrix infrastructure orchestration” (page 151) for more information.
Accessing the infrastructure orchestration organization administrator portal

Access the infrastructure orchestration organization administrator portal from a browser. Navigate to https://<cms-name-or-ip>:51443/oap/<organization-name>.

Users can belong to more than one organization. These users can be simultaneously logged in to one or more of the portals (organization and self service) belonging to different organizations. If a user is removed from an organization, it takes effect after the user is logged out from the infrastructure orchestration organization administrator portal.

Organization administrator portal interface overview

The infrastructure orchestration organization administrator portal displays the following tabs:

- **Home**
  Displays an overview of the infrastructure orchestration organization operations providing statistics, resource usage, and links.

- **Templates**
  View the templates available to the organization, both published and unpublished. Published templates can be used by all organization users. Submit create service requests using a template and the resources assigned to the organization.

- **Requests**
  View a list of requests and the details of a request submitted by organization users. The organization administrator can cancel a request and approve or reject paused requests. The service provider administrator can approve or reject paused requests originating from organizations. The service provider administrator, but not the organization administrator, receives email alerts from paused requests.

- **Services**
  View all the organization infrastructure services and their details. Submit requests to delete a service or change its lease period.

- **Servers**
  View all the organization resource pools, and create, modify, and delete pools. Assign users to the pools.

- **Networks**
  View the networks that have been assigned to the organization, and their details.

- **Organization**
  Customize the organization’s portals by changing the organization title and logo on the login page and each tab of the infrastructure orchestration organization administrator portal and the infrastructure orchestration self service portal. See “Customizing the organization administrator and self service portals” (page 86) for more information.

- **Users**
  View a list of users and groups and the pools assigned to them. A user can be a member of multiple groups.
For more information on using the infrastructure orchestration organization administrator portal, see the infrastructure orchestration organization administrator portal online-help system by clicking the ? button in the upper-right portion of the infrastructure orchestration organization administrator portal window.

Customizing the organization administrator and self service portals

The organization administrator can customize the organization administrator and self service portals from the Organization tab of the organization administrator portal. By default, both portals display the title “HP Matrix infrastructure orchestration” and the HP logo.

The Title Logo and Login Logo Change buttons upload images.

- The title logo displays an image file on the left side of the title bar at the top of each screen in the organization administrator and self service portals.
- The login logo displays an image file in the center of the login screen in the organization administrator and self service portals.
Type in the **Organization Title** text box to update the name of the organization displayed in the center of the login screen, and on the left side of the title bar at the top of each screen in both portals.

Updates can be undone using **Restore Default**. Changes take place immediately.

Use the links to the self service portal and organization administrator portal login pages to verify changes.

**Matrix OE infrastructure orchestration self service portal**

The infrastructure orchestration self service portal enables you to create **infrastructure services** from published **templates**.

The infrastructure orchestration self service portal can be customized by the service provider administrator with an application title and logo. See “Customizing the organization administrator and self service portals” (page 86) for more information.

Organization users have the same capabilities as service provider users except that they are restricted in the resources that they can use. Only published templates and networks that have been assigned to the organization can be used, and a compute resource must be in a pool that has been assigned to the user by the organization administrator.

To create infrastructure services:

1. Review the published templates and decide which template is appropriate for the current objectives.
2. Review the assigned pools and select the resources to use for your service.
3. Submit a request to provision the service.
4. After the administrator approves the request, monitor the service provisioning execution.

**Accessing the infrastructure orchestration self service portal**

To access infrastructure orchestration self service portal, you must:

- Have appropriate authorizations to use infrastructure orchestration on the CMS.
- Be a member of the HPIO_Users group with applicable rights on a Windows operating system.

Access infrastructure orchestration self service portal from the desktop or a browser. To access infrastructure orchestration self service portal from the desktop, do the following:

1. Open a web browser on the CMS where Systems Insight Manager is installed.
   
   Service provider users navigate to `https://<cms-name-or-ip>:51443/hpio/portal/`
   
   Organization users navigate to `https://<cms-name-or-ip>:51443/ssp/<organization-name>`.
2. From the desktop, double-click the infrastructure orchestration self service portal icon.
The infrastructure orchestration self service portal displays the following tabs:

- **Home**
  Displays an overview of infrastructure orchestration operations providing statistics, resource usage, and links.

- **Templates**
  Displays a list of the available templates and enables you to view the details of a template and submit a template for provisioning.
  Architects and administrators can also use the **Templates** tab to launch infrastructure orchestration designer allowing them to create or edit templates.

- **My Requests**
  Displays a log of requests and enables you to cancel a request and view the details of a submitted request. Request messages can be suppressed.

- **My Services**
  Displays a list of infrastructure services and enables you to view details and request changes to the service.

- **My Pools**
  Displays a list of the resource pools available to use in service provisioning requests.
• **My History**

Displays a list of system and important event notices, including the date and time of the event, the result, and description of the event result. For example, if a request fails, the event displays on the *My History* tab with an explanation of why the request failed.

• **My Calendar**

Enables you to search for and view utilization information of your services, graphically displaying usage and conflicts. The calendar displays content relevant to the search context.

For more information on using infrastructure orchestration self service portal, see the infrastructure orchestration self service portal online-help system by clicking the ? button in the upper-right portion of the infrastructure orchestration self service portal window.
Matrix infrastructure orchestration lifecycle operations

Matrix infrastructure orchestration covers the IT lifecycle, from the initial design of system configurations to the ultimate repurposing of assets. It enables IT resource requests to be handled in a systemic manner than leverages standard configurations, self service provisioning tools, and automated approval processes.

Matrix infrastructure orchestration executes the following infrastructure lifecycle management operations.

Create service operation

The Create Service operation automatically provisions an infrastructure based on the specification in a service template, using resources allocated from assigned pools.

To create a service

1. Open the infrastructure orchestration console, self service portal, or organization administrator portal
2. Select the Templates tab
3. Select a template and click Create Service

During a Create Service operation, infrastructure orchestration:

- Validates the request
- Customizes attributes, if specified
- Allocates network and IP addresses
- Allocates the servers (server blades or virtual machine hosts)
- Allocates the boot disk (physical and virtual)
- Obtains approval
- Creates virtual machine or blade server profile
- Deploys the operating system and other software to boot disk
- Configures the virtual hardware
- Customizes the operating system (networking, Sysprep)
- Allocates the physical data disks
- Provisions the servers for data disks
- Boots the servers
- Executes custom actions
- Sends notifications

After successfully completing a Create Service operation, the provisioned infrastructure orchestration infrastructure service is available for the duration of the lease period. Access the servers through the network.

A Create Service operation fails when:

- Resources are not available to allocate
- SAN administrator cannot create the disks
- Matrix infrastructure orchestration administrator rejects the request
Delete service operation

When deleting a service, the Delete operation automatically deprovisions an existing infrastructure and frees the resources for use in other services.

To delete a service

1. Open the infrastructure orchestration console, self service portal, or organization administrator portal
2. Select the Services or My Services tab
3. Select a service and click Delete
   OR
4. Select a service and click Details or View Details
5. From the Actions or Server Actions list, select Delete service

When executing the operation, infrastructure orchestration:
   • Validates the request
   • Scrubs the boot and data disks
   • Powers off the servers
   • Deletes the virtual machine or server blade profile
   • Deallocaates the servers (server blades and virtual machine hosts)
   • Deallocaates the networks and IP addresses
   • Deallocaates the boot and data disks
   • Executes custom actions
   • Sends notifications

After successfully completing a Delete operation, the infrastructure orchestration infrastructure service is destroyed, deprovisioning all server, network, and storage resources making them available for new Create Service, Add servers to group, and Add data disk to group operations. If deprovisioning fails, the infrastructure service is still deleted. When this occurs, the infrastructure orchestration administrator must manually clean up the servers or disks.

Add server to group operation

To add a server

1. Open the infrastructure orchestration console, self service portal, or organization administrator portal
2. Select the Services or My Services tab
3. Select a service and click Details or View Details
4. From the Actions or Server Actions list, select Add servers

During an Add server to group operation, infrastructure orchestration:
   • Validates the request
   • Allocates the servers (server blades or virtual machine hosts)
     See “Allocating servers to a VM Host” (page 97) for more information.
   • Allocates IP addresses
   • Allocates the boot disk (physical and virtual)
     See “Allocating storage to virtual machines” (page 98) for more information.
   • Obtains approval
• Creates virtual machine or blade server profile
• Deploys the operating system and other software to boot disk
• Configures the virtual hardware
• Customizes the operating system (networking, Sysprep)
• Allocates the physical data disks
• Provisions the servers for data disks
• Boots the servers
• Executes custom actions
• Sends notifications

After successfully completing the operation, infrastructure orchestration provisions the additional servers into the infrastructure orchestration infrastructure service, and they are available for the duration of the service lease period. Access the new servers through the network.

The operation fails when:
• Resources are not available to allocate
• SAN administrator cannot create the disks
• Matrix infrastructure orchestration administrator rejects the request

Remove servers from group operation

The Remove Servers operation deactivates the servers, deallocates them and removes them from the server group.

To remove a server
1. Open the infrastructure orchestration console, self service portal, or organization administrator portal
2. Select the Services or My Services tab
3. Select a service and click Details or View Details
4. From the Actions or Server Actions list, select Remove servers
5. Expand the tree and select the servers you want to remove from the server group

NOTE: Reducing a server group to size 0 is not allowed. Removing the first server from a server group that uses shared disks or linked clones is not allowed.

When executing this operation, infrastructure orchestration:
• Validates the request
• Validates preconditions for removing the selected servers from the infrastructure
• Runs custom OO flows for the service
• Runs custom OO flows for the selected servers
• Pauses the request for manual disk scrubbing, if the OS was manually deployed
• Removes the selected servers
• Runs custom OO flows for manual disk deletion, if necessary (for example, if virtual servers with physical data disks are present)
• Removes resources from IO database
• Runs custom OO flows for the selected servers
• Runs custom OO flows for the service
Add data disk to group operation

The **Add data disk to group** operation adds private or shared data disks to an existing infrastructure service. Matrix infrastructure orchestration provisions and allocates the storage to their attached servers.

**NOTE:** You can add a data disk based on the size of an existing data disk, or you can specify the size and other attributes of the data disk to add to the server group. The size does not need to be the same as the size and configuration of an existing disk in the template.

To add a data disk

1. Open the infrastructure orchestration console, self service portal, or organization administrator portal
2. Select the **Services** or **My Services** tab
3. Select a service and click **Details** or **View Details**
4. From the **Actions** or **Server Actions** list, select **Add disks**

When executing this operation, infrastructure orchestration:

- Validates the request
- Allocates the data disks
- Obtains approval
- Powers down servers
- Makes the new disk visible to the servers
- Powers up the servers
- Executes custom actions
- Sends notifications

After successfully completing the operation, infrastructure orchestration provisions the additional disks in to the infrastructure orchestration infrastructure service.

The operation fails when:

- Resources are not available to allocate.
- SAN administrator cannot create the disks.
- Matrix infrastructure orchestration administrator rejects the request.

Activate servers in group operation

The **Activate servers in group** operation restarts the server.

To activate servers

1. Open the infrastructure orchestration console, self service portal, or organization administrator portal
2. Select the **Services** or **My Services** tab
3. Select a service and click **Details** or **View Details**
4. From the **Actions** or **Server Actions** list, select **Activate servers**

During this operation, infrastructure orchestration:

- Validates the request
- Reallocates the servers (server blades)
- Powers on the servers
- Executes custom actions
• Sends notifications

When reallocating a server blade, infrastructure orchestration must find a server blade that matches the original logical server definition, and physical characteristics of the previously allocated server blade, including processor architecture and model. In addition, the new server blade must have at least the same number of processors, amount of memory, and processor speed. If infrastructure orchestration cannot find a server blade that meets these requirements, the request fails.

After successfully completing the operation, the physical server blades are allocated and configured into existing server profiles, physical and virtual servers are powered on, and the servers return to normal operation.

If the operation fails, the servers are not available to activate.

Deactivate servers in group operation

The **Deactivate servers in group** operation places the selected servers in standby and removes them from service.

**To deactivate servers**

1. Open the infrastructure orchestration console, self service portal, or organization administrator portal
2. Select the **Services** or **My Services** tab
3. Select a service and click **Details** or **View Details**
4. From the **Actions** or **Server Actions** list, select **Deactivate servers**.

During this operation, infrastructure orchestration:

• Validates the request
• Deallocates the servers (server blades)
• Powers off the servers
• Executes custom actions
• Sends notifications

After successfully completing the operation, infrastructure orchestration deallocates the physical server blades, making them available for other uses. Matrix infrastructure orchestration retains the server profiles, SAN disks, virtual disks, and powers off the virtual servers.

If the operation fails, infrastructure orchestration powers off the servers.

Power on servers

**To power on servers**

1. Open the infrastructure orchestration console, self service portal, or organization administrator portal
2. Select the **Services** or **My Services** tab
3. Select a service and click **Details** or **View Details**
4. From the **Actions** or **Server Actions** list, select **Power on servers**

During this operation, infrastructure orchestration:

• Validates the request
• Executes custom actions
• Starts the PowerOn process for all the selected servers
• Executes custom actions
• Sends notifications
Power off servers

To power off servers
1. Open the infrastructure orchestration console, self service portal, or organization administrator portal
2. Select the Services or My Services tab
3. Select a service and click Details or View Details
4. From the Actions or Server Actions list, select Power off servers

During this operation, infrastructure orchestration:
• Validates the request
• Checks that the servers to be powered off are in the state that is allowed to be stopped
• Executes custom actions
• Starts the PowerOff process for all the selected servers
• Executes custom actions
• Sends notifications

Power cycle servers

To power cycle servers
1. Open the infrastructure orchestration console, self service portal, or organization administrator portal
2. Select the Services or My Services tab
3. Select a service and click Details or View Details
4. From the Actions or Server Actions list, select Power cycle servers

During this operation, infrastructure orchestration:
• Validates the request
• Checks that the servers to be powered off are in the state that is allowed to be stopped
• Executes custom actions
• Starts the PowerOff process for all the selected servers
• Executes custom actions
• Starts the PowerOn process for all the selected servers
• Sends notifications

Change lease operation

To modify the starting or ending dates of the service, or to extend or reduce the lifetime of the service, use the Change Lease Period operation.

To change a service lease period
1. Open the infrastructure orchestration console, self service portal, or organization administrator portal
2. Select the Services or My Services tab
3. Select a service and click Details or View Details
4. From the Actions or Server Actions list, select Change service lease period.
During this operation, infrastructure orchestration:

- Validates the request for a new lease period
- Modifies servers (server blades or virtual machine hosts) allocation for a new lease period
- Modifies network and IP addresses allocation for a new lease period
- Modifies disk allocation for a new lease period
- Obtains approval to extend a lease

**NOTE:** Reducing a lease period does not require approval.

- Executes custom actions
- Sends notifications

After successfully completing a **Change Lease Period** operation, infrastructure orchestration modifies the lease period for the infrastructure and updates the allocation of each resource for the new lease period. If a resource is not available or an administrator rejects the request, the **Change Lease Period** operation fails.

When a lease on an infrastructure service expires, infrastructure orchestration deactivates the service. This action preserves all the logical servers in the service, and retains all resource allocations except for physical servers, which are freed for other uses. Deactivating a service is the default policy for handling a lease expiration. The administrator can change this policy to:

- ignore the lease expiration
- de-provision the infrastructure service on lease expiration

The lease end policy can be changed in the ..\Program Files\HP\Matrix infrastructure orchestration\conf\hpio.properties file.

```
# Specifies the lease period end policy.
# Acceptable values (not case sensitive):
# - Ignore = Simply ignore the lease period ending.
# - Delete = Deletes the infrastructure. This cancels all pending and in-progress requests.
# - Deactivate = Deactivates all infrastructure's resources. This cancels all pending and in-progress requests.
```

Matrix infrastructure orchestration sends email notifications to the service owner one week and one day prior to a lease expiration. For an expired service that is running or deactivated, infrastructure orchestration sends email notification once a week after the expiration, until the lease is extended or the service is deleted. These notification time periods are configured in the ..\Program Files\HP\Matrix infrastructure orchestration\conf\hpio.properties file.

```
# In *minutes*, when to send the first and the second lease ending notification
# emails and the frequency on which the expired notifications will be sent.
lease.ending.notification.email.first=10080
lease.ending.notification.email.second=1440
lease.expired.notification.email=10080
```

**Edit virtual servers operation**

To modify the number of processors and memory size of a virtual machine after a service is created, use the **Edit Virtual Servers** operation. This operation is not available for Integrity VMs, and for virtual machines provisioned to a cloud provider.

**NOTE:** The number of processors and memory size per server, as well as the selected networks, and IP address assignment types of server group and network connections also can be changed when a service is created. To change these values, check **Customizable** on the template, and specify the proper format (shown when you hover your mouse over the field) in the **Custom Attributes** field on the infrastructure orchestration console **Create Service** dialog. See “Customizing template attributes when a service is created” (page 117) for more information.
To edit a virtual server
1. Open the infrastructure orchestration console, self service portal, or organization administrator portal
2. Select the Services or My Services tab
3. Select a service and click Details or View Details
4. From the Actions or Server Actions list, select Edit virtual servers
5. Expand the tree and select the virtual machine you want to edit
6. Increase or decrease the number of processors by using the arrows in the Number of Processors field, up to the Maximum (shown in red).
   The initial and maximum values are specified on the infrastructure orchestration designer Configure Server Group Config tab, in Processors Per Server.
7. Enter a new value in the Memory Size field, up to the Maximum (shown in red).
   The initial and maximum values are specified on the infrastructure orchestration designer Configure Server Group Config tab, in Memory Size.
   The Cost per Processor and Cost per Unit of Memory are also displayed, and reflect the values entered on the Configure Server Group Config tab.
   The Total Reconfiguration Cost shows the total changed cost of the increased or decreased number of processors or amount of memory, based on the per unit cost specified on the Configure Server Group Config tab.

During this operation, infrastructure orchestration:
- Validates the request
- Obtains approval
- Sends an edit logical server request to Matrix OE logical server management with the corresponding parameters for each of the request’s target servers
- Updates the IO service metadata based on the request execution results

Provisioning physical servers using local disk
Matrix infrastructure orchestration includes support for Virtual Connect logical servers using a local disk for boot. (Local disk is also referred to as DAS, or Direct Attached Storage.) Although these logical servers lack the flexible movement of those using boot from SAN, a logical server using local disk boot can be initially activated on a server, the operating system installed on the local disk, and then later suspended and activated back onto that same physical server. If the logical server is activated on a different physical server (with a local disk of suitable size), the operating system must be re-deployed.

In a Virtual Connect environment, the Matrix OE software automatically gathers information about server blades (memory, processors, and potential connectivity). Local disk information is not currently gathered, so it is necessary to annotate the collected server information to indicate if it has a local disk with particular properties. Local disk boot volumes are not represented by storage pool entries.

You can enable Matrix infrastructure orchestration to provision to a physical server using local disk. This involves some manual edits of property files to ensure that Matrix is aware of the servers that have local disks and that have mobility restrictions.


Allocating servers to a VM Host
Matrix infrastructure orchestration uses the following guidelines to determine the VM Host that will host a newly provisioned virtual machine.
Matrix infrastructure orchestration filters VM Hosts based on service template requirements, including:

- Linked clone support (if applicable)
- High availability (HA) support (if applicable)
- VM template compatibility (if specified as Automatic OS deployment)
- Sufficient number of processors
- Sufficient available memory
- Sufficient available disk space
- Network connectivity

From these candidates, infrastructure orchestration selects the VM Host that has the most:

- Available disk space

If all VM Hosts have the same amount of free disk space (which is common with cluster shared volumes), infrastructure orchestration selects the VM Host based on processor number and available memory.

**NOTE:** Matrix infrastructure orchestration does not perform load balancing. Load balancing is performed by the VM technology.

- All servers from a server group in an IO template must come from the same server pool. IO does not split a single server group across multiple pools. IO will search through all available server pools in the order that they are listed. For example, if the order of the pools is “A, B” – and server pool A does not have capacity, then IO will continue to pool B. If there is sufficient capacity, IO will deploy to the resources in pool B. If there is insufficient capacity from either pool, then the request will fail. (If the IO template has two or more server groups, then IO can place each server group in different server pools.)

- The server pool list governs where IO will target. If the server hosting the VM template is in pool B, but pool A is listed first in the provisioning request, then IO will try to find capacity in pool A. Only if there is insufficient capacity in pool A, will IO try pool B for capacity. Pool order overrides the affinity to the VM template.

To see the IP address of the VM Host where a virtual machine was provisioned, in the infrastructure orchestration console Services tab, select the service and click Service Details. Select the server group, and select the Resource Details tab in the lower pane. The rightmost column is labeled Resource Binding ID, and contains the IP address of the ESX host where the VM was ultimately created.

### Allocating storage to virtual machines

Matrix infrastructure orchestration uses the following guidelines to place virtual machine disks.

- Matrix infrastructure orchestration allocates storage to the datastore on the target VM Host with the most free space available.

- For each VM, the boot disk and private data disks are always allocated to the same datastore. For Integrity VMs, a single Shared Logical Volume Manager (SLVM) datastore may be composed of one or more physical volumes/disks. IO interprets an SLVM datastore as a single entity, with a single size.

- For ESX 4.0 and later, if a shared disk is defined for the server group, all disks for all the VMs in the server group are allocated to the same datastore. (Hyper-V, Integrity VM, and ESX 3.5 do not support shared disks.)

When shared disks are specified, the first VM in the service takes longer to create than subsequent VMs. This occurs because the first VM is created separately. After its completion, the rest of the VMs are created in parallel.
- If linked clone provisioning is specified (by checking **Deploy as Linked Servers** in the server group configuration), all disks for all VMs in the server group are allocated to the same datastore.

- If a Storage Volume Name is specified in the infrastructure orchestration template, all disks for all VMs in the server group are allocated to the datastore that matches the Storage Volume Name.

- If there are no shared disks, no Storage Volume Names, and no linked clones, then each VM in the server group and its disks may be allocated to different hosts on different datastores, or to the same host and different datastores, based on free space.

Virtual data disk names can contain letters (A-Z, a-z), numbers (0-9), space, underscore, and hyphen. Other characters, including double-byte characters, are not allowed. Physical data disks and boot disks can contain localized names.

**Excluding disks on a VM Host from the storage pool**

For VM guests, use shared storage instead of storage that is only local to the host. This enables efficient movement when the VM guest is moved to another VM Host. It is also a best practice to isolate the backing storage for virtual machines on a separate drive from any storage containing hypervisor system files, which results in greater performance.

Infrastructure orchestration services can be configured with the devices to be used for provisioning VMs. Unless configured, IO considers all volumes on a VM Host for provisioning a virtual machine.

To exclude disks on a VM Host from consideration as a datastore for a virtual machine, do the following:

1. Log into the CMS.
2. Navigate to the `..\Program Files\HP\Matrix infrastructure orchestration\conf\hpio.properties` file.
3. In the `hpio.properties` file, locate the following section:

   `########################### VOLUMES TO EXCLUDE ###########################`

   `# A semicolon separated list of volumes to be excluded for the`

   `# list possible for allocation. They can be either VMware or`

   `# Hyper-V style volumes:
   # e.g. /vmfs/volumes/privateStorage; /vmfs/volumes/NotHere`

   `# or C;;Y;;Z;`

   `# An entry may contain one or more "*" characters which`

   `# represent a wildcard and will match any character.`

   `# comparison are case-insensitive.`

   `# For example, if you had two volumes with Ids of`

   `# "/vmfs/volumes/storage1" and "/vmfs/volumes/storage2" -`

   `# you could exclude them both with an entry of`

   `# "/vmfs/volumes/storage*".`

   `# Note:

   `# This exclusion list applies to all hosts. So any host that`

   `# is found to have a volume that matches an entry on the`

   `# exclusion list - the volume will be removed and not reported`

   `# as available to that host.`

   `volume.exclusion.list =`

4. To configure a Hyper-V VM Host, add the drive letters to exclude (for example, "C;;Y;;Z;") to the property `volume.exclusion.list`.

5. To configure a VMware VM Host, add the datastore path to exclude (for example, `/vmfs/volumes/privateStorage`) to the property `volume.exclusion.list`.

6. Save the file.

NOTE: Because the `volume.exclusion.list` values are treated as regular expressions, some characters are interpreted to have special meaning, for example, backslash (\), question mark (?), and brackets {}. To indicate that these characters should be treated as regular characters, they need to be escaped with a backslash. Because a backslash is a special character in the property file syntax, it has to be escaped as well.

For example, to exclude the volumes `C:;Q:;\\??\Volume{1868cf92}`, add the following line to `volume.exclusion.list`:

```
volume.exclusion.list=C:;Q:;\\\\??\\Volume\{1868cf92\}
```

Manually processes within the lifecycle operations

The execution of the infrastructure orchestration lifecycle operations might require the infrastructure orchestration administrator to perform manual tasks. If defined, infrastructure orchestration invokes an Operations Orchestration workflow to initiate, remind, or otherwise facilitate a manual task and generates a Systems Insight Manager event. Use workflow integration or the infrastructure orchestration console interface to signal completion of a manual task.

The manual tasks are associated with paused states in the infrastructure orchestration automation and include:

- **Boot disk allocation**
  
  When LUNs with the required attributes are not available for a Create Service or Add servers to group operation, disk allocation is blocked and the infrastructure orchestration administrator is notified.

  The operation pauses until the infrastructure orchestration administrator:

  - Works with a SAN administrator to create the storage.
  - Defines the storage in HP Matrix OE logical server management.
  - Continues the operation.

  When the operation continues, infrastructure orchestration reattempts to allocate the resources. Success depends on the availability of unused boot LUNs.

- **Approval**
  
  After resources are reserved, the Create Service, Add servers to group, Add data disk to group, and Change Lease Period (extend only) operations pause for infrastructure orchestration administrator approval. The infrastructure orchestration administrator can approve or reject the request. If the request is approved, the request continues into provisioning.

  **NOTE:** Administrator submitted requests do not require approval.

- **Manual operating system deployment**
  
  A service template typically assigns a server deployment or virtual machine software to a group of servers, however it is possible (though not typical) to define a service template without assigning server deployment or virtual machine software to a group of servers. In this case, the Create Service and Add servers to group operations pause to allow the infrastructure orchestration administrator to deploy the operating system manually.

- **Data disk allocation**
  
  When LUNs with the required attributes are not available for a Create Service, Add servers to group, or Add data disk to group operation, disk allocation is blocked and the infrastructure orchestration administrator is notified.

  The infrastructure orchestration administrator:

  - Works with a SAN administrator to create the storage.
* Defines the storage in Matrix OE logical server management.
* Continues the operation.

When the operation continues, infrastructure orchestration reattempts to allocate the resources. This pause is always necessary when infrastructure orchestration is configured to perform manual storage provisioning and data disks are defined in the service template. It may or may not be necessary when multi-initiator NPIV storage features are enabled.

- **Add data disk to group operation**
  The *Add data disk to group* operation adds private or shared data disks to an existing infrastructure service. Matrix infrastructure orchestration provisions and allocates the storage to their attached servers. When executing this operation, infrastructure orchestration:
  * Validates the request
  * Allocates the data disks
  * Obtains approval
  * Power down servers
  * Makes the new disk visible to the servers
  * Powers up the servers
  * Executes custom actions
  * Sends notifications

- **Data disk scrubbing**
  If a *Create Service* operation uses manual operating system deployment, the corresponding *Delete* service operation requires disks to be scrubbed manually. The infrastructure orchestration administrator is notified and the operation pauses until the infrastructure orchestration administrator scrubs the disks attached to the servers being deprovisioned and continues the operation.

- **Data disk deletion**
  When configuring infrastructure orchestration to perform manual storage provisioning, the infrastructure orchestration administrator is notified at the end of a *Delete* service operation. The infrastructure orchestration administrator must:
    * Edit Matrix OE logical server management storage pool entries
    * Remove all LUNs added during the manual data disk allocation from the applicable storage pool entries to make them available for provisioning

### Creating infrastructure orchestration templates

### Creating a template with a physical ProLiant or Integrity server

Perform the following steps to create a service template for deploying a physical server on a ProLiant or Integrity system.

1. Launch infrastructure orchestration designer at `https://<cms-name-or-ip>:51443/hpio/designer/` and click **New** to begin.
2. Drag one of each of the **Physical Server Group** (which includes **Physical Storage**), and **Network** components onto the working area.

3. Connect the **Physical Server Group** to the **Network**.
4. Set the attributes for each of the components. Right click on the **Physical Server Group** and select **Edit Server Group Configuration**. Note the **Server Type** is “Physical.” The **Processor Architecture** must match the storage pool entry.

5. Set the **Networks** attributes for the server group.
Specify a **Hostname**. There are three parts to the physical server’s hostname. The first part is defined in this service template. The second part is specified by a user’s service creation request. The third part is a numeric suffix based on the number of servers created for this server group.

The "#" is used in this template as a replacement string indicating where to place the requestor’s portion of the hostname. Although the requestor replacement string is optional, if you do not use it, this template can only be provisioned once without generating duplicate hostnames.

Keep in mind that all the pieces must be short enough to fit into common network hostname restrictions.

For example, if the hostname value in the template is `matrix#`, and the completion string is `abc6`, the resulting hostname of the first server in the group will be `matrixabc601`.

Set the **Network Interface Assignment Type** according to your IO environment configuration. DHCP type will obtain the IP address from your DHCP server, while Static and Automatic types will obtain the IP addresses from the static IP addresses configured in the network resource configuration.

**NOTE:** For Integrity deployment, always select “Automatic” or “Static.” IO does not support DHCP for HP-UX OS deployment.

You can specify a network connection as requiring redundancy. When selected, IO automatically configures NICs to the same network. The VC Profile is constructed such that the NICs are distributed across alternate VC-Ethernet modules. IO only assigns auto/static IP addresses to the primary NIC of the redundant pair. The failover NIC will not have an IP address allocated or assigned. The service XML model is annotated with the NICs that participate in the redundant pair and will also include the MAC addresses that have been assigned to each connection. IO does not automatically team the NICs at the OS level.

The order in which you connect the networks in infrastructure orchestration designer governs the NIC order in the VC profile. PXE is supported only on the first two ports of a LOM or MEZZ NIC. In designer, add networks in order with the boot network in the first (or second) position in the list.
When using active/active configuration, the **Redundant** flag must be left deselected, and you must explicitly wire two separate Virtual Connect networks to represent the same active/active network in the data center.

6. In the **Software** tab, select the OS and any additional software.

7. (Optional) On the **Load Balance** tab, request a load balancer containing the specified attributes to distribute network traffic across servers in a virtual or physical server group.

   For more information about configuring load balancers, see “Configuring a load balancer” (page 49).

8. Configure the **Physical Storage** component. The **Storage Type** is FC-SAN.

   Check **Select a storage template** or **Specify desired attributes**. See “Physical storage provisioning” (page 146) for a description of these options.

   Select the **Disk is bootable** checkbox. Leave the **RAID Level** set to Any.
The setting for Redundant SAN paths to disk depends on how you configured your logical server storage pool entries. At least one matching storage pool entry is required for each service provisioned. Those entries may or may not be fully configured with redundant paths.

9. Finish by editing the **Network** component.
10. Select the appropriate network and (optional) specify a cost. Click **Show All Network Details** for more information about the selected network.

11. Click **Customizable** to allow certain attributes of the template to be changed. See “Customizing template attributes when a service is created” (page 117) for more information. (Note that the **Recoverable** checkbox is not supported for physical server groups.)

12. After you have completed these steps, note that the **Validation Status** is green. If it is not green, click **Show Issues** and resolve those items.
13. Select the **Published** box, name the template, and then click **Save**. This template will now be available for deployment by authorized users.

Creating a template with a physical VM Host or ESXi VM cluster

The following figure shows the key features of a template that can be provisioned to a physical VM Host or ESXi VM cluster.

For detailed information, including how to create the template shown above, see the *HP CloudSystem Matrix How-To Guide: ESXi Cluster Provisioning* white paper at [Matrix Operating Environment Information Library](#).

Creating a template with a ProLiant or Integrity virtual machine

Creating a service template for deploying a VM is similar to the steps for a physical server.
2. Enter a template name and drag a Virtual Server Group (which automatically includes Virtual Storage), and a Network component onto the area where the instructions are displayed.
3. Connect the Virtual Server Group to the Network.

4. For each of the components, right click on the component and fill in the required attributes starting with the Virtual Server Group. Incomplete required items are shown with a red "X."
Select **Deploy as Linked Servers** to deploy the servers in the server group as linked, and adjust the maximum number of servers as required. When this option is checked, the first logical server in a linked clone logical server group is provisioned with both a parent VM and a clone (child) VM. The remaining logical servers in the logical server group are provisioned with only a clone VM. For more information about linked clones, see [VMware: Understanding Clones](#).

Notice the **Server Type** is **Virtual**. If **High Availability** is checked, infrastructure orchestration deploys the virtual logical server to a VM Host that is in a High Availability (HA) cluster.

If there are no clustered VM Hosts available, the service is not created. If the checkbox is not checked and only HA hosts/clusters are available in the target servers pools, the non-HA VMs are allocated to HA VM Hosts.

5. Fill in the **Networks** tab for the **Virtual Server Group**.

Specify a **Hostname**. There are three parts to the virtual machine's hostname. The first part is defined in this service template. The second part is specified by a user's service creation request. The third part is a numeric suffix based on the number of servers created for this server group.

The "#" is used in this template as a replacement string indicating where to place the requestor's portion of the hostname. Although the requestor replacement string is optional, if you do not use it, this template can only be provisioned once without generating duplicate hostnames. Keep in mind that all the pieces must be short enough to fit into common network hostname restrictions.

For example, if the hostname value in the template is `matrix#`, and the completion string is `abc6`, the resulting hostname of the first server in the group will be `matrixabc601`.

6. For the **Network Interface Assignment Type**, choose the appropriate setting depending on how you configured the IO environment:
DHCP Indicates that IP addresses are allocated dynamically to servers connected to the subnet using DHCP.

Static Indicates that the architect assigns the IP addresses used by each server connected to the subnet. Using static IP addresses creates a template that can be provisioned only one time.

Automatic Indicates that IO automatically selects the static IP addresses to be allocated from the static IP address range set for the network.

**NOTE:** For HP Integrity VM deployment, use **Automatic**.

7. On the **Software** tab, select the appropriate template to use. Only VM templates created using the procedure in “Insight Control virtual machine management templates” (page 40) are listed. (Physical Insight Control server deployment jobs are displayed, but they are unavailable for selection during the creation of a VM.)
When you use a Windows template, you can also choose a Sysprep file. The Sysprep files for you to select must be located in \Program Files\HP\Matrix infrastructure orchestration\conf\sysprep. When you click the Change button, all of the Sysprep files in the directory are displayed.

8. (Optional) On the Load Balance tab, request a load balancer containing the specified attributes to distribute network traffic across servers in a virtual or physical server group. For more information about configuring load balancers, see “Configuring a load balancer” (page 49).
9. Set the attributes for the Virtual Storage. Note that the Storage Type must be Virtual. Check Disk is bootable to denote that the disk is the boot disk for the server group.

- For bootable disks, you can assign a Storage Volume Name to match mounted volume names on a VM Host. Storage Volume Name(s) is an optional feature for the boot disk. Storage volume names are used for every virtual disk attached to the virtual server group. Enter the VM Host storage volume names separated by commas. During provisioning, IO allocates virtual storage from storage volumes with names that match the storage volume names of the boot disk.

- For non-boot disks (Disk is bootable is not checked), the Storage Volume Name field is not enabled. The Storage Volume Name is identical to that of the boot disk.

After you select the template, if the Virtual Storage size is insufficient, it will be increased to at least the size of the template.

10. Set the attributes for the Network. You should only need to select an appropriate network; there are no other attributes to specify. You can optionally include the cost values shown.

11. Click Customizable to allow certain attributes of the template to be changed, and click Recoverable to mark the template for disaster recovery. See “Customizing template attributes when a service is created” (page 117) and “Configuring a disaster recovery (DR) service” (page 44) for more information.

12. After you have completed these steps, note that Validation Status is green. If it is not green, click Show Issues and resolve those items.
13. Select the **Published** box and then click **Save**. This template is now available for deployment by authorized users.

**Creating a template to provision at a cloud service provider**

In addition to provisioning with on-premise resources, Matrix OE infrastructure orchestration supports provisioning virtual servers to the following public cloud providers: HP Cloud Services, Amazon EC2, and Savvis.

For detailed information about configuring your environment and creating a template for cloud provisioning, see the *Cloud bursting with HP CloudSystem Matrix infrastructure orchestration and HP Cloud Services or Amazon EC2* and *Cloud bursting with HP CloudSystem Matrix infrastructure orchestration and Savvis* white papers at [http://www.hp.com/go/matrixoe](http://www.hp.com/go/matrixoe).

**Creating a service request**

The infrastructure orchestration self service portal enables you to create infrastructure services from published templates.

1. From the CMS desktop, double-click the Self Service Portal icon, or open a browser to `https://<cms-name-or-ip>:51443/hpio/portal/`.
   
   Or, from Systems Insight Manager, open the infrastructure orchestration console by selecting **Tools** → **Infrastructure orchestration**.

2. Log into the infrastructure orchestration self service portal using an account that is a member of the HPIO_Users group, or log into the infrastructure orchestration console.

3. Select the **Templates** tab to see the available published templates.

4. Select a template.
NOTE:
When Systems Insight Manager runs the discovery task, it changes the logical server hostname by prefixing the hostname with the VM Host name and the service template name. For example, if IO provisions a virtual machine named vm1 on a VM Host named VMhost1 using a template named mytemplate, after Systems Insight Manager runs the discovery, the virtual machine hostname is changed to VMhost1_mytemplate_vm1.

There may be a delay between the discovery task and the automatic refresh in IO, during which the virtual machine’s hostnames are not the same in Systems Insight Manager and IO. After the next IO automatic refresh, the virtual machine name in IO is changed to match the Systems Insight Manager name.

5. Click **Create Service**.
6. In **Hostname Completion**, enter a completion string.
7. Click **Options**. On the expanded **Create Service From Template** dialog, specify the **Service Name**, and set or enter other desired options. The service name is used by users, administrators, and in progress logs to identify this create service request. The service name can contain up to 15 characters using letters (A-Z, a-z), numbers (0-9), space, underscore, and hyphen.

If the template is an ESX host or cluster, the resource pool selected is the name of the cluster. Optionally, specify a data center name. The default data center name is the service name.
8. Enter email address(es) to be notified of progress. Separate multiple e-mail addresses with commas or semicolons. Do not use a final semicolon after the last email address.
If an email address is not specified, email notifications are sent to the default email account used when infrastructure orchestration was installed.

9. Specify a Hostname. There are three parts to the virtual machine's hostname. The first part is defined in this service template. The second part is specified by a user's service creation request. The third part is a numeric suffix based on the number of servers created for this server group.
The "#" is used in this template as a replacement string indicating where to place the requestor's portion of the hostname. Although the requestor replacement string is optional, if you do not use it, this template can only be provisioned once without generating duplicate hostnames. Keep in mind that all the pieces must be short enough to fit into common network hostname restrictions.
For example, if the hostname value in the template is matrix#, and the completion string is abc6, the resulting hostname of the first server in the group will be matrixabc601.

10. Select the appropriate resource pool.
11. Click Submit.
12. Select the My Requests tab (or the Requests tab in the infrastructure orchestration console) to view status of the request. After initial validation has completed and resources have been reserved, the request is paused in the queue for approval.
Customizing template attributes when a service is created

When you create a service, you can customize the amount of memory and processor count for a server group. You can also customize the network name, IP address assignment types of server group and network connections, and IP address. These customizations allow you to reduce the number of templates in your environment, because different types of services can be created based on one master template.

**NOTE:** To modify the number of processors and memory size of a virtual machine after a service is created, use the **Edit Virtual Servers** operation. See “Edit virtual servers operation” (page 96) for more information.

Network customizations enable the use of one IO template to deploy a service to different networks (for example, test, development, and production). Note that a network connection cannot be added or deleted in the new service; the logical server group has the same connection, but the connection points to the customized network.

**NOTE:** Trunk networks (mapped or tunnel) cannot be customized. A trunk network configured in a service template cannot be replaced with another network, nor can a trunk network be used to replace another network.

If you specify a network by selecting “Specify desired attributes”, you cannot customize the network when the service is created. Network customization can be performed only on named networks.

Customizations affect only the service being created. The template is not changed. Organization administrators and users can customize networks only that are accessible to the organization.

Checking the **Customizable** checkbox in the template in infrastructure orchestration designer allows the IO architect to specify that the template may be customized.
When you create a service from the template in infrastructure orchestration console, organization administrator portal, or self service portal, you specify the custom attributes on the Create Service Options dialog. These attributes must take the following form:

```
subnet=<network-name-in-template>,<replacement-network-name>
addressingType=<logical-server-group-name>,<network-name>,DHCP | AUTOMATIC | STATIC [,<IP address>...] 
memory=<logical-server-group-name>,<new-size>MB | GB 
processor=<logical-server-group-name>,<new-count>
```

A tooltip is displayed containing the required format when you click the Custom Attributes text box. The text box expands in size when the cursor is placed in it, and is greyed out if the template is not customizable.

For example, to change the network name to “replacement network”, the network assignment type to “static”, the IP address to 192.168.0.99, the amount of memory to 4GB, and number of processors to 2, enter:

```
subnet=network-in-my-template, replacement-network; 
addressingType=server-group-in-my-template, second-network-in-my-template,STATIC,192.168.0.99; 
memory=server-group-in-my-template,4GB; 
processor=server-group-in-my-template,2
```

**NOTE:** Customizing the network assignment type of Integrity VMs to DHCP is not supported.
Changes are highlighted in the “approve or reject” e-mail and in the Request Details pane. The Customizable attribute is shown on the Templates tab.

You can also use the ioexec CLI or the SOAP API to customize attributes. Following is an example of the ioexec command:
Modifying the create service timeout value

By default, infrastructure orchestration sets a timeout of 180 minutes (logical) or 120 minutes (virtual) for server create requests in the ..\Program Files\HP\Matrix infrastructure orchestration\conf\hpio.properties file. Modify this value if needed.

```plaintext
# Maximum number of minutes wait for a single physical
# CreateLogicalServer operation
timeout.create.physical.logicalserver = 180

# Maximum number of minutes wait for a single virtual
# CreateLogicalServer operation
timeout.create.virtual.logicalserver = 120
```

A timeout occurs if any individual logical server provisioning takes longer than the time specified as measured from when the actual provisioning starts, not from when the create request started.

Approving and automating deployment

1. To approve the service request, connect to Systems Insight Manager and log in using an account that is a member of the HPIO_Administrators group. Select **Tools** → **Infrastructure orchestration**, then select the **Requests** tab to view the pending request queue.
2. Select the Create request in the queue, and click Approve. After the job has been approved, it will automatically proceed to be built and deployed with no further interaction required.

3. As provisioning proceeds, the requesting user can monitor progress of the deployment in the infrastructure orchestration self service portal My Requests tab. When the job completes, the requester receives an e-mail notification. The self service portal request queue status updates are synchronized with the status in the Requests tab in the infrastructure orchestration console.

The virtual machine is now fully available for use by the requester. The running service is visible in Systems Insight Manager, in the infrastructure orchestration console Services tab.
The virtual machine current status and resources can also be seen in the HP Matrix OE visualization view. (From Systems Insight Manager, select Tools→HP Matrix OE visualization.)

As an Administrator, you might want to complete the recognition of the new virtual machine by initiating an Systems Insight Manager discovery operation on the IP address now in use by the new guest (follow the steps in “Managing new logical servers” (page 122)). Alternatively, you can simply wait for the next scheduled discovery to run if you have it configured.

Until the new guest is fully recognized on the network, it will be displayed using a generated name comprising of its VM Host name, infrastructure orchestration service name, and the virtual machine name. Once discovered, all of the HP Matrix OE visualization attributes will be filled in.

For the physical logical servers provisioned by infrastructure orchestration, follow the steps in “Managing new logical servers” (page 122) to ensure that Systems Insight Manager and HP Matrix OE logical server management are ready to manage the newly deployed logical servers.

**NOTE:** Required for a physical HP-UX server only: To ensure the boot disk for a physical HP-UX server can be erased during infrastructure orchestration service deletion, the node must be discovered correctly with the correct root credential. If this is not done, the infrastructure orchestration service deletion will fail with the error message Failure: Error erasing disks for logical server.

**Managing new logical servers**

To manage the logical servers you create (described in “Creating a service request” (page 114)), perform the following steps:

1. Discover the new logical server with the IP addresses or hostname by defining a new discovery task in Systems Insight Manager. Configure the DNS server with both forward and reverse lookups.

   ESX hosts must connect to a VMware vCenter before this discovery operation. If the vCenter is a new server, discover the vCenter server and edit the system credentials of the discovered vCenter node in Systems Insight Manager, and add VME credentials using the Systems Insight Manager Options→VME Options→Add or Edit VME Credentials menu selection.

   For information about how to create discovery tasks, see the HP Systems Insight Manager User Guide located at the Systems Insight Manager Information Library.

2. In Systems Insight Manager, select Tools→HP Matrix OE visualization. Then select Tools→Logical Servers→Refresh and check the HP SIM checkbox. (A refresh is performed automatically every 30 minutes.)

   If the new logical server is a hypervisor (such as an Integrity VM Host), also refresh Insight Control virtual machine management resources.
3. Use the Insight managed system setup wizard (MSSW) to configure the system to be managed. From Systems Insight Manager, select **Configure** → **Managed system setup wizard**.

For more information, see the *Insight Managed System Setup Wizard Getting Started Guide* located at the Matrix Operating Environment Information Library.

**NOTE:**

Cross-technology logical servers are not supported by Matrix infrastructure orchestration. A logical server created in Matrix infrastructure orchestration (by deploying a service template) cannot be managed as a cross-technology logical server. For example, if a physical logical server is created in IO, it cannot be moved to a virtual machine using Matrix OE logical server management. Similarly, if a virtual logical server is created in IO, it cannot be moved to a server with Virtual Connect. Only logical servers created or imported in Matrix OE visualization (using **Create** → **Logical Server**, or **Tools** → **Logical Servers** → **Import**) can be moved from physical to virtual or virtual to physical.

For more information about cross-technology logical servers, see the *HP Matrix Operating Environment Logical Server Management User Guide* and the *HP Matrix Operating Environment Recovery Management User Guide* located at the Matrix Operating Environment Information Library.

### Automated allocation

Allocation is the process of finding the resources to match to the logical objects described in a template. An infrastructure orchestration template is the logical specification of an infrastructure service using template components known as logical objects, enabling the user to provision an infrastructure service from resources.

In infrastructure orchestration templates, logical objects are specified either by attribute value or by name. Logical server groups and storage are specified by attribute value, and networks are specified by name or attribute. The process of matching logical objects to resources is a key capability of infrastructure orchestration and is part of several request types, including **Create Service** request.

After validating the arguments of a **Create Service** request, the infrastructure orchestration controller performs an allocation. If infrastructure orchestration can locate the resources that match the template, then the allocation is successful. After a successful match, infrastructure orchestration reserves the selected resources and provisions to instantiate the infrastructure service specified by the template. If infrastructure orchestration does not locate the necessary resources, the request fails, the resources are not reserved, and the infrastructure service is not created.

Matrix infrastructure orchestration can also utilize the allocation process during the provisioning process. This internal allocation process can begin when infrastructure orchestration cannot successfully provision a logical sever. Matrix infrastructure orchestration releases the allocated server and attempts another allocation to find a replacement server and continue the provisioning. If the reallocation fails, the Create request fails.

When viewing logical resources in isolation, infrastructure orchestration might not be able to successfully allocate the template. Matrix infrastructure orchestration cannot allocate a network without successfully allocating the logical server groups connected to that network. Similarly, infrastructure orchestration cannot allocate logical server groups without successfully allocating the storage for all the servers within the group.

When infrastructure orchestration executes the allocation algorithm to search for resources, it attempts to allocate networks, then logical server groups, and finally storage. To maximize the chances of success, within each category, the allocation algorithm always attempts to allocate the most constrained logical object first. For example, all the networks in a template are evaluated, and the network with the smallest number of candidate subnets is chosen to allocate first.

A Virtual Connect Domain Group defines the boundaries for a set of resources, specifically servers, networks, and SAN volumes. Any resource within a VC Domain Group is visible to or connected
to any other resource within the same VC Domain Group. However, connectivity between VC Domain Groups is uncertain. The infrastructure orchestration algorithm verifies VC Domain group boundaries by backtracking, incrementally building candidate solutions for allocation, and abandoning each partial candidate as soon as it determines that it cannot possibly complete the allocation. If the subnet does not have enough servers attached to the network associated to the VC Domain Group, the subnet allocated to a network is abandoned. Matrix infrastructure orchestration chooses another candidate subnet and retries the logical server group allocation. If another valid candidate subnet is not located, the allocation process fails, and all partial reservations are released.

Allocation takes place within the context of multiple Create Service requests submitted simultaneously. If two allocations occur at the same time, they might fail. This occurs if users provision a solution using the same resources at the same time. Consequently, infrastructure orchestration treats allocation as a critical section to ensure only one allocation occurs at a time.

Automated operating system provisioning

Matrix infrastructure orchestration’s automated operating system provisioning supports either SAN boot or DAS boot on a server blade, but not both. When configured for boot from SAN, the internal hard drive must be disabled. Matrix infrastructure orchestration supports DAS boot with or without SAN data, but does not support SAN boot with DAS data.

Matrix infrastructure orchestration supports SAN boot or DAS boot OS deployment using Insight Control server deployment, HP Server Automation (SA), and Ignite-UX. (Automatic operating system provisioning for HP-UX using Ignite-UX is not supported when the template contains more than five networks. In this case, select manual operating system provisioning.)

With Insight Control server deployment, boot from SAN support in infrastructure orchestration requires that the Deploy ProLiant System Configuration (BL BFS) server deployment job (from HP Deployment Toolbox\Hardware Configuration folder) be placed in the job folder.

After provisioning HP-UX to an Integrity blade and after the newly provisioned server is discovered by Systems Insight Manager, the new Systems Insight Manager node needs to be authorized to run the CMS tools as follows:

1. Run Systems Insight Manager discovery from the UI, or on the command line by entering 
   ```
   mxnode -a <target IP or DNS name> -w.
   ```

   **NOTE:** To use the mxnode command, enter the root/\root password> for the 
   provisioned server into the global credentials for Systems Insight Manager (Options→Security 
   Credentials→Global Credentials).

2. Deploy the Systems Insight Manager agent to the server either from the GUI, or via the 
   command line 
   ```
   mxagentconfig -a -n <target IP or DNS name> -u <user> -p <password>.
   ```

   Where:
   
   `<user>`
   is root
   `<ip>`
   is the IP address of the newly created Systems Insight Manager node
   `<password>`
   is the root password of the newly created Systems Insight Manager node

   **NOTE:** Complete the above steps to successfully delete the server and have the storage attached 
   to the server correctly scrubbed before the server is made available for use in a new service.

   No additional configuration is needed for physical provisioning for HP Server Automation (SA).
Deploying an operating system to multi-path storage

Matrix infrastructure orchestration can deploy an operating system to a multi-path storage volume. For Insight Control server deployment, Windows operating systems do not require any server deployment modifications. However, for Red Hat Enterprise Linux 5.4, 5.5, and 6.0, modify the default server deployment process by editing the **Configure Boot Environment** job.

Edit the **Configure Boot Environment** job and add the `export kernparm=mpath` kernel parameter. After updating the job, Red Hat Enterprise Linux 5.5, 5.6, and 6.0 can be deployed to a multi-path LUN.

Assigning and retrieving cost and billing information (chargeback)

The Matrix infrastructure orchestration architect can specify allocation costs for resources in a service. Matrix infrastructure orchestration collects and stores this allocation data, which can be retrieved in a format that can be easily consumed by a variety of third party applications.

Following are the types of costs that can be allocated.

- **Fixed cost** – Specific per service instance. Represents startup cost, software or administrative overhead, and ongoing maintenance.
- **Server allocation cost** – cost for server is divided into:
  - Memory unit cost – Allocation cost associated to each CPU assigned to the server.
  - CPU unit cost – Allocation cost per CPU unit.
  - Server base cost – Represents the cost associated with the server to cover other services, such as linked clone deployment and high availability. Can also be used to assign cost on a per server basis, independent of the number of CPUs and memory.
- **Disk allocation cost** – allocation cost per disk unit (MB or GB). This is the disk space that is allocated, not the actual consumption of disk space.
- **IP addresses allocation cost** – cost assigned to each address allocated in the service, including Virtual IP addresses.
- **Cost frequency** – assigned to a service and inherited by all resources. This represents the recurrence of each cost mentioned above.

The chargeback system derives cost based on the value in minutes per cost frequency.

Cost frequency can be set to the following:

- Day 24 hours
- Week 7 days, which is 168 hours
- Month 30 days, which is 720 hours

Using the infrastructure orchestration chargeback feature, the administrator can:

- Map allocation data to services, logical servers, logical networks, and logical disks
- Map uptime for logical servers
- Filter data for a specific period in time
- Store allocation data for the last 365 days, and archive monthly data after 365 days

SOAP API extensions and the chargeback command line interface can be used to retrieve allocation data. See “Using API extensions to retrieve chargeback data” (page 130) and “Using the CLI to retrieve chargeback data” (page 133) for more information.

**NOTE:** The APIs and CLI command can retrieve data only for the last 365 days. Ensure that you save old data before it is more than one year old so that you can access the data, if needed.
Specifying fixed costs for templates and services

Matrix infrastructure orchestration allows a template architect to add a fixed cost to a template, in addition to server, network, and storage costs. Examples of fixed costs are power or setup costs.

Enter a fixed cost in infrastructure orchestration designer by clicking the **Cost** tab in a template, and entering a value in the **Fixed Cost** text box.

Select a value for **Cost Frequency**, which is the time interval for which a fixed cost is calculated. Values are Month (default), Week, Day, Hour, or Unspecified.

---

Specifying per-unit costs for resources

In infrastructure orchestration designer, right click on the server group to display the **Config** tab, where you can enter costs per number of servers in the server group, processors per server, and memory size.

Costs for a server in an IO template is split into three values:
Base Cost per Server

Encompasses all of the costs for the server except CPU and memory cost. It may include availability characteristics and type characteristics (physical, virtual, cloud). This cost does not change during the lifecycle of the server.

Cost per Processor

Cost per CPU in the server. This cost pushes the server cost up and down during the lifecycle of the server based on the changes performed by the user. This allows the server cost to be adjusted together with the server configuration.

Cost per Unit of Memory

Cost per unit of memory in the server. Server cost is also updated for changes to the server configuration based on the memory amount assigned to the server.

The **Total Cost per Server** is calculated as follows:

\[ \text{Total Cost per Server} = \text{Base Cost} + (\text{CPU cost per unit} \times \text{CPU units}) + (\text{Memory cost per unit} \times \text{Memory units}) \]

In infrastructure orchestration designer, right click on a network or trunk to display the **Config** tab, where you can enter the cost per IP address.
In infrastructure orchestration designer, right click on a virtual or physical disk to display the **Config** tab, where you can enter the cost per disk unit (MB or GB).

![Config tab](image)

**Specifying costs for services deployed to public cloud providers**

A template that is deployed to a public cloud service provider (by checking **Require in Cloud** on the **Config** tab, after the environment is configured for cloud provisioning) can associate a cost value and a cost frequency to the external resources in the same way as for all other resources in a template. This value represents the cost that the administrator or architect wants to charge users for that service, and has no relation to the actual cost the cloud provider will charge the administrator for the cloud instance.

The chargeback component reports costs for cloud external resources based on the cost assigned to them in the service template. This gives the administrator and architect the opportunity to assign costs that will cover service provider charges (recurrent, fixed, and so on) and the overhead required to maintain the cloud bursting infrastructure. If, however, the administrator wants to change this cost and charge users only for the cloud service provider charge for those servers, the chargeback component identifies which resources are deployed to an external cloud provider.

**Specifying a billing code for services**

When creating a service, you can add a billing code, which allows IO chargeback or other data mining solutions using the API or database to extract information about which organization to bill.

Enter a billing code by clicking the **Options** button on the **Create Service from Template** dialog, and entering a value in the **Billing Code** text box.

Deactivated logical servers are counted as logical servers when cost information is calculated. The billing code is displayed on the **Service Details** page.

**NOTE:** The billing code can be modified only on the console. It is read-only on the infrastructure orchestration self service portal and infrastructure orchestration organization administrator portal.

Email messages sent for Paused for Approval, Add Servers, and Add Disks display billing code information. If the billing code is not supplied, None is shown.
Specifying a global cost unit for all templates

Convert the global cost unit for a template by right clicking in a blank area of the template design area and selecting Convert Template to use Global Cost Units. This menu selection is enabled only if the cost unit for the template is different from the global cost unit defined by the cost.units.global.value property in the ..\Program Files\HP\Matrix infrastructure orchestration\conf\hpio.properties file. This difference can occur if:

- a template is imported with a different cost unit than the cost unit set in hpio.properties file
- the cost.units.global.value value in hpio.properties is changed after creating a template

On the Convert Template to use Global Cost Units dialog, enter a Conversion Factor, which is a positive decimal or integer value. For example, if the cost information in a template is expressed in euros (€) and the global cost unit set in the hpio.properties file is dollars ($), convert the template from euros to dollars by entering a Conversion Factor equal to the current exchange rate, such as 1.3358. If the current global cost unit is $/year and the cost information in the template is entered in dollars per month, enter a Conversion Factor of 12 to convert the template from months to years.

Enter a value of 1 to convert the template to the global cost unit without changing the values. For example, if the global cost unit is euros and the information in the template contains the correct amounts in euros but is expressed as dollars, enter 1 to convert the template from dollars to euros.

Chargeback metrics collected and reported

The following table describes the report metrics and their values.
Table 6 Chargeback reported metrics

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocation time</td>
<td>Measured in minutes. Represents the time the resource was allocated to an infrastructure service. Collected for all resources inside an infrastructure, including services, logical servers, disks, and IP addresses, and for the infrastructure itself.</td>
</tr>
<tr>
<td>Allocation cost</td>
<td>Measured in cost units. Represents allocation time multiplied by allocation cost in minutes. Calculated for all individual resources, including fixed costs, logical servers, disks, and IP addresses in the infrastructure and for the entire infrastructure.</td>
</tr>
<tr>
<td>Logical server uptime</td>
<td>Measured in minutes. Represents the time that the logical server is up and running (power status UP).</td>
</tr>
<tr>
<td>Fixed cost</td>
<td>Assigned to the service. Considered once for the entire service lifecycle.</td>
</tr>
</tbody>
</table>

Chargeback metrics collected after an upgrade

When upgrading from a previous version of Matrix OE to 7.1, the chargeback component automatically acknowledges the existence of deployed services and starts collecting chargeback metrics from the upgrade time forward. For these services, the chargeback component can report allocation time, uptime, disk size, number of IP addresses, and number of servers.

Templates and services from an earlier version do not have a cost frequency assigned. Therefore, costs for existing services are not tracked or reported, and negative values are returned for cost metrics for those services.

After an upgrade to 7.1, server costs are updated to reflect the server cost assignment. Existing total cost is assigned to base cost, and CPU unit cost and memory unit cost are assigned to 0. This is a model in which, independent of the number of the CPU and memory, the cost for that server is fixed.

Using API extensions to retrieve chargeback data

Matrix infrastructure orchestration includes API extensions to retrieve chargeback usage data. Client software can connect to the chargeback server to build infrastructure resource allocation and usage reports for information on current and past services.

The chargeback SOAP WSDL is located at https://<cms-or-ip-address>:55443/hpio/chargeback/soap/v1?wsdl.

Following are the API methods that you can use to retrieve chargeback usage data.

Table 7 Chargeback API methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>getServicesUsagePage</td>
<td>Returns usage and cost data for selected services. For daily infrastructure usage data, set the period.type flag to DAILY. To return summarized infrastructure for a period, set the period.type flag to PERIOD. Server, Disk and IP address data is consolidated per infrastructure.</td>
</tr>
<tr>
<td>getServiceUsageDetailPage</td>
<td>Returns detailed usage and cost data for selected services. For daily infrastructure usage data, set the period.type flag to DAILY. To return summarized infrastructure for a period, set the period.type flag to PERIOD. Data for each Server, Disk and IP address is shown in detail.</td>
</tr>
<tr>
<td>getAggregateServiceUsage</td>
<td>Returns aggregated usage and cost values for selected services. Returns one entry with consolidated data for the entire period.</td>
</tr>
</tbody>
</table>

Following is sample output from each API.
Figure 2 Sample response from getServicesUsagePage API

```xml
<?xml version="1.0" encoding="UTF-8" ?>
<soap:Envelope xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/"
    xmlns:ns1="http://v1.soap.io.metering.hp.com/"
    xmlns:ns="http://schemas.soap.io.metering.hp.com/">
  <soap:Body>
    <ns1:getServiceUsagePageResponse>
      <ServiceUsageSummary>
        <pagingInformation>
          <lastPage>true</lastPage>
          <pageIndex>0</pageIndex>
          <pageSize>100</pageSize>
          <totalPages>1</totalPages>
        </pagingInformation>
        <ServiceUsagePage>
          <ns1:getServiceUsagePageResponse>
            <soap:Body>
              ...
            </soap:Body>
          </ns1:getServiceUsagePageResponse>
        </ServiceUsagePage>
      </ServiceUsageSummary>
    </ns1:getServiceUsagePageResponse>
  </soap:Body>
</soap:Envelope>
```
Figure 3 Sample response from getServiceUsageDetailPage API

```xml
<soap:Envelope xmlns:soap="http://schemas.xmlsoap.org/soap/
 - <ns1:getServiceUsageDetailPageResponse xmlns:ns1="http://
 - <soap:Body>
  - <ns1:getServiceUsageDetailPageResponse>
   - <ServiceUsageDetailPage>
     - <pagingInformation>
       <lastPage>true</lastPage>
       <pageIndex>0</pageIndex>
       <pageSize>100</pageSize>
       <totalPages>1</totalPages>
     </pagingInformation>
     + <serviceUsageDetail>
     + <serviceUsageDetail>
     + <serviceUsageDetail>
   </ServiceUsageDetailPage>
 </ns1:getServiceUsageDetailPageResponse>
</soap:Body>
</soap:Envelope>
```

```xml
- <serviceUsageDetail>
  <date>2012-02-02T00:00:00-02:00</date>
  - <resourceUsageDetail>
    - <disks>
      - <diskUsageDetail>
        <allocationCost>0.4244</allocationCost>
        <allocationHours>6.1056</allocationHours>
        <logicalDiskName>Disk1-1</logicalDiskName>
        <sizeGb>5.0010</sizeGb>
      </diskUsageDetail>
      - <diskUsageDetail>
        <allocationCost>0.0006</allocationCost>
        <allocationHours>6.1056</allocationHours>
        <logicalDiskName>Disk2-1</logicalDiskName>
        <sizeGb>0.0098</sizeGb>
      </diskUsageDetail>
    </disks>
    - <fixedCost>0.4258</fixedCost>
    - <pAddresses>
      - <pAddressUsageDetail>
        <allocationCost>0.0086</allocationCost>
        <allocationHours>6.1056</allocationHours>
        <pAddress>172.16.100.180</pAddress>
        <pAssignmentType>DHCP</pAssignmentType>
      </pAddressUsageDetail>
    </pAddresses>
    - <servers>
      - <serverUsageDetail>
        <allocationCost>4.4687</allocationCost>
        <allocationHours>6.1056</allocationHours>
        <logicalServerName>SurGrp1-1</logicalServerName>
        <uptimeHours>6.1056</uptimeHours>
      </serverUsageDetail>
    </servers>
  </resourceUsageDetail>
- <serviceInformation>
  <billingCode>glauInc</billingCode>
  <id>InfrastructureService18abe6e9-8660-43c3-bf39-48f3</id>
  <name>DATADISK_2 3</name>
  <organizationId>SERVICEPROVIDER</organizationId>
  <owner>IO-CMS-DEV-802\Administrator</owner>
  <startDate>2012-02-02T17:49:28.327-02:00</startDate>
</serviceInformation>
</serviceUsageDetail>
```
Using the CLI to retrieve chargeback data

Matrix infrastructure orchestration includes a command line tool to retrieve chargeback usage data. This tool generates an xml file containing chargeback data that can be opened in a browser or using Microsoft Excel.

The `chargeback.bat` tool is found in the default location at `C:\Program Files\HP\Matrix infrastructure orchestration\chargeback\bin`.

### Table 8 Chargeback CLI commands

<table>
<thead>
<tr>
<th>Operation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>get usage</code></td>
<td>Returns usage and cost data for selected services.</td>
</tr>
<tr>
<td></td>
<td>For daily infrastructure usage data, set the <code>period.type</code> flag to DAILY.</td>
</tr>
<tr>
<td></td>
<td>To return summarized infrastructure for a period, set the <code>period.type</code> flag to PERIOD. Server, Disk and IP address data is consolidated per infrastructure.</td>
</tr>
<tr>
<td><code>get detailedusage</code></td>
<td>Returns detailed usage and cost data for selected services.</td>
</tr>
<tr>
<td></td>
<td>For daily infrastructure usage data, set the <code>period.type</code> flag to DAILY.</td>
</tr>
<tr>
<td></td>
<td>To return summarized infrastructure for a period, set the <code>period.type</code> flag to PERIOD. Data for each Server, Disk and IP address is shown in detail.</td>
</tr>
<tr>
<td><code>get aggregatedusage</code></td>
<td>Returns aggregated usage and cost values for selected services.</td>
</tr>
<tr>
<td></td>
<td>Returns one entry with consolidated data for the entire period.</td>
</tr>
</tbody>
</table>

To use the CLI tool, perform the following steps.

1. On the CMS, open a command prompt and change directory (cd) to `<IO-installation-path>\chargeback\bin`.
2. From a command prompt, enter the following:
   ```
   chargeback <operation> [general-options] <operation-options>
   ```

Figure 4 Sample response from `getAggregateServiceUsage` API

```xml
<?xml version="1.0" encoding="UTF-8" ?>
<soap:Envelope xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/"
    xmlns:ns1="http://v1.soap.io.metering.hp.com/"
    xmlns:ns2="http://schemas.xmlsoap.org/soap/mimeheader/"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <soap:Body>
    <ns1:getAggregateServiceUsageResponse xmlns:ns1="http://v1.soap.io.metering.hp.com/"
      xmlns:ns2="http://schemas.xmlsoap.org/soap/mimeheader/"
      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
      <AggregateServiceUsage>
        <DiskUsageSummary>
          <allocationCost>1.1864</allocationCost>
          <allocationHours>20.9286</allocationHours>
          <disksCount>5</disksCount>
          <disksSizeGB>17.3155</disksSizeGB>
        </DiskUsageSummary>
        <fixedCost>0.9652</fixedCost>
        <IpAddressUsageSummary>
          <allocationCost>0.0195</allocationCost>
          <allocationHours>13.9087</allocationHours>
          <IpAddressCount>3</IpAddressCount>
        </IpAddressUsageSummary>
        <ServerUsageSummary>
          <allocationCost>10.2236</allocationCost>
          <allocationHours>13.9087</allocationHours>
          <serversCount>3</serversCount>
          <uptimeHours>13.9087</uptimeHours>
        </ServerUsageSummary>
        <resourceUsageSummary>
          <servicesCount>3</servicesCount>
          <totalCost>21.6531</totalCost>
        </resourceUsageSummary>
      </AggregateServiceUsage>
    </ns1:getAggregateServiceUsageResponse>
  </soap:Body>
</soap:Envelope>
```
(Enter chargeback --help to see information about the options.)

For example, to see allocation usage data for April 23 with the results sent to output.xml, enter:

```
chargeback get usage -S 4/23/2012 -E 4/23/2012 -o output
```

3. From Windows Explorer, navigate to

```
<IO-installation-path>\chargeback\bin\reports
```

where the output.xml file is located.

4. To view the results, do one of the following:
   a. Drag output.xml to your browser's URL bar to view the file in your browser.
   b. Run Microsoft Excel, and open output.xml.
   c. Edit the output.xml file with information from a downloaded xsl file to create a report.
      Sample xsl files are available for download from HP Developer Resource Center for CloudSystem.

Following is an example of the output using the downloaded xsl file to display getServiceUsageDetail.

**Figure 5 Sample output from getServiceUsageDetail**

**getServiceUsageDetail: All metrics**

<table>
<thead>
<tr>
<th>Service Name</th>
<th>Date</th>
<th>Organization</th>
<th>Billing Code</th>
<th>Owner Name</th>
<th>Fixed Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>wiki_server</td>
<td></td>
<td>SERVICEPROVIDER</td>
<td>IT</td>
<td>QA-08\Administrator</td>
<td>7.8932</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Server Host Name</th>
<th>Server Resource Type</th>
<th>Server Allocation Hours</th>
<th>Server Allocation Uptime Hours</th>
<th>Server Allocation Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>wiki</td>
<td>VIRTUAL</td>
<td></td>
<td>56.8408</td>
<td>56.8408</td>
<td>15.7904</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Disk Name</th>
<th>InCloud</th>
<th>Size GB</th>
<th>Disk Allocation Hours</th>
<th>Disk Allocation Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disk1-1</td>
<td>false</td>
<td>0.0977</td>
<td>56.8408</td>
<td>0.7730</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IP Address</th>
<th>IP Assignment Type</th>
<th>Disk Allocation Hours</th>
<th>Disk Allocation Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHCP</td>
<td></td>
<td>56.8408</td>
<td>0.7901</td>
</tr>
</tbody>
</table>

continued...
Matrix infrastructure orchestration supports a range of storage provisioning capabilities to appropriately match the customer environment. Administrators can choose to manually define storage pool entries and manually provision storage, or can take advantage of the Matrix Operating Environment integration with HP Storage Provisioning Manager (SPM).

SPM is automatically installed as part of Matrix OE. Matrix infrastructure orchestration communicates with SPM to find or create storage resources that match the requirements in a request and makes that storage available for use. When defining service templates within infrastructure orchestration designer, the administrator can manually specify logical disk properties (for example, size, RAID, tags) or can browse storage templates defined in SPM and make an appropriate selection.

During service provisioning, infrastructure orchestration searches for storage pool entries that meet the logical disk needs, and can automatically create a storage pool entry if none is found (using the service template logical disk information).

Matrix infrastructure orchestration works with SPM to provide storage services and automate several operations related to storage. The interaction with SPM can take place during service provisioning, or can be done in advance, for customers who want to manually create storage pool entries and fulfill them through the SPM catalog. When storage requests are made to SPM (manually or automatically created), an SPM storage template is used. The template can be selected in infrastructure orchestration designer, or a default template is used. SPM will fulfill the request from the service catalog, perhaps using pre-provisioned storage or on-demand provisioned storage (based on the policies in the SPM storage template).

For more information, see “Populating the Storage Provisioning Manager catalog” (page 142), and the HP Storage Provisioning Manager (SPM) User Guide at Matrix Operating Environment Information Library.

**NOTE:** Storage pool entries can be created manually, or infrastructure orchestration can create storage pool entries automatically. In both cases, the storage pool entries can be fulfilled through SPM using pre-provisioned volumes or on-demand provisioning (based on customer need reflected in the storage templates defined in SPM).

Auto-generated storage pool entries are created based on the logical disk storage needs defined in a service template and follow certain conventions (for example, use of SPM, packing multiple volumes into the same storage pool entry, and choices of SAN fabric). If your specific storage configuration does not follow those conventions, a manually created storage pool entry is appropriate. For example:

- SPM is not used
- Boot volume in a separate entry from other private data volumes
- Combinations of private and shared disks without NPIV
- Multiple non-redundant disks on different fabrics
- Redundant paths to disks across unusual fabric combinations
- Mix of redundant and non-redundant volumes
- A Virtual Connect module connected to more than one SAN fabric

When Matrix is in an environment with Virtual Connect modules whose uplink ports connect to different SANs, the auto-generation of storage pool entries may not be sufficient. Matrix OE infrastructure orchestration will choose one representative uplink for each VC module and thus be aware of connectivity to that SAN (and not the SANs accessible through other uplinks on that module). In those environments the storage pool entries should be created manually (and can still be fulfilled manually or through SPM).
Following are the types of storage provisioning available in infrastructure orchestration. The overall system may be used with any or all of the processes combined.

- **On-demand storage provisioning**
  The storage administrator populates the SPM catalog with arrays and storage pools, then defines storage templates with various policies, including access to those pools. New volumes can be carved from existing pools (by an administrator or by infrastructure orchestration) through the use of storage services. Provisioning policy is controlled by the storage architect using template requirements.
  
  On-demand provisioning is supported for HP EVA/P6000 and HP 3PAR Storage Systems, and can include automated SAN zoning within Brocade SAN environments.

  **NOTE:** On-demand storage provisioning is disabled by default. To enable on-demand storage provisioning, see “Enabling on-demand storage provisioning in SPM” (page 144).

- **Pre-provisioned storage provisioning**
  The storage administrator populates the SPM catalog with arrays, storage pools and all of the volumes that will be used to fulfill storage services, then sets up access rights for those volumes. Volume selection policy is controlled by the storage architect by means of template requirements.
  
  Pre-provisioned storage is supported for HP P6000/EVA, HP P9000/XP, and HP 3PAR Storage Systems.
  
  Pre-provisioned storage provisioning cannot be used if:
  
  ◦ SPM is not configured
  ◦ the environment contains a combination of private and shared disks without NPIV
  ◦ boot disks and other private disks are contained in separate storage pool entries

  Storage requests can be created manually by the user or automatically by Matrix infrastructure orchestration and submitted to SPM for storage service fulfillment. SPM can fulfill with either on-demand or pre-provisioned storage (allowing the user to select from returned candidates, or IO will choose the best candidate).

  See the [HP Storage Provisioning Manager (SPM) User Guide](http://www.hp.com/go/matrixoe/docs) for details on specific storage solution models and software versions.

  After SAN volumes have been pre-provisioned, infrastructure orchestration can automate the LUN presentation process to a server using two different approaches.

  - Static SAN volume automation through multi-initiator NPIV
  - Dynamic SAN volume automation

<table>
<thead>
<tr>
<th></th>
<th>Manual storage provisioning using logical server management</th>
<th>Pre-provisioned storage provisioning by IO using SPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static (NPIV)</td>
<td>✓</td>
<td><img src="https://via.placeholder.com/15" alt="" /></td>
</tr>
<tr>
<td>Dynamic (SPM)</td>
<td><img src="https://via.placeholder.com/15" alt="" /></td>
<td>✓</td>
</tr>
</tbody>
</table>

**Static SAN volume automation through multi-initiator NPIV**

Using this process, SAN volumes are pre-masked to one or more initiator WWNs within the SAN, and logical servers can support more than one initiator on each physical HBA port (multi-initiator NPIV). Zoning is also pre-configured. The SAN volumes are then made available within Matrix OE visualization’s storage pool as storage pool entries.
At service creation, infrastructure orchestration selects one or more storage pool entries from the storage pool. Existing storage pool entries visible to infrastructure orchestration are already associated with storage volumes (through manual fulfillment, or fulfillment through SPM). If there is no suitable storage pool entry and SPM is being used, infrastructure orchestration will create a storage pool entry and attempt to fulfill through SPM. If SPM fulfillment fails, infrastructure orchestration indicates the need for manual storage provisioning. Given a storage pool entry, infrastructure orchestration examines the initiator WWNs associated with each of the storage pool entries and performs the required assignment to the server in order to enable server visibility within the SAN to the set of SAN volume targets defined by the storage pool entries.

This process has the advantage of the ability to separate the boot and data storage visibility to the server during OS provisioning without requiring any access to the existing SAN management interfaces. The approach is limited to Virtual Connect managed servers only.

**NOTE:** For non-Integrity servers, NPIV is enabled by default.

Manually enable NPIV for Integrity servers that use both private and shared disks for storage auto provisioning. Set `npiv.integrity.enabled=true` in `..\Program Files\HP\Matrix infrastructure orchestration\conf\hpio.properties` to enable NPIV support on Integrity servers. (The `npiv.integrity.enabled` property is set to false by default.)

### Dynamic SAN volume automation

In a more dynamic environment, pre-provisioned SAN volumes can have their LUN masking adjusted appropriately, or SAN volumes can be provisioned on-demand with suitable LUN masking.

In the pre-provisioned use case, SAN volumes are pre-created within SPM but are not yet masked to one or more initiator WWNs. Zoning must be pre-configured. The SAN volumes are made available within the SPM storage catalog and are visible in Matrix OE visualization’s storage pool as storage pool entries (either in advance for manually created storage pool entries, or at service provisioning when infrastructure orchestration automatically generated the storage pool entries).

At service creation, infrastructure orchestration attempts to find a suitable storage pool entry. The storage pool entry must fully match the storage requirements for the logical server: number of SAN volumes, size, RAID level, OS type, redundancy, and optionally a set of one or more tags. Unlike the multi-initiator NPIV approach above, infrastructure orchestration is able to perform automatic LUN masking and host mode assignment through SPM. This allows infrastructure orchestration to separate the visibility of boot and data storage during OS provisioning. It also allows a single storage pool entry to be re-used across different logical servers because the host mode may also be set dynamically based on the logical server’s requirements.

If a suitable storage pool entry is not found, infrastructure orchestration creates a storage pool entry and attempts to fulfill the request through SPM (matching to a pre-provisioned volume or using on-demand provisioning, based on the SPM storage template policies). The storage returned meets the needs of the service being provisioned, including masking/presentation to suitable initiator WWNs.

This process is supported only on Virtual Connect managed servers. This approach requires that a SAN administrator be willing to grant restricted access to the disk array management interface for performing the SAN volume inventory and LUN masking operations, and, if using on-demand provisioning, volume creation operations and access to the Brocade SAN management SMI-S instrumentation for SAN zoning. Storage administrators can specify policies within storage templates using SPM. SPM enables the storage administrator to create storage templates, which can capture policies such as size (with boundaries), RAID level to use (or avoid), tags, use of pre-provisioned SAN volumes and/or on-demand provisioning, use of thin provisioning (or preventing its use), and other aspects. SPM catalog entries represent the pre-provisioned SAN volumes and have granular control over operations (some may support LUN masking and changing host mode, others may not). This provides much more granular control than giving the server administrator the Admin password to the storage array.
Manual storage provisioning

Manual storage provisioning can be performed using the Matrix OE visualization logical server management Modify→Logical Server Storage Pools screen and SPM.

Manual storage provisioning is used when no storage has been pre-provisioned or when only a subset of the storage has been pre-provisioned for a logical server. At service creation, infrastructure orchestration attempts to locate and allocate the storage resources. The storage pool entry must fully match the storage requirements for the logical server: number of SAN volumes, size, RAID level, OS type, redundancy, and optionally a set of one or more tags.

When no storage resources are found, the overall request pauses for the administrator to manually provision the required storage. The administrator is notified by an Operations Orchestration-generated email message that contains the details of the service being provisioned and the storage resources that are required. After the administrator has completed the storage provisioning process, the request is re-activated and allowed to continue.

If the IO administrator submits storage requests to SPM and no candidates are returned, the unfulfilled requests are visible within SPM and the storage administrator can create appropriate storage matching the needs (and do appropriate SAN zoning), then fulfill the request within SPM. If IO cannot find storage for an automatically generated storage pool entry, the storage pool entry is deleted. The administrator can fulfill the storage manually, or can adjust the storage in SPM by, for example, putting more volumes in the catalog, importing arrays, or modifying the template before performing a repeated attempt to create the storage pool entry and fulfill it through SPM.

Manually creating SAN-backed storage in Matrix OE visualization

To manually create SAN-backed storage pool entries in Matrix OE visualization, perform the following steps.

1. Verify that the target enclosures have been successfully discovered by Systems Insight Manager.
2. Create a Virtual Connect domain group that includes the target enclosures in VCEM.
3. Refresh Matrix OE, synchronizing it with VCEM. To refresh Matrix OE:

The Refresh Server Resource Information page appears.
b. Select **Virtual Connect Enterprise Manager (VCEM)** and **Storage Pool Entries**, and then click **Refresh**.

4. Click **Modify → Logical Server Storage Pools**.

5. Select the target Virtual Connect portability group from the **Portability Group** list.
For detailed instructions about how to add or modify storage pool entries, see the help for the Manage Storage Pool screen or the HP Matrix Operating Environment Logical Server Management User Guide at Matrix Operating Environment Information Library.

Predefining storage pool entries in Matrix OE visualization

The following example illustrates the selection of a Linux SAN volume to build a storage pool entry. Select Modify→Logical Server Storage Pools from Matrix OE visualization. On the Manage Storage Pool screen, the target portability group is selected (in this case a Virtual Connect Domain Group) and a new catalog storage pool entry is added.

Specify the port and volume information on the screen, and save the storage pool entry. It can then be used for future service provisioning requests.

If the SPM catalog entry authorizes it, infrastructure orchestration is able to dynamically adjust the LUN masking and, if necessary, the host mode for the storage pool entry. If there were no pre-provisioned volumes to meet the need, and on-demand provisioning is enabled for the template being used, SPM can create the appropriate storage (and perform automated zoning in a Brocade SAN environment).
Creating storage tags

Matrix infrastructure orchestration uses the tags selected from the Tag List in the storage pool entry to match the logical disk tags provided in the infrastructure orchestration designer.

**IMPORTANT:** When logical disk tags are specified in the template design, only volumes with the exact tags are allocated. If logical disk tag information is not provided, the allocation process ignores the storage volume tags.

To create storage tags:

3. Click Manage Tags. The Manage Storage Tags page appears.
4. Add storage tags and an optional description.

Storage tags are displayed in the Tag List for all Storage Pool Entries. Click Modify next to the storage pool entry, then check the checkbox next to a tag name to associate the tag with the storage pool entry.

For more detailed information on the use cases and how storage is managed in Matrix OE visualization, see the HP Storage Provisioning Manager (SPM) User Guide, HP Matrix Operating Environment Logical Server Management User Guide, and the Faster storage provisioning in an HP BladeSystem Matrix and Insight Dynamics environment white paper at Matrix Operating Environment Information Library.
Populating the Storage Provisioning Manager catalog

To use dynamic SAN volume automation, configure SPM for access to one or more arrays. To start SPM, open an internet browser to https://localhost:8000, where “localhost” is the name of the primary CMS.

**NOTE:** By default, Matrix OE finds and communicates with the SPM service using the host specification of “localhost”. If you want to use SPM from Matrix OE in a clustered environment, edit the C:\Program Files\HP\Virtual Server Environment\conf\lsa\lsa.properties file.

Change the SPM_HOST=localhost property to SPM_HOST=<cluster FQDN>.

Select Arrays from the tree view on the left side, and click Import Arrays in the lower right corner. The Choose Array Type screen is displayed.
A managed array enables SPM to perform certain storage operations such as gathering property information, changing the hostmode, performing LUN masking, or on-demand provisioning. Unmanaged arrays do not support the automated mechanism to change hostmode and LUN masking or perform on-demand provisioning. Any pre-presented SAN volume can be communicated to SPM as unmanaged storage via XML files, creating a catalog entry which can be matched against a SAN pre-populated catalog storage pool entry to provide logical server storage suitable for use by infrastructure orchestration.

SPM supports a device management layer that performs appropriate communication with the supported storage solutions (for example, P6000/EVA, HP 3PAR Storage Systems, and P9000/XP).

SPM provides extension mechanisms that can be used to extend the out-of-the-box support. For more information, see the HP Storage Provisioning Manager (SPM) User Guide at Matrix Operating Environment Information Library.

Specify the connection information for the arrays to import (for example, the 3PAR F & T Series Arrays):

Select one or more arrays for import. Once the array has been imported, view and select the SAN volumes that are visible on the array and select the volume(s) to be included in the catalog. For each array, select the settings.

**IMPORTANT:** Select the **Matrix Security Group** for the security group.
From the left navigation bar, select **Volumes**, then select volumes to import and press **Import Volumes**.

After the SPM catalog has been populated, you can do the following:

- Continue to use pre-provisioned storage (no additional steps are needed)
- Allow infrastructure orchestration to automatically generate storage pool entries (no additional steps are needed)
- Enable on-demand storage provisioning (see “Enabling on-demand storage provisioning in SPM” (page 144))
- Predefine storage pool entries using the Matrix OE visualization’s storage pool entry screens and build one or more storage pool entries that reference the volumes just imported through SPM (see “Predefining storage pool entries in Matrix OE visualization” (page 140))

**Enabling on-demand storage provisioning in SPM**

There are two ways to enable on-demand provisioning:

- In the **HP Matrix Default Storage Template**. On-demand provisioning will apply to all requests from logical server management and those from IO that manually specify logical disk
information, and those for which the HP Matrix Default Storage Template was chosen. Enabling on-demand provisioning is typically done in conjunction with a capacity constraint (for example, no more than 256 GB) and that constraint applies to all requests using the default template. This allows the constraint to be applied to only on-demand provisioned volumes and not pre-provisioned volumes.

- By creating a new template and enabling on-demand provisioning for that new template (with a capacity constraint). On-demand provisioning is used for those IO service templates that select this storage template.

**IMPORTANT:** Use caution when making changes to the default Matrix template because those changes impact all such requests. For example, if you were to set a maximum size of 100 GB for that template, no manual path could fulfill through SPM with a volume larger than 100 GB. Similarly, if you want to enable on-demand provisioning for all manual requests, you would do so by modifying the default Matrix template and perhaps impose a capacity constraint such as no on-demand provisioned volume can exceed 500 GB but pre-provisioned volumes have no size limitations.

To enable on-demand storage provisioning:
1. Log in to Storage Provisioning Manager. You must be a storage administrator to enable on-demand storage provisioning.

   To start SPM, open an internet browser to https://localhost:8000, where “localhost” is the name of your CMS.

2. Select **Templates** under **Storage Services**.
3. Search for and select **HP Matrix Default Storage Template** in the list of templates, or click **Create Template** to create a new template.

4. Click **Edit Template**.
5. In the **Edit Template** dialog, select the **Read-Only Requirements** tab.
6. Select the **Resource Existence** requirement in the Template read-only requirements.

7. Click **Edit**.
8. Change the level from Required to **Recommended**. Verify that **Use existing volume** is selected.

10. Click **OK** (or Apply).

**Physical storage provisioning**

Matrix infrastructure orchestration displays the storage volumes available for provisioning on the infrastructure orchestration console **Storage** tab. The volumes that are also storage pool entries are also visible on the Matrix OE visualization – Modify Logical Server Storage Pools page.

During service provisioning, infrastructure orchestration searches for an appropriate storage pool entry and can create one if none is found. The auto-generated storage pool entries are fulfilled through SPM using either pre-provisioned catalog storage pool entries or on-demand provisioned storage.

For each physical logical server, infrastructure orchestration supports up to 16 data disks.

**Service template defines storage by “Selecting a storage template”**

HP Storage Provisioning Manager (SPM) allows storage architects to create storage templates, which are used for all storage provisioning requests. Using SPM, storage architects can encapsulate their policies in storage template definitions, specifying various requirements (for example, a specific RAID level, a capacity constraint, or the recommended or required use of thin provisioning).
These storage templates can be viewed and selected in infrastructure orchestration designer when defining a logical disk in a service template, or you can define logical disk attributes manually. In either case, the storage fulfilling the request might be pre-provisioned or newly created on-demand through SPM.

The selected storage template requirements are combined with any user modified or added requirements to formulate the goal that the provisioning process meets.

**NOTE:** The storage template specification is used to fulfill storage through SPM only if there are no existing storage pool entries that match the requirements.

To force infrastructure orchestration to use SPM for storage instead of an existing storage pool entry, ensure that there are no available matching storage pool entries. One way to do so is to select a tag for the storage that is not associated with any storage pool entry, but is associated with volumes or storage pools in SPM.

In SPM, storage architects create a set of storage templates representing their policies with required degrees of protection (for example, Windows boot disks, HP-UX boot disks, LUNs for transaction logs, LUNs for various applications). SPM can create storage volumes on-demand and perform appropriate presentation and zoning steps. Storage architects determine the extent by which they want to use on-demand provisioning capabilities by defining the “Resource Existence” requirement as a template read-only requirement. If “Resource Existence” is set to required and “Use Existing Volume” is selected and required, then on-demand provisioning is not used, and only existing volumes are used to satisfy the request.

**IMPORTANT:** If you configured secondary CMSs for use in a federated CMS environment, ensure that each SAN storage volume is managed by only one HP Storage Provisioning Manager. (A storage array can be shared by multiple SPMs.)

HP recommends that you select the **HP Matrix Default Storage Template**, and optionally define additional attributes, when configuring physical storage in a service template.

Each CMS contains its own HP Matrix Default Storage Template, and these templates are independent of each other. The default storage template shown in infrastructure orchestration designer is the default storage template on the primary CMS. However, storage auto-provisioning is based on the template found on the CMS that deploys the template.

If you do not select the HP Matrix Default Storage Template and instead select a user-defined storage template, the same SPM Server is used for all volume definitions. If a SAN storage volume is managed by multiple SPMs or CMSs, unpredictable results can occur.

### Service template defines storage by “Specifying desired attributes”

During service provisioning, infrastructure orchestration uses the SPM storage template specified in the service template definition or, if logical disk properties were manually specified, the **HP Matrix Default Storage Template** that is predefined in SPM and integrated in Matrix OE. The desired attributes specified in the service template are combined with any requirements that are defined in the HP Matrix Default Storage Template.

The predefined HP Matrix Default Storage Template contains minimal constraints, allowing any capacity, RAID level, presentation requirement, or tags, and requires pre-provisioned storage.

Using SPM, the HP Matrix Default Storage Template can be edited or copied to make additional templates.

By default, “Resource Existence” is set to required in the HP Matrix Default Storage Template, so only existing volumes (pre-provisioned storage) are used to satisfy all manually defined storage requests. This includes specifying the logical disk information for a service template (by selecting **Specify desired attributes**) or manually creating a storage pool entry in Matrix OE visualization logical server management and fulfilling it through SPM.
For instructions about how to change “Resource Existence” to enable on-demand provisioning for all manually specified storage, see “Enabling on-demand storage provisioning in SPM” (page 144).

**NOTE:** Any edits made to the HP Matrix Default Storage Template will apply to all manually specified storage.

If you select a storage template when configuring a service template in infrastructure orchestration designer, the default requirements of the storage template define the desired attributes of the storage you are configuring. You can modify these values and add additional values that were not defined by the storage template.

When defining SPM storage templates, use the Description field to summarize the requirements (for example, if the template supports only RAID 1 and RAID 5). That description is visible to the architect in infrastructure orchestration designer. When using a specific SPM storage template in IO, be aware of the storage template’s capacity, RAID, and tag requirements (included in the description field). Do not specify values that conflict with these requirements or the storage may not be correctly provisioned.

The storage requirements that you can manually define are as follows:

- **Name** of the disk.
- **Individual Disk Size** is the size for the disk in gigabytes (GB). For physical (SAN) disks, this attribute is used to find a SAN disk that is at least as large as the value specified. (For physical storage, MB x 1000 = GB.)
- **Cost per GB** is the estimated cost per gigabyte in numeric form.
- **RAID Level** is a specific RAID level, or Any. If you specify a RAID level, the selection is matched against Matrix OE storage volume properties during service allocation. Only SAN volumes with a matching RAID level are used to satisfy a provisioning of that template.
- **Disk is bootable** denotes that the disk will be the boot disk for a server group.
- **Redundant SAN paths to disk** denotes that the disk will have redundant paths to the disk. If the disk is a boot disk, the selected software must be an image with embedded multi-path software.
- **Disk is shared across servers** denotes that this disk is a data disk (non-boot disk) shared between all servers in the group.
- **Tags** allow you to select or enter one or more tags from the list of tags defined in Matrix OE logical server management. Storage tags are used to match a corresponding SAN storage volume in the Matrix OE inventory (or the SPM storage catalog). The tag set is not pre-defined or limited by IO.
- **Additional Tags** allows you to enter a comma-separated list of tags.

**NOTE:** During service allocation, any specified tags are used to find a suitable allocation match with an existing Matrix OE storage pool entry or passed through to SPM for fulfillment of a newly created storage pool entry. Only SAN volumes with matching tags (either pre-provisioned or created on demand) are used to satisfy a provisioning of that IO template. Leaving tag fields empty expands the provisioning options for that IO template.

**Virtual storage provisioning**

The infrastructure orchestration designer **Virtual Storage** component Config tab allows you to configure a bootable disk or data disk for each server in the server group that is connected to the virtual storage.

**NOTE:** All storage volumes for a virtual machine logical server must be part of the same datastore. File volumes are created on the same disk as the virtual machine’s configuration file.
The virtual storage requirements that can be manually defined are as follows:

- **Name** of the disk.
- **Individual Disk Size** is the size for the disk and specifies if it is in megabytes or gigabytes. For virtual disks, this value sets the actual size of the disk. (For virtual storage, MB x 1024 = GB.)
- **Cost per GB** is the estimated cost per gigabyte in numeric form.
- **Disk is bootable** specifies that the disk will be the boot disk for a server group. For bootable disks, you can assign a Storage Volume Name to match mounted volume names on a VM Host. If the Storage Volume Name is not matched, you can allocate virtual storage manually. Any data disks configured for the logical server will inherit the names set for the boot disk.
  
  For non-boot disks (Disk is bootable is not checked), the Storage Volume Name field is not enabled. The Storage Volume Name is identical to that of the boot disk.

- **Disk is shared across servers** specifies that the disk is a data disk (non-boot disk) and it is shared between all of the servers in the group.

- **Storage Volume Name(s)** is a comma-separated list that specifies the VM Host storage volume(s) used to allocate virtual storage for the attached server group. (This is analogous to specifying the storage volume used to allocate storage for physical servers using Physical Storage tags.) Storage Volume Name(s) can only be set or edited for virtual boot disks; however, the volume names specified on the boot disk will apply to all disks attached to the server group, including data disks.

  Storage Volume Name(s) can be simple VMware ESX data store names (for example: "ClusterStorageOne"), simple Hyper-V data store names (for example: "S") or HP-UX Shared Logical Volume groups (for example: "/dev/slvm_disk1"). If one or more volume names are specified, only volumes matching those names will be considered when the template is provisioned.

**Matrix infrastructure orchestration approach to storage reservation and allocation**

A key step in the service creation process involves both a reservation and an allocation phase for all resources required by the service template. This section describes the storage reservation and allocation rules in the storage algorithm.

The following matching rules are applied in sequential order. A rule cannot be partially matched. For a rule to match, the entire rule definition must match. The rules give priority to finding a match for the boot disk first.

1. Find a storage pool entry (SPE) that contains only a fully matched boot disk per the logical server’s boot disk definition.
   
a. If found, find one or more additional SPEs that fully match the logical server’s data disk definitions.

   **Result:** If both rules 1 and 1a successfully match, provision the server(s) with the matched SPEs. Otherwise, continue trying to find matching SPEs in different configurations.

2. If the boot disk reservation cannot be satisfied with a single SPE and independent data volume entries, seek a single SPE that fully matches both the logical server’s boot disk and private data disk requirements. (Shared data disks must be contained in their own storage pool entries.)

   **Result:** If rule 2 successfully finds an SPE, provision the server(s) with the matched SPE.

3. If the boot disk reservation still cannot be satisfied, seek a single SPE that fully matches the logical server’s boot disk definition only. (This may be the same SPE found in rule 1.)

   **Result:** If there is a matching boot disk, skip to rule 5 to provision storage for the data disks.
4. If the boot disk reservation still cannot be satisfied, Matrix OE attempts to automatically create an SPE that will be automatically fulfilled through SPM, containing the boot disk and the private data disks.

**Result:** If the boot disk is not fulfilled, the request pauses and raises an email alert (using an Operations Orchestration workflow) requesting manual storage provisioning for the boot and data disks. If the service contains shared data disks, Matrix OE will create separate SPEs as appropriate and attempt to fulfill through SPM.

If the boot/data disk requests are fulfilled, but SPM has indicated the need for manual zoning, the request pauses and raises an email alert (using an Operations Orchestration workflow) requesting manual storage zoning for the appropriate disks. The storage administrator zones the storage and edits the XML files for SPM. The request can then be resumed. At that time, Matrix OE uses the appropriate SPEs (and does not repeat the algorithm above).

5. If the boot disk has been reserved, but the data disk reservation still cannot be satisfied, Matrix OE attempts to automatically create an SPE for the data disk(s) that will be fulfilled through SPM.

**Result:** If data disk(s) are still not fulfilled, pause the request and raise an email alert (using an Operations Orchestration workflow) requesting manual storage provisioning for the data disks.

If the boot/data disk requests are fulfilled, but SPM has indicated the need for manual zoning, the request pauses and raises an email alert (using an Operations Orchestration workflow) requesting manual storage zoning for the appropriate disks. The storage administrator zones the storage and edits the XML files for SPM. The request can then be resumed. At that time, Matrix OE uses the appropriate SPEs (and does not repeat the algorithm above).

6. For all paused requests for storage provisioning, the administrator can manually create the storage pool entry and try to fulfill it manually or through SPM (which could match the request to pre-provisioned storage or use on-demand provisioning, if enabled). Requests paused for storage zoning can be resumed once the storage administrator has manually zoned the storage and edited the SPM XML files to reflect that zoning.

**NOTE:** When a request that was paused for manual storage provisioning is continued, infrastructure orchestration re-enters the reservation algorithm, applying the same logic to satisfy both the boot and data disk requirements for the logical server.

When the fulfillment is through SPM, IO monitors the job status. When complete, it uses that storage in the service request. When a request that was paused for manual storage zoning is continued, the infrastructure orchestration algorithm uses the appropriate SPEs already fulfilled through SPM (which are now zoned and suitable for use).

Using the preceding steps, the following priority is observed when trying to satisfy the storage requirements:

1. Try: Static SAN volume automation through multi-initiator NPIV (each volume in a separate SPE)
2. Fall back to: Dynamic SAN volume automation via LUN masking (combine volumes in SPEs)
   a. Search for existing SPEs
   b. If none are found, auto-generate SPEs and attempt to fulfill through SPM
3. Fall back to: Manual storage provisioning
Multi-tenancy in Matrix infrastructure orchestration

Multi-tenancy allows data center resources to be dynamically and securely shared among separate tenants by providing each organization with a virtual infrastructure orchestration system. In Matrix infrastructure orchestration, tenants are known as organizations.

For detailed information, see Multi-Tenancy in HP Matrix OE Infrastructure Orchestration and HP CloudSystem Matrix Step-by-Step Guide: Multi-tenancy at http://www.hp.com/go/matrixoe.

Overview of organizations

An organization’s virtual infrastructure orchestration system is intended for a business entity that:

- has a number of users, or groups of users, that want to use an infrastructure orchestration system to create services
- requires that information about resources, activities, and users is kept private within the organization and secure from interference from other organizations

There is information security and privacy between the virtual IO systems used by different organizations. There is no access to the service provider or CMS from an organization.

Matrix infrastructure orchestration contains two levels, Service Provider and Organization.

• Service Provider

Matrix infrastructure orchestration contains a single permanent service provider (essentially the IO system in previous versions). The service provider contains the following roles:

  ◦ Service provider administrator
    - Uses the infrastructure orchestration console, and can log in to the infrastructure orchestration organization administrator portal and the infrastructure orchestration self service portal for any organization
    - Has full access and control of the IO system and all its resources
    - Is responsible for creating organizations in the infrastructure orchestration console and assigning resources to them
    - Can create pools and assign service provider users to them
  
  ◦ Service provider architect
    
    Can access the infrastructure orchestration designer to create, modify, and publish templates for the Service Provider and organizations
- Service provider user
  Can log into the infrastructure orchestration self service portal and initiate requests for provisioning using published templates

- Organization
  The service provider administrator dynamically creates the organization and makes resources available to the organization using the infrastructure orchestration console. See “Creating an organization” (page 154) and “Adding resources to an organization” (page 156) for more information.

Two Microsoft Windows groups are created on the CMS for each organization:

- `<organization-id>_Administrators` use the infrastructure orchestration organization administrator portal to manage the organization’s virtual IO system.

- `<organization-id>_Users` are essentially the same as service provider users, except that the organization user’s access and control is restricted to the resources assigned to the organization’s virtual IO system.

See “Assigning users to an organization” (page 156) for more information.

**Security in infrastructure orchestration multi-tenancy**

Multi-tenancy in infrastructure orchestration ensures that information from one organization does not pass to another organization. Table 9 (page 152) and Table 10 (page 154) show how resources and information is filtered.

**Access to resources**

Access to resources in infrastructure orchestration is hierarchical. The service provider administrator has unrestricted access to resources and can make them available to organizations. Within an organization, the organization administrator controls access to compute resources by organization users.

A service provider administrator assigns service provider users to templates. However, an organization administrator cannot assign organization users to templates. An organization user has access to all of the templates assigned to that organization.

A Windows user may be both a service provider user and an organization user. In this case, if the Windows user logs into the self service portal, the user will have access to the templates to which he/she is assigned. If the Windows user logs into the organization administrator portal, the user has access to all of the templates assigned to the organization.

**Table 9 Resources visible to service provider and organization administrators and users**

<table>
<thead>
<tr>
<th>Resource</th>
<th>Organization</th>
<th>Service provider administrator controls</th>
<th>Service provider user access</th>
<th>Organization administrator access</th>
<th>Organization user/group access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure orchestration templates</td>
<td>Created by IO architect using infrastructure orchestration designer</td>
<td>Assign to one or more organizations and/or restrict</td>
<td>Visible if published. If access restrictions are enabled,</td>
<td>Visible if assigned to the organization by the service provider</td>
<td>Visible if assigned to the organization by the organization</td>
</tr>
</tbody>
</table>
### Table 9 Resources visible to service provider and organization administrators and users (continued)

<table>
<thead>
<tr>
<th>Resource</th>
<th>Origination</th>
<th>Service provider administrator controls</th>
<th>Service provider user access</th>
<th>Organization administrator access</th>
<th>Organization user/group access</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>service provider user/group access</td>
<td>visible if published AND</td>
<td>administrator</td>
<td>administrator</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>the template is assigned to</td>
<td>(published and unpublished)</td>
<td>(published only)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>the user/group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Networks</td>
<td>Created or discovered by IO; can be edited by</td>
<td>Assign to one or more organizations¹</td>
<td>No restrictions</td>
<td>Visible if assigned to the</td>
<td>Visible if assigned to the</td>
</tr>
<tr>
<td></td>
<td>service provider administrator</td>
<td></td>
<td></td>
<td>organization by the service</td>
<td>organization by the</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>provider administrator</td>
<td>organization administrator</td>
</tr>
<tr>
<td>Compute resources</td>
<td>Discovered by IO</td>
<td>Keep at service provider or assign to</td>
<td>Visible if resource is kept</td>
<td>Visible if assigned to the</td>
<td>Visible if assigned to the</td>
</tr>
<tr>
<td>(physical servers, VM Hosts, ESX</td>
<td></td>
<td>one organization</td>
<td>at the service provider</td>
<td>organization by the service</td>
<td>organization by the</td>
</tr>
<tr>
<td>resource pools, and cloud</td>
<td></td>
<td></td>
<td>level and the user is assigned</td>
<td>provider administrator</td>
<td>organization by the</td>
</tr>
<tr>
<td>resources)</td>
<td></td>
<td></td>
<td>to the pool containing the</td>
<td></td>
<td>resource by the</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>resource by the service</td>
<td></td>
<td>organization administrator</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>provider administrator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage pool entries</td>
<td>Automatically generated by Matrix OE, or created</td>
<td>Allocate a separate storage tag to</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>by service provider administrator using Matrix</td>
<td>each organization. Match logical disk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>OE logical server management, optionally using</td>
<td>disk tags with storage pool entry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Storage Provisioning Manager</td>
<td>tags, or choose the appropriate SPM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>storage template using tags in the</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>IO template</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹ IO does not include or preclude active firewalling between VLANs.
² Storage management for physical server blades can be performed only by the service provider administrator.

### Information security

The following table shows the information that is visible to the service provider administrator, service provider user, organization administrator, and organization user.

Service provider administrators and users see messages only related to that organization. To prevent information from passing from one organization to another through storage, infrastructure orchestration scrubs both the boot and data disks when a service is deleted.

Only the service provider administrator can log in to the infrastructure orchestration CMS to access other technologies such as logical server management and Systems Insight Manager, and detailed infrastructure orchestration logs.
<table>
<thead>
<tr>
<th>Information</th>
<th>Service provider administrator using Console</th>
<th>Service provider user using Self Service Portal</th>
<th>Organization administrator using Organization Administrator Portal</th>
<th>Organization user using Self Service Portal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Users</td>
<td>Windows users and groups associated with each organization</td>
<td>Not visible: Other users</td>
<td>Users and groups assigned to the organization Not visible: Other organizations</td>
<td>Not visible: Other users</td>
</tr>
<tr>
<td>Request messages</td>
<td>Unrestricted</td>
<td>Messages from user’s requests</td>
<td>Messages from all organization users’ requests</td>
<td>Messages originating from the user, from all organizations to which the user is a member</td>
</tr>
<tr>
<td>Services</td>
<td>Unrestricted</td>
<td>Services created by the user</td>
<td>Services created by all organization users</td>
<td>Services created by the user</td>
</tr>
</tbody>
</table>

1 Users can belong to more than one Windows group; out-of-band information sharing can occur.
2 Service names must be unique within an organization, but different organizations can use the same name. However, a service provider administrator or user cannot create a service with a name that is being used by an organization.

Creating an organization

Using the infrastructure orchestration console, the service provider administrator must create an organization in the Organization tab before an organization administrator can log in to the infrastructure orchestration organization administrator portal.

When it is created, each organization has a unique name and a unique identifier of the form `org<string of decimal digits>`. The organization identifier is used in the names of the local Windows Groups on the CMS that contain the organization administrators and users. The organization identifier is unchanged when an organization is renamed.

To create an organization:

1. From the infrastructure orchestration console Organization tab, click Create. The Create new Organization page appears.
2. In **Organization Name**, enter a name for the new organization.
3. Click **Add**.
4. (Optional) Add organization administrators. Enter the name of a local user, Windows Active Directory (AD) user, or Windows AD group, and click **Add User** or **Add Group** as appropriate.
5. (Optional) Add organization users. Enter the name of a local user, Windows AD user, or Windows AD group, and click **Add User** or **Add Group** as appropriate.
6. Click **Close**.

To delete an organization, the organization must have no compute resources assigned to it, and all services must have been deleted.

**Deleting an organization**

To delete an organization, the organization must have no compute resources assigned to it, and all services must have been deleted.

1. In the infrastructure orchestration organization administrator portal **Services** tab, delete all services that were provisioned by users of the organization.
2. In the infrastructure orchestration organization administrator portal **Servers** tab, move all server pools to the unassigned pool. The pools will then appear in the infrastructure orchestration console **Servers** tab.
3. In the infrastructure orchestration console, unassign all templates, networks, and server pools from the organization.
4. Delete the organization from the infrastructure orchestration console **Organization** tab.
Assigning users to an organization

Using the infrastructure orchestration console, the service provider administrator populates the <organization-id> Administrators and <organization-id> Users groups by adding pre-existing local Windows users. If the CMS is part of a Windows domain, pre-existing Active Directory users and groups can also be added to the <organization-id> Administrators and <organization-id> Users groups.

When a Highly Available (HA) CMS fails over to a new node, the <organization-id> Administrators and <organization-id> Users groups for each organization are automatically created on the new node. Groups that are no longer valid for the currently active node are removed.

NOTE: If the service provider administrator modifies the <organization-id> Administrators or <organization-id> Users groups outside of the organization administrator portal (for example, in Windows Local Users and Groups), Matrix infrastructure orchestration must be running in Systems Insight Manager. Otherwise, any changes are lost when infrastructure orchestration is restarted.

After any changes are made outside of the organization administrator portal, run `ioexec sync Organizations`, or wait for IO to synchronize the changes automatically based on the value of organization.sync.interval in the ..\Program Files\HP\Matrix infrastructure orchestration\conf\hpio.properties file. The default is 600 seconds (10 minutes).

Adding resources to an organization

The service provider administrator assigns a compute resource to an organization on the infrastructure orchestration console Organization tab.

The newly created organization contains, by default, Maintenance and Unassigned pools.

IMPORTANT: To be assigned to an organization, a compute resource must be in the service provider Unassigned pool, and cannot be in use.

After it has been assigned to an organization, the compute resource appears in the organization’s Unassigned pool. The Organization tab also allows resources to be removed from an organization. These removed compute resources move to the service provider’s Unassigned pool.

The service provider administrator can assign and unassign:

- A set of compute resources, where a compute resource can be a virtual machine host, a physical blade, an ESX Resource Pool or a Cloud Resource.

A compute resource cannot be shared among organizations.

The service provider and organization administrator can create resource pools. A compute resource can be assigned to or from an organization if it is not in use and it is in an Unassigned pool. Only an organization’s Unassigned pool is visible to the service provider administrator.

HP recommends that all nodes of a cluster are kept at the service provider level or assigned to the same organization.

- A set of networks.

Networks can be assigned to multiple organizations. Sharing networks among organizations is not prevented by infrastructure orchestration; it is a service provider policy decision. The service provider administrator can assign a network to one or multiple organizations. An in-use network can be de-assigned from an organization. Any existing services are unaffected, but organization users can no longer create services that use the network. If the service provider policy forbids network sharing, then any services using the network must be deleted before the network is re-assigned to another organization.

See “Assigning networks to organizations for VLAN separation” (page 157) for more information.
• A set of infrastructure orchestration templates. IO templates can be assigned to multiple organizations.

To assign or unassign resources:
1. From the infrastructure orchestration console Organization tab, select an organization. The organization name is displayed in the right Organization list.
2. From the Service Provider list, select a compute resource, network, or template. Only compute resources that are in the service provider’s Unassigned pool and are not in use are available to be moved.
3. Select one or more resources by expanding a tree and selecting a resource in the left Service Provider list and clicking the right arrow. This places the selected resource in the right Organization list, assigning the resource to the organization. Selecting a resource and clicking the left arrow unassigns the resource from the organization.

Continue to select resources, using the arrows to adjust the resources assigned to the organization.

4. Click Save.

Assigning networks to organizations for VLAN separation

Assigning different Matrix infrastructure orchestration networks to each organization provides VLAN separation for provisioning of either physical or virtual hosts.

When an IO template is defined, networks can be specified using attributes instead of by selecting a specific networks. One of the attributes is the network name. Using naming conventions, a template can call out a network by part of its name and the appropriate network for the organization is assigned during allocation of the service. For example:

1. On the infrastructure orchestration console tab, assign VLANs organization_1_Production and organization_2_Production to organization_1 and organization_2, respectively.
2. In infrastructure orchestration designer, create a template, and specify the network as follows:
   a. In the Configure Network tab, select “Specify desired attributes”
   b. Specify the “Allocation Name Hint:” as “_Production”
When a service is created for organization_1, the network will bind to organization_1_Production. When a service is created for organization_2, the network will bind to organization_2_Production.

**NOTE:** If you specify a network by selecting “Specify desired attributes”, you cannot customize the network when the service is created. Network customization can be performed only on named networks.
7 Troubleshooting

Verifying the CMS configuration

Matrix infrastructure orchestration utilizes the vseassist tool and the Systems Insight Manager Diagnose menu to help identify and resolve any CMS configuration issues. The **Check CMS Configuration** task performs configuration checks on the CMS. To run this task, from the Systems Insight Manager menu, select **Diagnose → Troubleshoot Matrix OE → Check CMS Configuration**. Additionally, when installing infrastructure orchestration on the system, a set of checks related to the infrastructure orchestration configuration and resource availability execute to help identify any issues with the infrastructure orchestration configuration.

IOAssist has its own command line interface. However, IOAssist is primarily used through vseassist, either through the Systems Insight Manager interface or through the vseassist command line interface (`vseassist -c`). For more information on vseassist, see the vseassist(1M) manpage and the Matrix Operating Environment help system.

**Synopsis**

```
ioassist [-f <filter>] [-o <output type>]
ioassist -g <group id> [-f <filter>] [-o <output type>]
ioassist -c <check id> [-d] [-f <filter>] [-o <output type>]
ioassist -L <locale>
```

Where:
- `[-f <filter>]` filters the output by levels. Valid entries are **ALL**, **PASS**, **INFO**, **WARN**, and **FAIL**.
- `[-g <group id>]` executes checks on a specific group.
- `[-d]` forces the execution of whole dependency checks (used only with `--c`).
- `[-c <check id>]` performs a verification of the check identified by the check identification number provided.
- `[-L <locale>]` displays output in the appropriate language (en for English, ja for Japanese).
- `[-o <output type>]` displays output in a format, **DEFAULT** or **XML**.
- `[-l]` list the available checks and groups, or checks available for a given group.
- `[-h]` Displays help and exits.

**Example: Running all checks in CLI**

```
..\Documents and Settings\Administrator>ioassist -g all
HP IO Assist tool
Executing checks...
Checking group all
-----------------------------------
Check: HP IO Database Responsiveness
Result: PASS
Actions:
-----------------------------------
Check: HP SIM Responsiveness in Primary CMS
Result: PASS
Actions:
-----------------------------------
Check: HP IO And Domain User Groups Configured
Result: WARN
Actions:
```

There are no users or user groups in the HPIO_Architects group in the Primary CMS.
Assign a valid user or user group to the HPIO_Architects group.
There are no users or user groups in HPIO_Users group in the Primary CMS.
Assign a valid user or user group to the HPIO_Users group.

(…)

Amount of checks executed: xx

Checks provided with infrastructure orchestration

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IO CMSs Communication</td>
<td>Verifies that the CMSs are communicating correctly in a federated environment</td>
</tr>
<tr>
<td>IO Database Responsiveness</td>
<td>Validates the infrastructure orchestration configuration file for database communication</td>
</tr>
<tr>
<td>IO Responsiveness</td>
<td>Verifies the communication between infrastructure orchestration and Systems Insight Manager</td>
</tr>
<tr>
<td>IO User Groups Configured</td>
<td>Verifies if infrastructure orchestration user groups are properly configured in Windows for basic operations</td>
</tr>
<tr>
<td>IO ToolBox Configured in HP SIM</td>
<td>Verifies if infrastructure orchestration user groups are properly configured in Systems Insight Manager for infrastructure orchestration operations</td>
</tr>
<tr>
<td>Insight Control virtual machine management software Responsiveness</td>
<td>Verifies the communication between infrastructure orchestration and virtual machine management</td>
</tr>
<tr>
<td>Virtual Infrastructure Server Configuration</td>
<td>Verifies the virtual infrastructure server configuration in Systems Insight Manager</td>
</tr>
<tr>
<td>Deployment Services</td>
<td>Verifies if deployment servers are available for automatic operating system deployment</td>
</tr>
<tr>
<td>Logical Server Management Communication</td>
<td>Verifies if infrastructure orchestration is able to communicate with logical server management</td>
</tr>
<tr>
<td>IO Network Configuration</td>
<td>Verifies if at least one network is properly configured in infrastructure orchestration for provisioning with minimum required parameters</td>
</tr>
<tr>
<td>IO User Pools Configuration - Resources Availability</td>
<td>Checks for the availability of resources on infrastructure orchestration User Pools (virtual and physical)</td>
</tr>
<tr>
<td>IO User Pools Configuration - Users Assigned to Pools</td>
<td>Checks if there are users assigned to the infrastructure orchestration pools</td>
</tr>
<tr>
<td>Organizations, pools, networks, users, and templates</td>
<td>Verifies the networks, resources pools, user pools, user groups and templates for each configured organization</td>
</tr>
<tr>
<td>Operations Orchestration Workflows Configuration</td>
<td>Checks available infrastructure orchestration workflows configured in Operations Orchestration</td>
</tr>
<tr>
<td>Virtual Software Customization</td>
<td>Checks if virtual software customization is properly configured for automatic operating system deployment</td>
</tr>
<tr>
<td>IO Template Available and Published</td>
<td>Checks if there are published and valid infrastructure orchestration templates</td>
</tr>
<tr>
<td>Storage pools assigned to VCDG</td>
<td>Checks if there are Storage pools available on each VCDG for physical provisioning</td>
</tr>
<tr>
<td>Available Networks</td>
<td>Checks if there are available physical, virtual, and mixed networks for provisioning</td>
</tr>
<tr>
<td>Servers Availability</td>
<td>Checks if there are virtual and physical servers available for infrastructure orchestration operations</td>
</tr>
<tr>
<td>Available Software</td>
<td>Verifies if deployment servers contain software for automatic operating system deployment</td>
</tr>
</tbody>
</table>
For each check performed, one of the following status indicators displays:

- **PASS**—No configuration issue was found.
- **FAIL**—A serious configuration problem was found, which must be resolved for correct operation.
- **WARN**—A configuration problem was found. The problem may not necessarily prevent correct operation, but it may limit or restrict operation of some features.
- **N/A**—Not Applicable: the check does not apply to this type of system.

**IOAssist execution timeout**

<table>
<thead>
<tr>
<th>Issue</th>
<th>A check in ioassist failed to communicate with infrastructure orchestration, generating a TimeoutException.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>There was a delay in virtual machine management responding with VM Host details. The default timeout value for each IOAssist check is two minutes. A timeout indicates that the verified component (infrastructure orchestration, its subsystem or partner) either is not responding or is unavailable, or is responding in an undesirable response time. If IOAssist times out, assume that the component is not responding in the expected response time. Do not assume that the component is unavailable. Any other conclusion is indicated by IOAssist error messages.</td>
</tr>
</tbody>
</table>
| Action | Choose one of the following:  
  - In ..\Program Files\HP\Matrix infrastructure orchestration\conf\ioassist.properties, set timeout.await to a value greater than 120 seconds.  
  - In a Windows Command Prompt, execute the ioassist command line. |

**Manually enabling federated CMS**

A federated CMS environment contains one primary CMS running infrastructure orchestration, and one or more secondary CMSs running Matrix OE.

| Issue | Matrix infrastructure orchestration federated CMS is enabled by default during new installations. At the end of a new installation, the Insight Management installer displays: |
Warning — HP Matrix infrastructure orchestration was successfully installed but the federated CMS feature was not enabled. Refer to the HP Matrix infrastructure orchestration User Guide for information about how to enable federated CMS.

Possible cause

The CMS IP address cannot be correctly resolved to the CMS FQDN during installation, so the Installer adds the CMS IP address to the `managed_cms_list` property. However, the `managed_cms_list` must be configured with the CMS FQDN.

Action

In a federated CMS environment, forward DNS lookups resolve CMS hostnames to IP addresses. Additionally, on the primary CMS, forward and reverse DNS lookups must resolve for each secondary CMS.

1. Verify that all DNS lookups can be resolved using the FQDN of each system.
2. Enable federated CMS manually. See “Configuring a federated CMS environment” (page 19) and the HP Matrix Operating Environment Federated CMS Overview white paper at Matrix Operating Environment Information Library for detailed information.

## Service creation

### Physical service creation

Unable to allocate servers and networks in the same Virtual Connect Domain Group

<table>
<thead>
<tr>
<th>Failure message</th>
<th>Unable to allocate servers and networks in the same Virtual Connect Domain Group. Either more available servers are required, or could not match existing servers against memory size, disk space and processor count requirements.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>Reservation failed because:</td>
</tr>
<tr>
<td></td>
<td>• There were insufficient suitable servers in the server pools referenced in the Create Request.</td>
</tr>
<tr>
<td></td>
<td>• One or more servers considered available for use were actually in the maintenance pool.</td>
</tr>
<tr>
<td></td>
<td>• At least one of the server blades in a referenced user server pool already has a profile assigned.</td>
</tr>
<tr>
<td>Action</td>
<td>• Verify that the infrastructure orchestration server pools referenced in the Create Request contain sufficient suitable servers taking into account all the server, storage and networking requirements of the template.</td>
</tr>
<tr>
<td></td>
<td>• Check whether or not any servers were moved to the maintenance pool due to a previous provisioning failure. Check for “clean-me” logical servers. If there are any, perform a manual clean-up process. See “Manual clean-up process (physical)” (page 195).</td>
</tr>
<tr>
<td></td>
<td>• If these steps do not identify the issues, then verify that each server (blade only), that infrastructure orchestration considers free, does not have a Virtual Connect profile assigned to it. To do this, identify each available (not “in use”) server blade in infrastructure orchestration and do the following:</td>
</tr>
<tr>
<td></td>
<td>1. From Systems Insight Manager, select Tools→Integrated Console→Virtual Connect Enterprise Manager.</td>
</tr>
<tr>
<td></td>
<td>2. Select the Server Profiles tab, and unassign any profile associated with the server blade.</td>
</tr>
<tr>
<td></td>
<td>3. From the Matrix OE visualization screen, select Tools→Logical Servers→Refresh to refresh Matrix OE and activate the changes.</td>
</tr>
<tr>
<td></td>
<td>4. In the infrastructure orchestration console Servers tab, click the circling green arrows icon (to the left of: Click to refresh server resources) for changes to be detected.</td>
</tr>
</tbody>
</table>
At least one OS or software deployment has failed

<table>
<thead>
<tr>
<th>Failure message</th>
<th>Task for logical server &lt;logical server name&gt; ... Failure: At least one OS or software deployment has failed. Check the deployment service to diagnose the details.</th>
</tr>
</thead>
</table>
| Possible cause  | • Problem with a LUN allocated to server or firmware issue on server  
                   • Insight Control server deployment Erase ProLiant ML/DL/BL Array Configuration (LinuxPE) job has not been modified for infrastructure orchestration. |
| Action          | To verify the LUN and/or server firmware:  
                   1. Use Remote desktop and log into the server deployment server.  
                   2. Verify that the server deployment console for the enclosure bay for the logical server XYZ. The message should state RDeploy: The disk was not found.  
                   3. From the request messages, identify the LUN that has been allocated to the logical server.  
                   4. If the message indicates a possible server WWN issue with the LUN, see “Configuring storage pool entries, FC zones, and disk array presentations” (page 197).  
                   5. For a suspected firmware error, use iLO to observe the progress of booting the server. If the message WARNING Adapter NVRAM contains invalid data displays, press <ALT-Q> to enter Fast!UTIL and reset the adapter defaults. For more information, see “Correcting a checksum error” (page 200).  

To modify the Insight Control server deployment job:  
1. Follow the steps in the Creating server deployment job folders procedure. The job must have only two steps:  
<table>
<thead>
<tr>
<th>Task</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Run Script</td>
<td>Wipe Disk</td>
</tr>
<tr>
<td>Power Control</td>
<td>Shutdown (if available)</td>
</tr>
</tbody>
</table>

2. Perform a manual clean-up process for any affected logical server.

Provisioning request for service has paused

<table>
<thead>
<tr>
<th>Failure message</th>
<th>Provisioning request for &lt;service_id&gt; has paused. Manual data disk allocation is required.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>This error indicates that insufficient LUNs exist to provision the service.</td>
</tr>
<tr>
<td>Action</td>
<td>Create the LUNs and continue provisioning.</td>
</tr>
</tbody>
</table>

Timeout occurs while provisioning storage in a multi-disk request

<table>
<thead>
<tr>
<th>Failure message</th>
<th>Timeout occurred while provisioning storage.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>Submitting a multi-disk request (for example, a logical server group with one server, one private disk, and one shared disk) takes longer than expected and times out.</td>
</tr>
</tbody>
</table>
| Action          | 1. In the infrastructure orchestration console Requests tab, delete the paused request.  
                   2. Edit the timeout.generate.storage.entry property in the infrastructure orchestration properties file in the default location at C:\Program Files\HP\Matrix infrastructure orchestration\conf\hpio.properties.  
                   3. Increase the default timeout from 25 minutes (1500 seconds) to 60 minutes (3600 seconds).  
                   4. Edit the spm_timeout property in the logical server management properties file in the default location at C:\Program Files\HP\Virtual Server Environment\conf\lsa\lsa.properties. |
5. Increase the default timeout from 20 minutes (1,200,000 milliseconds) to 40 minutes (2,400,000 milliseconds).
6. Restart the HP Matrix infrastructure orchestration service.
7. Restart the HP Logical Server Automation service.
8. On the Templates tab, select the template and submit a new create service request.

Task for logical server failed due to invalid UUID

<table>
<thead>
<tr>
<th>Failure message</th>
<th>Task for logical server &lt;logical_server_id&gt; has failed. Logical server job (ID = ...) completed with a failure status. The deployment server does not have the specified system UUID recorded. Deployment Service Connector cannot confirm the system UUID provided by the caller.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>The deployment server cannot bootstrap the server. This issue can occur if the LUN attached to the server already has an OS deployed to it so that the server is booting from the presented LUN rather than booting into the designated deployment server.</td>
</tr>
</tbody>
</table>
| Action          | 1. Locate the Provisioning logical server message that identifies the server blade in use.  

Storage pool entry status is “Presentation Completed with Errors – Inoperable” or “Presentation Completed – Inoperable”

<table>
<thead>
<tr>
<th>Issue</th>
<th>After creating a storage pool entry from an array imported into SPM, the status of the storage pool entry on the Matrix OE visualization Manage Storage Pool screen is “Presentation Completed with Errors Inoperable” or “Presentation Completed Inoperable”.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>When the array was imported into SPM, a security group other than the Matrix Security Group was selected on the Array Properties screen.</td>
</tr>
</tbody>
</table>
| Action | The storage administrator or an administrator with permissions to use SPM should perform the following steps.  
1. Start SPM by pointing a browser to https://localhost:8000, where “localhost” is the name of the CMS.  
2. Right click on an array and select Change Security Group.  
The status of the inoperable storage pool entry will change to “Presentation Completed – Available”. |

Auto-provisioning storage fails with “No matching storage found” error

<table>
<thead>
<tr>
<th>Issue</th>
<th>Matrix OE logical server management requests storage from Storage Provisioning Manager that matches the requirements in the IO template. In certain environments, auto provisioning does not succeed and the error “No matching storage found” is displayed.</th>
</tr>
</thead>
</table>
| Possible cause | For non-redundant storage requests in IO:  
Matrix OE logical server management picks a fabric, and asks SPM if there is any storage on that fabric that matches that requirements defined by the IO architect. If that fabric does not return any matching storage, logical server management tries the next fabric in the list until it finds storage or has exhausted all of the fabrics. If it has exhausted all of the fabrics without finding matching storage, auto-provisioning fails.  
Once a fabric is used for the first volume, all other volumes within that same storage pool entry must be found on the same fabric, or auto-provisioning fails.  
For redundant storage requests in IO:  
Because the combination of fabrics to try can be a large number, logical server management limits the combinations by only picking pairs of fabrics that are associated with natural pairings of connection bays. For example, in an enclosure, bays 3 and 4 are a natural pairing, as are 5 and |
6, and 7 and 8. A non-natural pair of fabrics is tried only if there are only two fabrics in the VC Domain Group.

Once a pair of fabrics is used for the first volume, all other volumes within the same storage pool entry must be found on the same pair of fabrics, or auto-provisioning fails.

<table>
<thead>
<tr>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use the Matrix OE visualization logical server management Modify→Logical Server Storage Pools screen to manually configure storage.</td>
</tr>
</tbody>
</table>

Logical servers are inoperable if they are associated with guests that use SLVM file-based storage

<table>
<thead>
<tr>
<th>Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>After starting an HP Integrity VM Host, logical servers are inoperable if they are associated with guests that use SLVM file-based storage.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Possible cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP Integrity guests can use SLVM storage, referred to as file-based storage in Matrix OE logical server management. These volumes are created in HP-UX LVM volume groups. By default, the volume groups are not online when the HP-UX host starts up. This results in existing guests being unable to access their storage, further causing any associated logical servers to become inoperable.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create a multi-node Serviceguard package for each of the SLVM volume groups to activate volume groups after a host reboot. This will enable the SLVM volume groups to be started when Serviceguard starts during HP Integrity VM Host start up. Follow the first two steps in section 10.5.2 (Creating and Configuring VMs as Serviceguard Packages, Having SLVM Backing Storage) in HP Integrity Virtual Machines 4.3: Installation, Configuration, and Administration, available from <a href="http://www.hp.com/go/hpux-hpvm-docs">www.hp.com/go/hpux-hpvm-docs</a>. To enable Serviceguard to start automatically during an HP Integrity VM Host boot, set AUTOSTART_CMCLD to 1 in /etc/rc.config.d/cmcluster.</td>
</tr>
</tbody>
</table>

Could not find server serial number or task for logical server failed

<table>
<thead>
<tr>
<th>Failure message</th>
</tr>
</thead>
</table>
| - Could not find server with serial number <serial_number>.
- Task for logical server <logical_server_id> has failed. Logical server job <job_id> completed with a failure status. Failure: Exception creating connection to: 15.2.50.138; nested exception is: java.net.NoRouteToHostException: No route to host: connect.
- Task for logical server <logical_server_id> has failed. Logical server job <job_id> completed with a failure status. Failure: no such object in table. |

<table>
<thead>
<tr>
<th>Possible cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>A server blade that was allocated has suffered hardware or firmware problems during the provisioning process, for example, insufficient power alert or power outage.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Action</th>
</tr>
</thead>
</table>
| 1. Use Onboard Administrator to verify the status of the server blade.
2. Verify that the server blade has the latest firmware installed.

Manual storage provisioning email states that more data LUNs than are required should be added

<table>
<thead>
<tr>
<th>Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual Storage Provisioning email states that more data LUNs than are required should be added.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Possible cause</th>
</tr>
</thead>
</table>
| This email is sent when adding a new server to an existing service and one or more of the following applies:
- A server is added to a deployed server group using the Add Server feature.
- The servers in the selected group are connected to a shared data disk.
- A manual storage provisioning action is required for the data disk. |

<table>
<thead>
<tr>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>If you receive this email, add the LUN information to both the new server and the existing servers. You only need to add the LUN information to the Matrix OE storage pool entry for the new server.</td>
</tr>
</tbody>
</table>
Cannot add servers to an existing service using a static IP address

<table>
<thead>
<tr>
<th>Issue</th>
<th>Cannot add servers to an existing service using a static IP address.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>Static IP allocation limitation. When a service contains multiple servers and the network is configured with static IP addresses, additional servers cannot be added to the provisioned service, even though the infrastructure orchestration interface enables you to create the request without a warning. When this type of request is processed, it fails. Provisioning a service from a template can only be done once if the template defines a server group with statically defined IP addresses and an auto allocated network. Typically, static IP addresses are used together with an explicitly defined network in the template. Matrix infrastructure orchestration does not support multiple infrastructures divided into separate networks and VLANs with duplicate IP address sets. When static IP addresses are allocated to one network, they cannot be reallocated to a different network.</td>
</tr>
<tr>
<td>Action</td>
<td>Change static IP addresses in the template each time you use the template, or use automatic IP address allocation. Automatic allocation enables you to use the template multiple times for multiple infrastructures, each having a different set of IP addresses assigned to the service.</td>
</tr>
</tbody>
</table>

Provisioning request remains paused during manual storage allocation and a storage pool entry cannot be created

<table>
<thead>
<tr>
<th>Issue</th>
<th>A provisioning request remains paused during a manual storage allocation (approximately 5%), and a storage pool entry cannot be created in Matrix OE because the VC Domain Group is not listed on the Storage Pools screen.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>VCDG is using factory default MAC/WWN settings. Matrix OE and infrastructure orchestration do not support a VCDG with factory default MAC/WWN settings. Logical servers require portable WWNs and MAC addresses that can be moved from blade server to blade server.</td>
</tr>
</tbody>
</table>
| Action | When creating a VCDG in Virtual Connect Enterprise Manager, select the HP Pre-Defined option to enable portable WWNs and MAC Addresses. (For more information, see the Virtual Connect Enterprise Manager documentation at Matrix Operating Environment Information Library.)  
• To avoid this issue, make sure the servers from a VCDG not configured for portable addresses are not included in infrastructure orchestration server pools.  
• To resolve an existing issue, cancel the request and resubmit the request using a target infrastructure orchestration Pool that contains servers from a VCDG with portable addresses. |

Integrity firmware blade corruption during provisioning Integrity blades

<table>
<thead>
<tr>
<th>Issue</th>
<th>Integrity firmware blade corruption during provisioning of the following Integrity blades: BL870c, BL870c i2, BL890c, or BL860c i2.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>Matrix infrastructure orchestration issues power cycle operations during provisioning and deprovisioning when deploying Integrity blades. If a power cycle operation happens before the boot process completes, the blade HBA firmware could become corrupted. Power cycle time requirement is measured as the time from power-on until the EFI shell prompt appears.</td>
</tr>
</tbody>
</table>
| Action | For physical provisioning to perform correctly, infrastructure orchestration and logical server management must be configured to wait the appropriate length of time for the slowest server blade to complete booting.  
• In infrastructure orchestration, in the ..\Program Files\HP\Matrix infrastructure orchestration\conf\hpio.properties file, increase the serverboot.physical.wait.seconds property.  
• In logical server management, in the ..\Program Files\HP\Virtual Server environment\conf\lsa\lsa.properties file, increase the INTEGRITY_POWERON_WAITTIME property. |
Following are recommended minimums. Depending on the size of memory and number of HBA cards on each server blade, the values may need to be greater than the minimums.

- **Integrity BL860c and BL860c i2 blades:**
  - For infrastructure orchestration `serverboot.physical.wait.seconds`, use the default minimum of 360 seconds.
  - For LSM `INTEGRITY_POWERON_WAITTIME`, use the default minimum of 360000 milliseconds.

- **BL870c and BL870c i2 blades:**
  - For infrastructure orchestration `serverboot.physical.wait.seconds`, use the default minimum of 540 seconds.
  - For LSM `INTEGRITY_POWERON_WAITTIME`, use the default minimum of 540000 milliseconds.

- **BL890c and BL890c i2 blades:**
  - For infrastructure orchestration `serverboot.physical.wait.seconds`, use the default minimum of 1080 seconds.
  - For LSM `INTEGRITY_POWERON_WAITTIME`, use the default minimum of 1080000 milliseconds.

---

**Cannot deploy Integrity VM guests when gWLM is controlling the host**

| Issue | If IO chooses a host controlled by gWLM for deploying an Integrity VM guest service template, the guest cannot start and the following messages appear in the `/var/opt/hpvm/common/command.log`:
|       | 05/31/12 11:43:45 | ERROR | Guest_number | root | Guest Guest_number has been marked as not startable.
|       | 05/31/12 11:43:45 | ERROR | Guest_number | root | An external manager (gWLM) is managing VMs on this Host. This manager is located on location and can be accessed via http://location. Add the VM to the manager to make it available for starting.

| Possible cause | Integrity VM guests cannot be deployed when gWLM is controlling the VM host.
| Action | Exclude any Integrity VM hosts and VSPs under the control of gWLM from the IO server pools.

---

**OS deployment through Insight Control server deployment fails when deploying to a SAN booted physical server**

| Issue | The operating system deployment process through Insight Control server deployment fails when deploying to a SAN booted physical server.
|       | If the target server is sharing FC zones with other servers in the environment, changes in the SAN, like an RSCN (Registered State Change Notification) event may lead to operating system deployment or SAN boot failures.
| Possible cause | Use initiator WWN zones to isolate each of the servers within the fabric. This is a typical best-practice in SANs where servers are booted from a disk within the SAN. See “Configuring storage pool entries, FC zones, and disk array presentations” (page 197).
Service creation fails in the target reconfiguration phase

<table>
<thead>
<tr>
<th>Failure message</th>
<th>Service creation fails in the target reconfiguration phase. Service creation intermittently fails when a service is created with RedHat Enterprise Linux 6 OS.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>The target server fails to shut down due to an issue with the HP Health Agents versions 8.70 and older.</td>
</tr>
<tr>
<td>Action</td>
<td>1. Identify the failed target servers in the Maintenance server pool.</td>
</tr>
<tr>
<td></td>
<td>a. In infrastructure orchestration, select the <strong>Servers</strong> tab.</td>
</tr>
<tr>
<td></td>
<td>b. Expand the <strong>Maintenance</strong> server pool.</td>
</tr>
<tr>
<td></td>
<td>c. Note the names of servers in this server pool as they are the serial numbers of the servers.</td>
</tr>
<tr>
<td></td>
<td>2. Delete the logical servers from Matrix OE visualization.</td>
</tr>
<tr>
<td></td>
<td>a. In Systems Insight Manager, select <strong>Tools</strong>→<strong>Matrix OE visualization</strong>.</td>
</tr>
<tr>
<td></td>
<td>b. Select <strong>Logical Server</strong> from the Perspective drop-down box.</td>
</tr>
<tr>
<td></td>
<td>c. Identify the logical server entries where the name starts with “Clean-me” and contains the previously noted serial number.</td>
</tr>
<tr>
<td></td>
<td>d. Select these logical servers and delete them by selecting to <strong>Delete</strong>→<strong>Delete Logical Server</strong>.</td>
</tr>
<tr>
<td></td>
<td>3. After the logical servers are successfully deleted, move the servers from the Maintenance pool to an appropriate server pool.</td>
</tr>
<tr>
<td></td>
<td>a. Select <strong>Tools</strong>→<strong>Infrastructure orchestration</strong>, then select the <strong>Servers</strong> tab.</td>
</tr>
<tr>
<td></td>
<td>b. Select the server pool to which to move the servers from the maintenance pool.</td>
</tr>
<tr>
<td></td>
<td>c. Click the <strong>Modify Pool</strong> button.</td>
</tr>
<tr>
<td></td>
<td>d. Select <strong>Maintenance</strong> from the drop-down list.</td>
</tr>
<tr>
<td></td>
<td>e. Select the server that needs to be moved from the list displayed and click the &gt;&gt; button.</td>
</tr>
<tr>
<td></td>
<td>f. Save the server pool.</td>
</tr>
</tbody>
</table>

Service creation fails for physical requests when Windows Server OS is selected

<table>
<thead>
<tr>
<th>Issue</th>
<th>Service creation fails when a physical template with Windows Server OS is selected. HP Insight Management WBEM provider installation on the target server hangs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>An infrastructure orchestration timeout waiting for Insight Control server deployment to complete installation of Insight Management Agents.</td>
</tr>
<tr>
<td>Action</td>
<td>When a request fails, infrastructure orchestration automatically retries the request and a new server is provisioned with the requested service. The original server is moved to the maintenance pool and can be cleaned and moved back to a valid server pool. If the failure is observed frequently, the following steps can be followed to disable the installation of Insight Management WBEM providers. Insight Management SNMP agents continue to provide management capabilities when WBEM providers are not installed.</td>
</tr>
<tr>
<td></td>
<td>1. Edit the install.cmd file, found under <code>&lt;Insight Management installation folder&gt;\rdp\deployment server\hpfeatures\hpagents-ws\components folder</code>, and remove the following two lines.</td>
</tr>
<tr>
<td></td>
<td>• call :installsc wbem%PROCESSOR_ARCHITECTURE%</td>
</tr>
<tr>
<td></td>
<td>• if %cpresult% geq 1 set /a cpresults=cpresults+1</td>
</tr>
<tr>
<td></td>
<td>2. Save the file.</td>
</tr>
<tr>
<td></td>
<td>The new service requests now no longer attempt to install Insight Management WBEM providers.</td>
</tr>
</tbody>
</table>

Request with a future start date stays at 10% with status of Reserved

<table>
<thead>
<tr>
<th>Issue</th>
<th>A request with a future start date stays at 10% (<strong>Progress</strong> field), with status of Reserved (rather than Scheduled).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>The request is scheduled, but its status is not updated.</td>
</tr>
<tr>
<td>Action</td>
<td>Do one of the following.</td>
</tr>
<tr>
<td></td>
<td>• Wait until the selected start date; the request should then start provisioning automatically.</td>
</tr>
</tbody>
</table>
• Cancel the request, then resubmit it.
  
  **NOTE:** Use this option to prepare for future changes to the lease period before the service is provisioned.

• Restart infrastructure orchestration, which will update the request status.

---

**Physical server provisioning using Insight Control server deployment fails during the final personalization step**

<table>
<thead>
<tr>
<th>Issue</th>
<th>Physical server provisioning using Insight Control server deployment fails during the final personalization step when the CMS is configured with an automatic proxy configuration script in IE.</th>
</tr>
</thead>
</table>
| Possible cause | There is a problem or delay communicating with the automatic configuration script configured in Microsoft Internet Explorer. The problem is in Windows .NET, and the proxy configuration is shared between IE and .NET. If the proxy configuration is causing physical deployment failures, the infrastructure orchestration log file at ..\Program Files\HP\Matrix infrastructure orchestration\logs will show an error similar to the following:

```plaintext
ERROR com.hp.hpio.sbapi.tasks.CreatePhysicalServerTask.execute — Error personalizing OS with host uuid: 38C77BED-9FAE-4886-8C06-0F536BA46507 com.hp.hpio.sbapi.exception.AresAdapterException: Deployment server did not accept customization data.
```

The log file for the connector software that drives Insight Control server deployment (..\Program Files\HP\Systems Insight Manager\logs\Alc1_0.0.0.log), shows that the operations that perform the customizations are timing out.

| Action | Do one of the following:

• Configure Internet Explorer with an explicit proxy server address and appropriate exceptions instead of using an automatic configuration script. Check “Bypass proxy server for local addresses” if the server deployment server is on the CMS. Otherwise, include the address of the server deployment server in the Exceptions field of the Advanced options for configuring a proxy server.

• Provide a .NET configuration file for Internet Explorer so that it will not use the system default proxy. Create the file ..\Program Files\HP\Systems Insight Manager\bin\alc-rdpaccess.config with the following content:

```xml
<configuration>
  <system.net>
    <defaultProxy>
      <proxy usesystemdefault = "false" />
    </defaultProxy>
  </system.net>
</configuration>
```

---

**Server reservation and allocation fail even though servers exist in the assigned pool**

| Issue | Server reservation and allocation fail with the following messages, even though servers exist in the assigned pool that satisfy the template requirements.

• Reservation failed for logical server <server>. Unable to find a physical server with the following requirements: There are no valid available targets to provision the service. Check if the targets in the selected pools are in maintenance.

• Unable to allocate servers and networks in the same Virtual Connect Domain Group. Either more available servers are required, or could
not match existing servers against memory size, disk space and processor count requirements.

Possible cause | Matrix infrastructure orchestration’s Resource Manager has marked servers as “invalid” during resource discovery because of a communication error between logical server management and OA.

Action | Check the status of server blades within the enclosures.
1. In the infrastructure orchestration console, select the Servers tab and look at the Enclosures column. This identifies the C-Class enclosures within the environment.
2. Find each enclosure in the Systems Insight Manager All Enclosures collection. The page for each enclosure includes a link to the Onboard Administrator (OA).
3. Login to the OA; under Enclosure Information, click Device Bays and resolve any status errors or warnings.

TIP: In some cases, status errors may be cleared by a reset of the active OA.

Create request fails, but the service is still listed in the Service tab in “Reserved” state, and no resources are allocated

| Issue | A Create request fails, but the service is still listed in the Service tab in “Reserved” state, and no resources are allocated.
| Possible cause | A data migration attempt occurred while the Create request was waiting for approval.
| Action | Do not attempt data migration when a service request is waiting for approval. Either approve or reject the Create request and allow the request to complete before migrating data.

Virtual service creation

Password is blank for Windows 2008 R2 and higher provisioned VMs

| Issue | If a VM is provisioned with Windows 2008 R2 OS from infrastructure orchestration without setting any password in the Sysprep file, the following occurs:
• VM deployed on ESX and ESXi hosts boot up and can be logged in with a blank password.
• VM deployed on Hyper-V boot up to prompt the user to set a password.
| Possible cause | Microsoft removed the option “password never expires” in Windows 2008 R2 and higher (as part of Sysprep).
VMware overrides the option “prompt for a password on the next boot.”
| Action | • Specify an explicit password in the Sysprep.ini file for any deployment of a VM that has a Windows 2008 R2 or higher operating system, or
• Specify an empty string “” password in the Sysprep.ini file, which results in the “prompt for a password on the next boot” from VMware.

Error deploying logical server: Copy virtual machine failed: Unable to access file vmware-template-name.vmdk

In the message above, “/.../” represents the datastore allocated for the VM; [inactive-datastore-name] represents the datastore on which the template resides.

Possible cause: The template selected for provisioning an ESX VM resides on an inactive datastore.

Action:
- Do one of the following:
  - Activate the datastore on which the selected VMware template resides.
  - In infrastructure orchestration designer, select a different VMware template for provisioning the ESX VM.

Start function on virtual machine failed: there are not enough licenses installed to perform the operation

<table>
<thead>
<tr>
<th>Failure message</th>
<th>The start function on virtual machine &lt;logical_server_id&gt; failed: There are not enough licenses installed to perform the operation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>ESX host not licensed.</td>
</tr>
<tr>
<td>Action</td>
<td>Use vCenter to apply a full ESX license to the host.</td>
</tr>
</tbody>
</table>

Select or create an empty folder as the target destination

<table>
<thead>
<tr>
<th>Failure message</th>
<th>Select or create an empty folder as the target destination.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>The directory that infrastructure orchestration is attempting to deploy to is not empty, probably due to a previous failed provisioning which was not cleaned up completely.</td>
</tr>
<tr>
<td>Action</td>
<td>When infrastructure orchestration deploys a virtual machine, it creates a directory structure into which the virtual machine is provisioned. The directory that is created follows the pattern: &lt;VMFS Volume&gt;&lt;Service Name&gt;&lt;VM Name&gt;. This folder contains all the folders and files corresponding to the virtual logical servers. Delete this folder and all its contents. For ESX, the easiest way to accomplish this is to use the vCenter client to browse the ESX server’s datastore, then navigate to the directory and delete the offending directory and directory contents.</td>
</tr>
</tbody>
</table>

Unable or failed to delete <vm name>

| Failure message | • Unable to delete <vm name> on <host:path/to/vm>, VM may still exist. Please clean up the directory manually.  
• Failed to delete VM <vm name> from <host:path/to/vm>. Please clean up the directory manually. |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>A provisioning failure occurred and infrastructure orchestration lost communication with the virtual machine hosts. As a consequence, infrastructure orchestration was unable to complete the deletion of the virtual machines.</td>
</tr>
</tbody>
</table>
| Action          | When infrastructure orchestration deploys a virtual machine, it creates a directory structure into which the virtual machine is provisioned. The directory that is created follows the pattern: <VMFS Volume>\<Service Name>\<VM Name>. This folder contains all the folders and files corresponding to the virtual logical servers. Delete this folder and all its contents. For ESX:  
  1. Use the vCenter client to browse the ESX server’s datastore.  
  2. Navigate to the directory and delete the offending directory and directory contents.  
For Hyper-V:  
  1. Connect to the Hyper-V hypervisor.  
  2. Delete the VM from the Hyper-V Manager (if it has not already been deleted).  
  3. Navigate to the directory and delete the offending directory and directory contents.  
If HP Server Automation (SA) deployment was used to provision the VMs:  
  1. Remove the ESX and/or Hyper-V VMs using the preceding steps.  
  2. Connect to the SA server. |
3. From the HP Server Automation (SA) “Devices” view, select the VMs.
4. Perform a “deactivate” and a “delete.”

New servers do not appear in the Unassigned pool

<table>
<thead>
<tr>
<th>Issue</th>
<th>Possible cause</th>
<th>Action</th>
</tr>
</thead>
</table>
| New servers do not appear in the infrastructure orchestration Unassigned pool. | Resources are added to the Unassigned pool when infrastructure orchestration recognizes that they are available and are licensed and configured correctly. By default, infrastructure orchestration discovers and updates the available resources once an hour. Recently added resources are available only in the infrastructure orchestration Unassigned pool after 1 to 2 hours (depending on the discovery process of the other products, such as Insight Control virtual machine management, VCEM, and Matrix OE). | • From the Matrix OE management screen, select Tools→Logical Servers→Refresh to refresh Matrix OE and activate the changes. From infrastructure orchestration screen, click on Servers tab and then click Refresh to trigger a refresh of servers inventory.  
• Perform a Systems Insight Manager Discovery. A server must be discovered at the Systems Insight Manager level through the IP address discovery mechanism before it can be used in infrastructure orchestration. VM Hosts must be registered with Insight Control virtual machine management.  
• Ensure that servers are licensed for Matrix OE.  
• Ensure that VMware ESX hosts have a full ESX license (not a base license). |

“Could not retrieve mounted disk drive details” error when deploying a Hyper-V template

| Failure message | When customizing a Hyper-V VM, the error **Could not retrieve mounted diskdrive details** is displayed.                                                                 | Possible cause | Insight Control virtual machine management requires that the boot disk for a Hyper-V VM must be on the disk ide0:0. | Action  | • Edit the template in SCVMM and change the boot disk to be in ide0:0, or  
• Delete the virtual machine management template, change the original VM to set the boot disk to ide0:0, then recreate the template. |

Insight Control virtual machine management cannot manage a Hyper-V VM

| Failure message | A Hyper-V VM cannot be managed by virtual machine management.                                                                                                                                                                                                 | Possible cause | After service creation, if a Hyper-V VM has single local disk in ide1:1 with the OS installed in ide1:1, the VM is not managed by virtual machine management. | Action  | • Edit the template in SCVMM and change the boot disk to be in ide0:0, or  
• Delete the virtual machine management template, change the original VM to set the boot disk to ide0:0, then recreate the template. |

Service creation fails in the VM customization phase

| Issue | Service creation fails in the VM customization phase.  
• Service creation fails when a virtual machine is created on a Hyper-V host.  
• Service creation fails during the customization phase of deploying virtual machines. The VMware fault.CustomizationPending.summary appears in the Insight Control virtual machine management log files.  
• Failure in customizing a Windows Server 2008 virtual machine. VM console has the following error message: Windows could not parse or process the unattend answer file for pass [specialize]. The settings specified in the answer file cannot be applied. The error was detected while processing settings |
|-------|-------------------------------------------------------------------------------------------------|----------------|-------------------------------------------------------------------------------------------------|---------|-------------------------------------------------------------------------------------------------|
The computer restarted unexpectedly or encountered an unexpected error. Windows installation cannot proceed. To install Windows, click OK to restart the computer, and then restart the installation.

### Possible cause
- The environment is not completely configured.
- The virtual machine used in the virtual machine management template was not powered off properly.
- The vCenter or vSphere is not configured properly for successful customization.
- The incorrect product key was specified for the operating system in the Sysprep file.
- The IO Sysprep file contains an invalid parameter.
- The HyperV host is configured with a password that contains | or " characters.
- Windows Sysprep files are not added or missing.

### Action
- For VMware ESX VMs, verify the source VM being used to create the template has the VMware Tools installed and configured. For Linux VM guests, ensure the `vmware-config-tools.pl` command was executed after installing the tools.
- Verify the source VM being used to create the template has been stopped or paused (not suspended) before creating the template.
- Verify the source VM being used to create the template has been properly shut down before creating the template. When guests are not gracefully shutdown or halted it can cause customization phases to fail.
- Verify that the product key (and any other configuration option) being used in the Sysprep file functions with the VM by performing the following test. In vCenter or vSphere:
  - Locate the original VM that was used to create the virtual machine management template that is experiencing the failure.
  - Right-click the VM, and select Template → Clone to Template. This action creates a vSphere template of the VM.
  - Create a new VM from this vSphere template in vSphere. During the VM creation wizard, select the option to customize the VM and input the requested customization parameters.
  - If this VM customization process fails, deployment in IO fails. Correct the vSphere customization issues, and create a new Insight Control virtual machine management template from the functional VM. Proceed with deployments from IO.
- Verify the IO Sysprep file does not contain an invalid parameter. Use the sample file as a reference.
- For VMware VMs, VMware vCenter Server must have Sysprep tools installed on the vCenter management server in the VMware VirtualCenter\sysprep\svrOS folder. For Hyper-V, Sysprep tools are required on the CMS in the Insight Control virtual machine management Sysprep folder.
- Change the password on the Hyper-V host to something that does not contain | or " characters.
  1. Select the Hyper-V host from the system list.
  2. Edit the system credentials. Go to Options → Security → Credentials → System Credentials… and select the Hyper-V host from the list.
  3. Change the sign-in credentials and save the new credentials. Wait a few minutes for the host to complete re-identification.
  4. Start the IO service request.
  5. Verify the Windows Sysprep files have been added:
    - For Hyper-V VMs running Windows, go to the CMS and copy the Sysprep files to `C:\Program Files\HP\Insight Control virtual machine management\Sysprep\2003`.
    - For VMware ESX VMs running Windows, go to the system which has Virtual Center installed and copy the Sysprep files to the following paths:
      - Virtual Center 4.x and 5.x: `C:\Documents and Settings\All Users\Application Data\VMware\VMware VirtualCenter\sysprep\svr2003`
## Service creation fails with a virtual machine customization error

<table>
<thead>
<tr>
<th>Issue</th>
<th>Create Request fails with a virtual machine customization error.</th>
</tr>
</thead>
</table>
| Possible cause | • The environment is not completely configured  
• The virtual machine used in the virtual machine management template was not powered off cleanly |

If the environment is not completely configured, requests might fail when executing the virtual machine customization step. Issues can include missing the `sysprep` folder on the vCenter Server, insufficient licenses on the vCenter Server, or attempting to customize a virtual machine with a guest operating system that is not supported on the vCenter Server.

| Action | • Verify that the environment is correctly configured and provisioning a supported guest operating system. For more information on configuration, see [HP Insight Management Installation and Configuration Guide](http://www.hp.com/go/insightcontrol/).  
• Power off the virtual machine cleanly before creating the virtual machine management template. |

## Hyper-V host changes UUIDs of VMs with simultaneous create service requests

<table>
<thead>
<tr>
<th>Issue</th>
<th>When 10 or more Create Service requests reach a Hyper-V VM host at the same time, the Hyper-V host changes the UUID of some of the VMs.</th>
</tr>
</thead>
</table>
| Failure message | Input provided by IO: Note the UUID shown in value=.
2012-05-22 07:04:29,682 | DEBUG | RMI TCP Connection(18256)-172.16.101.0 | 8026 | Entering | setDeviceProperty(config=vmfile://172.16.0.161/E:\VSE_VirtualMachines\Template1_5.22_c_testCirotest06, device=BIOSSerial, prop=BIOSGUID, value=2EFDP6C5-8FAE-9C41-BB68-DF1598E3BCB4) | 1337681069682 |
VM Details in Insight Control virtual machine management: Note the UUID in biosID= is different than shown above.
vm://172.16.0.161/E:\VSE_VirtualMachines\Template1_5.22_c_testCirotest09\Virtual Machines\2BC14013-0967-46EC-AFDC-E0A743A5626B.xml biosId = C11CA80F-C9A0-4891-869B-F2B2-55C78A09FCFC |
| Action | • Specify a larger boot disk size to create a sufficient time difference between the parallel requests, or  
• Create the VMs on two or more different Hyper-V VM hosts. |

## Service creation fails with internal error

<table>
<thead>
<tr>
<th>Issue</th>
<th>A Create Service request fails on ESX or Hyper-V with an error similar to the following: “Failed, Task for Logical Server ESXre301 has failed. Logical server job completed with a failure status. Failure: Internal Error (Error occurred while executing deploy template Operation: null).”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>This error is displayed during startup of the Systems Insight Manager and Insight Control virtual machine management services. The issue can occur during an upgrade, during a restart of services after data migration, or during a restart of the CMS. The timing of these services becoming fully up and running can lead to a small window of time that results in incorrect initialization of data.</td>
</tr>
<tr>
<td>Action</td>
<td>Restart the Insight Control virtual machine management service and retry the create service request.</td>
</tr>
</tbody>
</table>

## Service creation fails with “Unable to locate boot disk path”

| Issue | A Create Service request fails on ESX or Hyper-V with an error similar to the following: “Unable to locate boot disk path H:\VSE_VirtualMachines for logical server (logical_server)_ls. VM host |

174 Troubleshooting
A create service request fails on a Hyper-V host with the error “Remote Exception: Error while setting the VLAN ID on Switch Port null for the VM” for a certain duration of time. The Hyper-V host events display an error with Error Code: 2424869.

**Possible cause**
The [Microsoft KB for this issue](https://support.microsoft.com/en-us/kb/2424869) indicates that this is a timing issue that occurs when certain backup programs are installed and running on the host.

**Action**
Retry the create service request on another host, or at a later time on the same host.

---

**A create service request fails for an ESX VM template with automatic OS deployment. The following error is displayed:**

Failure: Error powering on logical server. The start function on virtual machine vm-name failed: VMware ESX Server cannot open the virtual disk disk-name for clustering. Please verify that the virtual disk was created using the 'thick' option. Cannot open the disk disk-name or one of the snapshot disks it depends on. Reason: Thin/TBZ disks cannot be opened in multiwriter mode. This error may occur when no virtual machine licenses are available on the target VM Host.

**Possible cause**
VMware ESX Server 3.5 is the target VM Host, which is no longer supported by infrastructure orchestration.

**Action**
Update the VM Host to a supported version of ESX, or edit the IO service and select a different resource pool that contains an ESX VM Host with a supported version of ESX.

---

**The time zone set in Sysprep.inf is not reflected in Microsoft Windows 2008 virtual machine guest**

**Issue**
The time zone set in `Sysprep.inf` is not reflected in the Microsoft Windows 2008 virtual machine guest, and defaults to GMT (Greenwich Mean Time).

**Possible cause**
The default configuration file in the virtual machine management installation contains worldwide standard time zones defined and available for customization. For time zones other than those in the virtual machine management default configuration file, an index was not assigned in the file `tzmapping`.

**Action**
1. Edit the `tzmapping` file installed in the bin directory `(.\Program Files\HP\Insight Control virtual machine management\bin)`.
2. Assign the unique index for any new time zone that should be included in the virtual machine guest.
   
   `<Unique number>=<New Time Zone>
   For example: 235=Tokyo Standard Time`
Error getting DHCP address during add server request

| Issue | A user cannot allocate DHCP addresses from a particular subnet during an add server request |
| Possible cause | This problem occurs when the following conditions are met:  
- Matrix OE is running in a federated CMS environment  
- Simultaneous changes are made on subnets (requests allocating IP addresses while the subnet is being edited)  
- After error messages, a backup/restore process is initiated |
| Action | To avoid this issue:  
- Do not edit a subnet that is having its address allocation changed by a request (create/delete/add server)  
- Do not allow more than one logged user to edit the same subnet  
If the issue has occurred:  
The system recovers from this state on its own after some time. |

Virtual data disk names cannot contain double-byte characters

| Issue | When a template is created and a virtual data disk is named using invalid or double byte characters, the request is not submitted, and the following error message is displayed: Invalid logical disk name for disk <disk-name>. A logical disk name may contain only the following characters: A-Z, a-z, 0-9, '_', '-' and ' '. Other characters are not allowed. Physical data disks and boot disks can contain localized names. |
| Possible cause | The virtual data disk name contains characters other than letters (A-Z, a-z), numbers (0-9), space, underscore, and hyphen. |
| Action | Rename the virtual data disk using valid characters and resubmit the request. |

A Microsoft Windows 2008 virtual machine guest cannot join the Active Directory domain

| Issue | A Microsoft Windows 2008 virtual machine guest cannot join the Active Directory domain. |
| Possible cause |  
- The domain name is not specified on the Windows Settings and DNS tabs on the Network tab or in the Sysprep.inf file.  
- The DomainAdmin username is prefixed by the domain name in the Sysprep.inf file. |
| Action | To specify that infrastructure orchestration automatically join new virtual machines to a Microsoft Windows domain:  
1. Specify the domain name for the network that your virtual machine will attach to.  
   a. From the Networks page in the infrastructure orchestration console, select the network and open the Edit Network dialog box.  
   b. Edit the DNS tab to specify the MS Domain.  
   c. Edit the Windows Settings tab to specify the MS Domain.  
2. Edit the infrastructure orchestration Sysprep.inf file, located at ..\Program Files\HP\Matrix infrastructure orchestration\conf\sysprep\Sysprep.inf.  
   On the following lines, specify the username and password for the domain. The DomainAdmin value must be a username without a domain prefix.  
   DomainAdmin="Administrator"  
   DomainAdminPassword="password" |

Troubleshooting
### Provisioning virtual machine failed with a VM must be powered off for customization error message

<table>
<thead>
<tr>
<th>Issue</th>
<th>Provisioning a virtual machine failed with a VM must be powered off for customization error message.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>The Insight Control virtual machine management template that is being used was created when the virtual machine was in a suspended state.</td>
</tr>
<tr>
<td>Action</td>
<td>Provisioning fails during customization with an error message if the virtual machine management template is created when the virtual machine is in a suspended state and then used in infrastructure orchestration. To resolve this issue, power off the virtual machine before creating virtual machine management template from the virtual machine.</td>
</tr>
</tbody>
</table>

### Provisioned VMs fail due to improper VM Host hardware configuration

<table>
<thead>
<tr>
<th>Issue</th>
<th>Provisioned VMs fail due to improper VM Host hardware configuration. The customization of the provisioned VMs fail and the HP Matrix infrastructure orchestration service request fails.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>Virtual network manager fails to load during rapid provisioning of VMs on ProLiant servers with Microsoft Hyper-V 2008 R2 SP1/SP2. The following error message is displayed: Task for logical server has failed, failure virtual machine hardware was not configured correctly.</td>
</tr>
</tbody>
</table>
2. Enable the TCP offload feature in the Hyper-V host.  
   • Access the Network Adapter Properties window for the VM Host.  
   • Click the Advanced tab.  
   • Select the TCP offload options in the Property list and select Enable as the Value.  
   • Click OK. |

### VM Host server blade is not returned to server pool as Unused when VM Host service is deleted

<table>
<thead>
<tr>
<th>Issue</th>
<th>VM Host server blade is not returned to server pool as Unused when VM Host service is deleted. The server blade remains marked as an In-Use VM Host, and is not available for other deployments.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>The VM Host HP Matrix infrastructure orchestration service was deleted without first unregistering the VM Host from Insight Control virtual machine management.</td>
</tr>
</tbody>
</table>
| Action | Use the Insight Control virtual machine management client API to unregister the VM Host.  
1. Login:  
   ```bash  
   ..\Program Files\HP\Insight Control virtual machine management\clientapi\bin>adminlogin
   ```  
2. Unregister the VM Host:  
   ```bash  
   ..\Program Files\HP\Insight Control virtual machine management\clientapi\bin>cli unregisterAgent -host <VM_host_IP_address>
   ```  
3. Retrieve the list of IP addresses registered as VM Hosts:  
   ```bash  
   ..\Program Files\HP\Insight Control virtual machine management\clientapi\bin>cli getHostIds
   ```  
4. Verify that the VM Host IP address is no longer listed. |
Task for logical server has failed: Service console load average on the source server is greater than the threshold value

### Failure message

Task for logical server <ls name> has failed. Failure: Service console load average on the source server is greater than the threshold value. Retry the operation later.

### Possible cause

The load average on the source or target VM Host may be too high. Verify this issue by examining the Insight Control virtual machine management log file at: ..\Program Files\HP\Virtual Machine Management\log\hpvmmsvc.log. Look for logging messages similar to the following:

- 2009/07/29 08:31:02 | INFO - Source server 16.92.61.30 load average for 5 Minute -> 1.85
- 2009/07/29 08:31:02 | INFO - Source server 16.92.61.30 load average for 15 Minute -> 2.27
- 2009/07/29 08:31:02 | WARN - Source server 16.92.61.30 load average exceeded the threshold

These logging messages indicate that the VM Host identified with the "Source server" tag exceeded the allowable threshold and the VM deployment failed.

### Action

The memory and CPU shares that are allocated to the VMware Service Console may be increased to obtain better performance on the VM Host. For more information, see "Increasing VMware Service console memory and CPU shares" (page 202).

---

### Storage pool entries defined in Matrix OE are not shown in the infrastructure orchestration console Storage tab

#### Issue

Storage Pool Entries defined in Matrix OE may not be shown in the infrastructure orchestration console Storage tab.

#### Possible cause

- The infrastructure orchestration console’s Storage page has not been refreshed since changes are made in the Matrix OE Manage Storage Pool page.
- The storage pool entry is filtered out because it is invalid for infrastructure orchestration to use.

#### Action

- Refresh the infrastructure orchestration Storage page.
- Verify the storage pool entry in the Matrix OE Manage Storage Pool page to make it valid for infrastructure orchestration to use:
  - Ensure the Storage Entry Operating System is correctly specified.
  - Ensure the WWN is correctly specified.
  - Ensure the LUN is correctly specified.
- Refresh the infrastructure orchestration Storage page.

---

### Service deletion

#### Physical service deletion

**Matrix infrastructure orchestration Delete Service request leaves “clean-me” logical servers**

#### Issue

Matrix infrastructure orchestration Delete Service request leaves “clean-me” logical servers

#### Possible cause

If using Insight Control server deployment, the job “Erase ProLiant ML/DL/BL Array Configuration {LinuxPE}” has not been modified for infrastructure orchestration.
If using Ignite-UX, the client has not been set up with permission to run the erase disk job in Systems Insight Manager.

If using Insight Control server deployment, follow Step 9 in the Creating server deployment job folders procedure. The job must have only two steps:

<table>
<thead>
<tr>
<th>Task</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Run Script</td>
<td>Wipe Disk</td>
</tr>
<tr>
<td>Power Control</td>
<td>Shutdown (if available)</td>
</tr>
</tbody>
</table>

**NOTE:** When using the `mxnode` command, enter the `root/<root password>` for the provisioned server into the global credentials for Systems Insight Manager (Options → Security → Credential → Global Credentials).

```
mxagentconfig -a -n <target IP or DNS name> -u <user> -p <password>
```

Where:
- `<user>` is root
- `<target IP or DNS name>` is the IP address of the newly created Systems Insight Manager node
- `<password>` is the root password of the newly created Systems Insight Manager node

**Matrix infrastructure orchestration did not correctly erase the disk during deprovisioning**

<table>
<thead>
<tr>
<th>Issue</th>
<th>Matrix infrastructure orchestration did not correctly erase the disk during deprovisioning.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>The Insight Control server deployment erase disk job name is not correct.</td>
</tr>
<tr>
<td>Action</td>
<td>For infrastructure orchestration to correctly erase the disk content when deprovisioning physical servers using a non-English server deployment version, there must be an English <strong>Erase ProLiant ML/DL/BL Array Configuration {LinuxPE}</strong> job under the <strong>Server Deployment Toolbox\1 \Hardware Configuration\Array\server deployment folder</strong>. Copy and paste the equivalent non-English server deployment job within the same folder, and then modify the <strong>Erase ProLiant ML/DL/BL Array Configuration {LinuxPE}</strong> job. For more information on modifying the job, see “Creating server deployment job folders” (page 30).</td>
</tr>
</tbody>
</table>

**An infrastructure service has been deleted, but I did not delete it**

<table>
<thead>
<tr>
<th>Issue</th>
<th>An infrastructure service has been deleted, but I did not delete it.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>Matrix infrastructure orchestration may be configured to remove infrastructure services when the lease period expires. When an infrastructure service lease period expires and the service is deleted, My History and Request Details displays a message stating the owner initiated the delete process even though the delete process was triggered by the lease period expiring.</td>
</tr>
<tr>
<td>Action</td>
<td>Email notices of lease expiration and service deletion can be sent one week, and then one day, in advance of the event. The emails are sent to the address set in the Operations Orchestration System Property: <code>HpioNotificationRecipients</code>. Use Operations Orchestration Studio to set this configuration parameter.</td>
</tr>
</tbody>
</table>
A delete request failed

<table>
<thead>
<tr>
<th>Issue</th>
<th>A delete request has failed. The environment must be manually cleaned.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>—</td>
</tr>
</tbody>
</table>
| Action | For virtual logical servers, infrastructure orchestration creates a folder under the virtual machine Host with the same name as the infrastructure service provided by the user. This folder contains all the folders and files corresponding to the virtual logical servers. Delete this folder and all its contents.  
For virtual logical servers, verify that all the virtual machines and the infrastructure folder name are removed from the vCenter Server. Locate the infrastructure orchestration folder under the virtual machine Host with the same name as the infrastructure provided by the user. Matrix infrastructure orchestration creates the virtual machines under this folder. If these still exist, remove the virtual machines and the infrastructure folder.  
For physical logical servers, perform a manual clean-up process for the affected logical servers. See “Manual clean-up process (physical)” (page 195). |  |

Virtual service deletion

Matrix infrastructure orchestration unable to successfully reserve resources

<table>
<thead>
<tr>
<th>Issue</th>
<th>In some circumstances, when processing a create request for a template containing a network specified by attributes and a virtual logical server group, infrastructure orchestration may be unable to successfully reserve resources even though they exist. There is not a specific failure message for this issue, although the problem is indicated by a server reservation failure message. The issue applies only to virtual logical servers.</th>
</tr>
</thead>
</table>
| Possible cause | Matrix infrastructure orchestration performs subnet allocation prior to server allocation. Consider the following case:  
Two subnets (Subnet1, Subnet2) match LogicalSubnetA.  
Subnet1 is associated with VmHost1 and no others.  
Subnet2 is associated with VmHost2 and no others.  
Based on subnet allocation criteria, Subnet1 is the best choice for LogicalSubnetA.  
However, if VmHost1 is unsuitable for the LogicalServerGroups associated with LogicalSubnetA, the reservation will fail without Subnet2 being evaluated. VmHost1 might be unsuitable because it is not recoverable or it has an insufficient number of processors, in which case the following server reservation error message would appear; "Reservation failed for logical server SvrGrp1-1. Unable to find a virtual server with the following requirements: Recoverable. 3 processor(s)." |  |
| Action | To resolve this issue, narrow the network selection options, eliminating general specifications (“Any” options) from the network selection attributes. If removing all general options does not select the correct network, specify the network by name or select fewer server pools and resources when submitting the request. |  |

Could not find a provisioned infrastructure service with the specified logical server in Matrix infrastructure orchestration

| Failure message | From the Matrix OE logical server perspective, clicking on the Manage this logical server with Matrix infrastructure orchestration icon displays the following message: Could not find a provisioned infrastructure service with the specified logical server in Matrix infrastructure orchestration. If a physical server was selected |  |
and the infrastructure service was provisioned by infrastructure orchestration, check if its status is not standby.

<table>
<thead>
<tr>
<th>Possible cause</th>
<th>The logical server had been deactivated.</th>
</tr>
</thead>
</table>
| **Action**       | • If it is not a “clean-me” logical server then return to infrastructure orchestration and issue an *Activate servers* request for the logical server.  
• If it is a “clean-me” logical server then perform a manual clean-up process for the logical server. See “Manual clean-up process (physical)” (page 195). |

Adding servers to services

Add data disk request fails

<table>
<thead>
<tr>
<th><strong>Issue</strong></th>
<th>Add data disk request fails.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Possible cause</strong></td>
<td>Server deactivated</td>
</tr>
<tr>
<td><strong>Action</strong></td>
<td>This error might occur if attempting to add a data disk for logical servers that are deactivated. To continue to add the data disk, initiate an <em>Activate servers</em> request, and after restoring the service, add the disks to the Logical Server Group.</td>
</tr>
</tbody>
</table>

Deactivate, activate, power off, or power on operations

Messages displayed when a paused boot disk deployment is cancelled by an administrator

<table>
<thead>
<tr>
<th><strong>Issue</strong></th>
<th>What messages are displayed when a paused boot disk deployment is cancelled by an administrator?</th>
</tr>
</thead>
</table>
| **Possible cause** | —  
When an administrator cancels a boot disk allocation that is paused, infrastructure orchestration may display two messages on the *Request* page:  
• The first message indicates that the boot disk deployment was canceled by an administrator, for example:  
"Request for 3Tier_infra_1 has been canceled by Ann."
• The second message contains notes entered by an administrator at the time of the cancellation, for example:  
"Unable to do this right now, please call me at 555-1234 to re-schedule, Ron." If a note is not entered by the administrator, this message is omitted. |

Console operations

The Matrix infrastructure orchestration tool cannot be displayed due to login failure

| **Failure issue** | The infrastructure orchestration console in Systems Insight Manager displays:  
"The Matrix infrastructure orchestration tool cannot be displayed. Problem: Failed to login to the HP Matrix infrastructure orchestration service from Systems Insight Manager." |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Possible cause</strong></td>
<td>The Windows user logging in is not a member of the HPIO Administrators group. Members of the Administrators group are not automatically members of the HPIO Administrators group.</td>
</tr>
</tbody>
</table>
| **Action** | Add the user to the HPIO Administrators group. For example, in Windows 2008:  
1. Select *Start* → *Administrative Tools* → *Computer Management*.  
2. Expand *System Tools* → *Local Users and Groups*. |
3. Click **Groups**.
4. Right-click **HPIO_Administrators**, and select **Add to Group**.
5. Click **Add...**
6. In the **Enter the object names to select (examples)** field, enter `<username_to_add>`.
7. Click **OK**.
8. Click **OK**.

The HP Matrix infrastructure orchestration tool cannot be displayed and User not authenticated messages

<table>
<thead>
<tr>
<th>Issue</th>
<th>Matrix OE infrastructure orchestration console in Systems Insight Manager displays the following message: The HP Matrix infrastructure orchestration tool cannot be displayed and the error dialog displays: User not authenticated.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>Signing out of the infrastructure orchestration designer after launching it from the infrastructure orchestration console (using the Template tab New or Edit buttons).</td>
</tr>
<tr>
<td>Action</td>
<td>In infrastructure orchestration designer, instead of clicking <strong>Sign Out</strong>, either close the IE7 browser (using the close (X) button in the upper right) or close the IE7 browser tab (using the close (X) button at the right end of the infrastructure orchestration designer tab).</td>
</tr>
</tbody>
</table>

The Matrix infrastructure orchestration tool cannot be displayed due to service contact failure

<table>
<thead>
<tr>
<th>Issue</th>
<th>When logging into infrastructure orchestration in Systems Insight Manager, an error page appears stating The Matrix infrastructure orchestration tool cannot be displayed. Cannot contact the infrastructure orchestration service running at: <code>&lt;service-name&gt;</code></th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>The infrastructure orchestration service is not running on the CMS.</td>
</tr>
</tbody>
</table>
| Action | On the CMS, in the Services window, verify that the HP Matrix infrastructure orchestration service is running.  
1. For example, in Windows 2008, select **Start»Administrative Tools»Services**.  
2. Confirm that infrastructure orchestration has Status: Started. |

The Matrix infrastructure orchestration tool cannot be displayed appears when listing server pools

<table>
<thead>
<tr>
<th>Issue</th>
<th>In Systems Insight Manager, the infrastructure orchestration error page The Matrix infrastructure orchestration tool cannot be displayed appears when listing server pools exceeds a one-minute timeout.</th>
</tr>
</thead>
</table>
| Possible cause | • The physical server or virtual machine hypervisor is not responding.  
• The HP Matrix infrastructure orchestration service is down.  
• The network is slow or disconnected. |
| Action | • Verify that the physical servers and VM Hosts are available.  
• Verify that the HP Matrix infrastructure orchestration service is started.  
• Verify that the network settings are configured correctly.  
• Refresh the **Servers** page. |
Users added to the HPIO_Administrators group cannot log in to infrastructure orchestration console

<table>
<thead>
<tr>
<th>Issue</th>
<th>Users added to the HPIO_Administrators group cannot log in to infrastructure orchestration console.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>The HPIO_Administrators group is not associated with the infrastructure orchestration toolbox in Systems Insight Manager.</td>
</tr>
<tr>
<td>Action</td>
<td>After Matrix infrastructure orchestration is installed, the HPIO_Administrators group must be associated with infrastructure orchestration toolbox in Systems Insight Manager. Make sure this association is set correctly on Systems Insight Manager. For more information, see “Configuring infrastructure orchestration users in Windows”.</td>
</tr>
</tbody>
</table>

Operating system information does not display on the Service Details page

<table>
<thead>
<tr>
<th>Issue</th>
<th>Operating system information does not display on the Service Details page.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>If a server or a service is in an UNKNOWN state, an issue has occurred on that server or service.</td>
</tr>
<tr>
<td>Action</td>
<td>If the operating system is not deployed, the operating system information does not display on the Service Details page. In these situations, infrastructure orchestration is able to clean up the database, but might not remove the service or server from the partner domain. If this occurs, the system administrator must clean up the unreachable servers. For physical servers, see “Manual clean-up process (physical)” (page 195). For virtual servers, see the troubleshooting issue “A delete request has failed. The environment must be manually cleaned.”</td>
</tr>
</tbody>
</table>

Networks tab does not retrieve network information

<table>
<thead>
<tr>
<th>Issue</th>
<th>The Networks tab does not retrieve any network information, or IO allocation failure and provision failure occurs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible causes</td>
<td>- VMware vCenter Server credentials are not configured or are lost during an Insight Control virtual machine management update. - VMware vCenter Server is unreachable.</td>
</tr>
</tbody>
</table>
| Action | - Enter the VMware vCenter Server credentials in HP SIM.  
  1. Go to Options→VME options→View VME options→View VME Settings and check the vCenter status.  
  2. Follow the steps on that page OR follow the steps below:  
     a. Select Options→Security→Credentials→System Credentials.  
     b. Edit system credentials.  
     c. Click on Show Advanced protocol credentials→VME tab.  
     d. Enter credentials and click OK.  
     e. Verify that the configured VMware vCenter Server is reachable. |

Request details displays allocated when a reservation process finishes

<table>
<thead>
<tr>
<th>Issue</th>
<th>Request details displays allocated when a reservation process finishes.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>Resources are reserved.</td>
</tr>
<tr>
<td>Action</td>
<td>Matrix infrastructure orchestration displays an “allocated” message when resources are reserved for a provisioning request. If this message appears for a scheduled provisioning operation, the resources are only reserved for the future lease period.</td>
</tr>
</tbody>
</table>
Users are not able to login to infrastructure orchestration after installation or after assigning the user to a different infrastructure orchestration group

<table>
<thead>
<tr>
<th>Issue</th>
<th>Possible cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Users are not able to login to infrastructure orchestration after installation or after assigning the user to a different infrastructure orchestration group.</td>
<td>The CMS requires a reboot.</td>
<td>A user might not be able to log in to the infrastructure orchestration console in Systems Insight Manager or the infrastructure orchestration self service portal after installing infrastructure orchestration, or after moving the user from one infrastructure orchestration user group to another, for example moving a user from the HPIO_Administrators to the HPIO_Users group. To resolve this issue, reboot the CMS.</td>
</tr>
</tbody>
</table>

Extending the lease period fails without stating a specific reason or error message

<table>
<thead>
<tr>
<th>Issue</th>
<th>Possible cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>When extending the lease period, the operation fails without stating a specific reason or error message.</td>
<td>There are insufficient resources. When attempting to extend the lease period of an infrastructure beyond the period available to its resources (insufficient static IP addresses or insufficient capacity on a virtual machine host), the infrastructure orchestration displays an error message, stating “The informed lease period conflicts with another infrastructure service lease period and cannot be updated.”</td>
<td>Verify that the following resources are sufficient and available: • Static IP addresses • Virtual machine memory resources • Disk resources</td>
</tr>
</tbody>
</table>

Operation on servers under a VCDG did not complete the requested operation

<table>
<thead>
<tr>
<th>Issue</th>
<th>Possible cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>An operation on servers under a VCDG did not complete the requested operation.</td>
<td>Server is not managed by Virtual Connect Enterprise Manager. Virtual Connect Domain Group status must display managed by Virtual Connect Enterprise Manager for infrastructure orchestration to correctly execute operations over its resources.</td>
<td>To perform maintenance activities on a Virtual Connect Domain that is managed by Virtual Connect Enterprise Manager and prevent infrastructure orchestration from attempting to use a physical server that is not available when the VCDG is under maintenance, do the following: 1. Access the infrastructure orchestration console and select the Servers tab. 2. Move the physical servers in the VCDG to the maintenance pool. 3. Access Virtual Connect Enterprise Manager and perform the required steps to complete the desired operation. 4. In infrastructure orchestration, move the physical servers from the maintenance pool back to the appropriate server pools to make them available for use in infrastructure orchestration.</td>
</tr>
</tbody>
</table>

Not all virtual resources are displayed in the Servers tab

<table>
<thead>
<tr>
<th>Issue</th>
<th>Possible cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not all virtual resources are displayed in the Servers tab.</td>
<td>Five minutes after clicking the refresh button, the Servers tab still shows no virtual hosts. (There is a TimeoutException from the getVMHostServerPools call in the stack trace within the hpio-controller.log file on the CMS). This may be caused by environmental issues that cause virtual machine management to take an unexpectedly long time to communicate with some VM Hosts, or by a large-scale setup that takes virtual machine management a long time to retrieve information from all VM Hosts. VM Hosts that respond within the time period return their results to the Servers tab.</td>
<td></td>
</tr>
</tbody>
</table>
Check the hpio-controller.log file for warning messages of the form: “Unable to get all VM Host data in the allotted time. The data from some hosts will not be returned.” and “Unable to get VM Host data in the allotted time for host : <hostname>.”

**Action**

Fix the environmental issues or increase the following timeout property settings. If a blade is not expected to ever be available again for provisioning (especially under actions 3 and 4, above), it can be moved to another server pool created especially for unavailable servers.

1. Edit the ..\Program Files\HP\Matrix infrastructure orchestration\conf\hpio.properties file.
2. Set timeout.get.serverpools to a longer interval. (For example, for a 20 minute interval, set timeout.get.serverpools=20).
3. Set timeout.get.vmhost to a longer interval, but less than timeout.get.serverpools. The default value of timeout.get.vmhost is 10. (If you change this value, the value is reset to the default after an upgrade of infrastructure orchestration.)

The value of timeout.get.vmhost should always be less than the value of timeout.get.serverpools.

<table>
<thead>
<tr>
<th>Server blades that are not in use are shown in infrastructure orchestration server pools but are not allocated for provisioning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Issue</strong></td>
</tr>
<tr>
<td><strong>Possible cause</strong></td>
</tr>
<tr>
<td><strong>Action</strong></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Moving servers to the Maintenance pool always deactivates the servers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Issue</strong></td>
</tr>
<tr>
<td><strong>Possible cause</strong></td>
</tr>
<tr>
<td><strong>Action</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Memory resources allocated to a virtual machine host are not available after using the Deactivate servers operation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Issue</strong></td>
</tr>
<tr>
<td><strong>Possible cause</strong></td>
</tr>
<tr>
<td><strong>Action</strong></td>
</tr>
</tbody>
</table>
Step in the Request Details fails

<table>
<thead>
<tr>
<th>Issue</th>
<th>A step in the Request Details is shown as having failed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>When executing a request, infrastructure orchestration might report the failure of one or more steps on the Request Details page. After such an error occurs, infrastructure orchestration attempts to recover by retrying the tasks or re-allocating the resources. During a recovery allocation process, infrastructure orchestration uses the server pools selected in the initial request. If a step fails too many times, the whole request fails.</td>
</tr>
<tr>
<td>Action</td>
<td>Configure the number of retries in the ..\Program Files\HP\Matrix infrastructure orchestration\conf\hpio.properties file.</td>
</tr>
</tbody>
</table>

Request continues to process after being canceled

<table>
<thead>
<tr>
<th>Issue</th>
<th>A request continues to process after being canceled.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>Current task in progress.</td>
</tr>
<tr>
<td>Action</td>
<td>When a request is canceled, infrastructure orchestration has to allow the ongoing tasks in the managed environment to complete. No new tasks are started, however all in progress tasks must complete before the request can be canceled.</td>
</tr>
</tbody>
</table>

Microsoft SCVMM templates do not appear in the Software tab

<table>
<thead>
<tr>
<th>Issue</th>
<th>SCVMM templates do not appear on the Software tab.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cause</td>
<td>—</td>
</tr>
</tbody>
</table>
| Action | 1. In the SCVMM server, open the powershell command prompt for virtual machine management 2. Enter the following commands:  
   - get-vmmserver -ComputerName localhost  
   - get-template | select -Property Name  
   - get-template | select -Property Name, VirtualizationPlatform  
   The templates returning the VirtualizationPlatform as “Hyper-V” will be listed in the infrastructure orchestration Software tab. |

The infrastructure orchestration Server pools tree was not removed from Systems Insight Manager during infrastructure orchestration uninstallation

<table>
<thead>
<tr>
<th>Issue</th>
<th>The infrastructure orchestration Server pools tree was not removed from Systems Insight Manager during the infrastructure orchestration uninstallation process.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>Systems Insight Manager was not available when infrastructure orchestration was being uninstalled.</td>
</tr>
</tbody>
</table>
| Action | • Stop the HP Matrix infrastructure orchestration service.  
  • Manually remove the HP SIM collections.  
  • Start the HP Matrix infrastructure orchestration service. |
Self Service Portal operations

Linux server does not list a recently added data disk

<table>
<thead>
<tr>
<th>Issue</th>
<th>My Linux server does not list a recently added data disk.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>The server was not rebooted.</td>
</tr>
<tr>
<td>Action</td>
<td>When adding a new data disk to an existing service, if the servers are physical Linux servers or the data disks are added manually (for example, Multi-initiator NPIV is not used), reboot the Linux server to make the disks available.</td>
</tr>
</tbody>
</table>

Entering a hostname in the network WINS setting causes a Windows customization to fail

<table>
<thead>
<tr>
<th>Issue</th>
<th>Entering a hostname in the network WINS setting causes a Windows customization to fail.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>—</td>
</tr>
<tr>
<td>Action</td>
<td>Enter an IP address or leave the network WINS setting blank.</td>
</tr>
</tbody>
</table>

Resources do not appear in the infrastructure orchestration Unassigned pool

<table>
<thead>
<tr>
<th>Issue</th>
<th>My resources do not show up in infrastructure orchestration Unassigned Pool.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>Resources are added to the infrastructure orchestration Unassigned Pool when infrastructure orchestration recognizes they are available, licensed, and configured correctly.</td>
</tr>
</tbody>
</table>
| Action | To display VM Hosts:  
1. In Insight Control virtual machine management, register the VM Host.  
2. In the infrastructure orchestration console Servers tab, click the circling green arrows icon (to the left of: Click to refresh server resources).  
To display physical servers:  
1. In the Matrix OE visualization menu, select Tools → Logical Servers → Refresh or wait 60 minutes (default; is configurable) for logical server management’s auto-discovery.  
2. In the infrastructure orchestration console Servers tab, click the circling green arrows icon (to the left of: Click to refresh server resources). |

Servers “disappear” from server pools

<table>
<thead>
<tr>
<th>Issue</th>
<th>Servers “disappear” from server pools.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>Communication problem with one of infrastructure orchestration inventory providers (logical server management or virtual machine management), or a provider service is stopped.</td>
</tr>
</tbody>
</table>
| Action | Matrix infrastructure orchestration periodically retrieves servers (blades and virtual machine hosts) in the managed environment to update the resources that are listed in the infrastructure orchestration server pools. The default polling interval is 60 minutes. When a resource does not appear in the inventory for two polling intervals, infrastructure orchestration removes the resource from the server pool. The assumption is that the resources have been removed from the managed environment and should be removed from the infrastructure orchestration server pool.  
Restore the communication or restart the provider service. Then refresh Matrix OE by using Systems Insight Manager, Tools → Logical Servers → Refresh. Select Refresh of Virtual Connect Resources or Refresh of Virtual Machine Resources as appropriate.  
Alternatively, change the number of polling intervals before a server is removed by changing the value of the server.keep.alive.rounds property in .\Program Files\HP\Matrix infrastructure orchestration\conf\hpio.properties. |
## Create Request fails for published template

<table>
<thead>
<tr>
<th>Issue</th>
<th>Possible cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create Request fails for my Published template.</td>
<td>Resources are unavailable. When a template is published, it is validated by infrastructure orchestration designer. However, if after publishing, resources are removed from the system (software, networks) the template might become invalid due to lack of resources. The template then cannot be discovered by infrastructure orchestration until it is revalidated, and saved in infrastructure orchestration designer.</td>
<td>After changing an environment configuration, revalidate any affected templates.</td>
</tr>
</tbody>
</table>

## Designer operations

### After period of inactivity, the template appears available to edit, until saving the template is attempted

<table>
<thead>
<tr>
<th>Issue</th>
<th>Possible cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>After period of inactivity, the template appears available to edit, until saving the template is attempted.</td>
<td>The infrastructure orchestration designer session service has expired.</td>
<td>Matrix OE infrastructure orchestration designer logs you out, but preserves the changes. To save the template, login, recover the modifications, and then save the template.</td>
</tr>
</tbody>
</table>

## A virtual IP address can be assigned only to the first network connected to the server group

<table>
<thead>
<tr>
<th>Issue</th>
<th>Possible cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>A virtual IP address can be assigned only to the first network connected to the server group.</td>
<td>The infrastructure orchestration designer enables the definition of virtual IP addresses for a server group. If multiple networks are connected to the group, infrastructure orchestration only allows virtual IP addresses to be assigned to the first network listed for the server group. Networks are listed in alphanumeric order.</td>
<td>• Start the network name that you want to use with an “a”, forcing it to be first in the list, or&lt;br&gt;• Export and edit the template XML, changing the network assigned to the virtual IP.</td>
</tr>
</tbody>
</table>

## Reservation failed for logical network

<table>
<thead>
<tr>
<th>Issue</th>
<th>Possible cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reservation failed for logical network <code>&lt;network-name&gt;</code>. The IP address(es) xx.xx.xx.xxx must be included in the static IP address range set for the network.</td>
<td>Static IP addresses defined in a template must be inside in the selected network’s static IP address range.</td>
<td>Modify the template to have a static IP address inside in the selected network’s static IP address range, or modify the selected network’s static IP address range to include the template’s static IP address.</td>
</tr>
</tbody>
</table>

## Special characters do not validate in Cost units field in designer

<table>
<thead>
<tr>
<th>Issue</th>
<th>Possible cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special characters do not validate in Cost units field in infrastructure orchestration designer.</td>
<td>The infrastructure orchestration designer does not validate the Cost units text field.</td>
<td>To avoid displaying unexpected characters, do not enter special characters in the Cost units field when configuring the template.</td>
</tr>
</tbody>
</table>
Template access restrictions for users and architects

<table>
<thead>
<tr>
<th>Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Template access restrictions for users and architects.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Possible cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Template viewing and use for non-administrators (architects and users) may have been configured by an Administrator so that Architects and Users only view and use templates that each have assigned access to. If restricted, in general:</td>
</tr>
<tr>
<td>- An administrator in infrastructure orchestration self service portal may view and use only their own templates</td>
</tr>
<tr>
<td>- An architect in infrastructure orchestration designer and infrastructure orchestration self service portal may view and use only their own templates</td>
</tr>
<tr>
<td>- A user in infrastructure orchestration self service portal may view and use published templates that they have access to</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact the administrator for resolution. In ..\Program Files\HP\Matrix infrastructure orchestration\conf\hpio.properties, the administrator can choose to either restrict a CMS’s templates: template.access.restricted=true or open up a CMS’s templates: template.access.restricted=false. If restricted, assign or unassign individual users to templates by going to the infrastructure orchestration console, click Templates and then click Modify Users.</td>
</tr>
</tbody>
</table>

Fatal error occurred while initializing designer

<table>
<thead>
<tr>
<th>Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designer error dialog message: A fatal error occurred while initializing the Designer. Please make sure the HP Matrix infrastructure orchestration service is running and try again.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Possible cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occurs when launching infrastructure orchestration designer from the infrastructure orchestration console (using the Template tab Edit buttons).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Launch infrastructure orchestration designer using a browser at https://&lt;cms&gt;:51443/hpio/designer and open the desired template.</td>
</tr>
</tbody>
</table>

Some template XML hand-editing errors are not caught when importing to infrastructure orchestration designer

<table>
<thead>
<tr>
<th>Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some template XML hand-editing errors, for example, Duplicate Logical Server Group boot order, are not caught during infrastructure orchestration designer’s Import of a template from XML.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>The template was exported from infrastructure orchestration designer to XML, then the XML was hand-edited with duplicate &lt;Ordinal /&gt; values, and finally the XML was imported back into infrastructure orchestration designer.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do not edit XML templates outside of infrastructure orchestration designer. Editing XML templates outside of infrastructure orchestration designer is unsupported and undocumented. The XML schema is not part of the public interface specification; HP may change the XML schema without notice. Users who modify XML templates, or who create their own XML templates, do so at their own risk. Use of an invalid template may cause provisioning failures. HP may require the user to reproduce an issue using an unmodified, IO-generated template before offering support.</td>
</tr>
</tbody>
</table>

Importing a template XML file that was created in a later release of IO into a previous release and backward compatibility

<table>
<thead>
<tr>
<th>Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Importing a template XML file that was created in a later release of IO into a previous release of IO displays the error: “The template is invalid and could not be read by the</td>
</tr>
</tbody>
</table>
Sporadic infrastructure orchestration designer interface failures in IE6

| Issue | With IE6, launching infrastructure orchestration designer from infrastructure orchestration console can cause sporadic infrastructure orchestration designer interface failures. Matrix OE infrastructure orchestration console in Systems Insight Manager displays the following message: “The HP Matrix infrastructure orchestration tool cannot be displayed.” |
| Possible cause | — |
| Action | In Systems Insight Manager, select **Tools** → **infrastructure orchestration** to return the infrastructure orchestration console to its normal display. |

Miscellaneous issues

Email and notification

Infrastructure orchestration email messages such as approval and notification are not sent

| Issue | The infrastructure orchestration email messages such as approval and notification are not sent. |
| Possible cause | • SMTP configuration parameters are not correct.  
• SMTP credentials are not correct.  
• SMTP server is not responding.  
• CMS is not able to communicate with SMTP server. |
| Action | • Make sure that the SMTP configuration parameters and credentials are correct.  
• Check CMS and SMTP server connectivity.  
• Check to make sure that the SMTP server is working correctly. |

Infrastructure orchestration notification email contains a URL that does not appear as a link in Microsoft Outlook

| Issue | The infrastructure orchestration notification emails contain a URL that does not appear as a link in Microsoft Outlook. |
| Possible cause | — |
| Action | Manually copy and paste the URL link into a browser. |

Infrastructure orchestration does not send email notifications to users assigned to, or unassigned from, a server pool

| Issue | Matrix infrastructure orchestration does not send email notifications to users assigned to, or unassigned from, a server pool. |
| Possible cause | — |
| Action | Verify that the oo.user.pool.notification.enabled=true is set in ..\Program Files\HP\Matrix infrastructure orchestration\conf\hpio.properties. |
Access error on infrastructure orchestration web pages from email notification using private network

### Issue
Access error on infrastructure orchestration web pages from email notification using private network.

### Possible cause
In some cases, the administrator cannot access the approve/reject web page (and other Matrix infrastructure orchestration pages) from the notification email that asks the administrator to continue or reject a user request. An access page error appears instead of the expected infrastructure orchestration request web page.

This error occurs when the infrastructure orchestration CMS is configured to use a private network, and the private network communicates with a public network. The private network is only accessible from the IO CMS, and it is used to provision virtual and physical infrastructures. IO notification email is set with the private network settings which does not allow external access to the URLs contained in the notification email.

### Action
1. Open HP Operations Orchestration Studio and log in using valid credentials.
2. Expand the Configuration node.
3. Expand the System Properties node.
4. Double click the HpioCmsIp property.
5. Click the Lock button to check out the property.
6. Update the property value to the hostname of the CMS.
7. Click Save and Check in.

### Operations Orchestration

#### Operations Orchestration Studio installation fails with error

**Studio version: 9.00 does not match Central version: 2.0. Setup will exit**

### Issue
Cannot install Operations Orchestration Studio. The following error is displayed: Studio version: 9.00 does not match Central version: 2.0. Setup will exit.

The correct version of Operations Orchestration Studio is installed on the CMS based on the OS type (32-bit or 64-bit) during the installation of infrastructure orchestration. Click the gear icon in the infrastructure orchestration designer Workflows tab to download only the 32-bit version of Operations Orchestration Studio.

### Possible cause
Attempted installation of the 32-bit version of Operations Orchestration Studio on a 64-bit CMS OS.

### Action
If there is a 64-bit OS installed on the CMS, install the 64-bit version of Operations Orchestration Studio available on the HP Insight Management DVD #2, in the /matrixio folder.

### Editing ESA flows when Operations Orchestration is not installed in the default path

### Issue
If infrastructure orchestration is installed other than in the default path (`..\Program Files\HP\Matrix infrastructure orchestration`), the workflows operations must be edited to reference the path where IO is installed.

### Possible cause

### Action
2. At the login prompt, log in to the Operations Orchestration administrator account using the following credentials:
   a. Username: admin
   b. Password: the Insight Management service account password specified during the installation
3. In the tree displayed in the left pane, expand Library, then expand Hewlett-Packard→ESA→Server→Flows.
4. Double-click the Get Inventory flow and check out the flow.
5. Double-click the Readfile operation.
6. In the Inspector grid, click the arrow button on the right side and edit the path displayed in the Constant Value field to match the actual path.
Matrix infrastructure orchestration Windows service

Matrix infrastructure orchestration may time out while waiting for the server to be recognized

<table>
<thead>
<tr>
<th>Issue</th>
<th>Matrix infrastructure orchestration may time out while waiting for the server to be recognized.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>Long server post times, particularly when using the BL620c G7 or the BL680c G7.</td>
</tr>
</tbody>
</table>
| Action | To avoid this issue on any server:  
1. Edit `..\Program Files\HP\Matrix infrastructure orchestration\conf\hpio.properties` and set the `retry.count.ares.pxe` parameter to a value greater than 30.  
2. Restart the HP Matrix infrastructure orchestration service. |

HP Matrix infrastructure orchestration service may not start automatically after a system restart with error Unable to retrieve database password from mxpassword

<table>
<thead>
<tr>
<th>Issue</th>
<th>HP Matrix infrastructure orchestration service may not start automatically after a system restart. The following error is displayed: Unable to retrieve HPIO's database password from mxpassword.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>When the CMS is under a high usage (mostly during services startup), the Systems Insight Manager <code>mxpassword</code> command can take more than one minute to return, causing a failure during infrastructure orchestration startup pre-conditions checking.</td>
</tr>
</tbody>
</table>
| Action | Perform one of the following actions.  
• Manually start the HP Matrix infrastructure orchestration service after other services have completed startup.  
• Increase the timeout and the number of attempts performed by IO to retrieve the required information. Increase the following properties in `..\Matrix infrastructure orchestration\conf\hpio.properties`  
  - `launcher.mxpasswd.retry.count`  
    Number of times that IO executes the `mxpassword` command if it fails. Default is 6.  
  - `launcher.mxpasswd.retry.timeout`  
    Time, in seconds, between each attempt. Default is 30 seconds. |

CMS crash recovery

Create Service request does not complete successfully after CMS crash recovery

<table>
<thead>
<tr>
<th>Issue</th>
<th>Create Service request does not complete successfully when resumed after CMS is recovered from a crash. Manual steps recommended by IO are inadequate to recover the logical server and re-issue the request successfully.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>VCEM and Virtual Connect Manager (VCM) are out of sync due to a CMS crash that occurred while assigning a server profile.</td>
</tr>
<tr>
<td>Action</td>
<td></td>
</tr>
</tbody>
</table>
• Perform VC Domain maintenance. See [HP Virtual Connect Enterprise Manager User Guide](#) for more information.  
• Delete the `clean-me-<LS>logical server` for any that are listed.  
• Move the blade from Maintenance to another server pool which frees up the server IP address and marks the blade as available.  
• Refresh server resources from logical server management.  
• Re-issue the infrastructure orchestration Create Service request. |
Deactivate physical server does not complete successfully after CMS crash recovery

<table>
<thead>
<tr>
<th>Issue</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deactivate physical server does not complete successfully when resumed after CMS is recovered from a crash. Manual steps recommended by IO are inadequate to recover the logical server and re-issue the request successfully.</td>
<td></td>
</tr>
</tbody>
</table>

| Possible cause | VCEM and VCM are out of sync due to a CMS crash that occurred while unassigning a server profile. |

| Action | • Perform maintenance of the VC Domain Group in VCEM, which unassigns the server profile. See *HP Virtual Connect Enterprise Manager User Guide* for more information.  
• Move the logical server from Maintenance to another server pool. This frees up the server IP address and marks the blade as available.  
• Refresh server resources from logical server management.  
• Activate the server from logical server management.  
• Re-issue the infrastructure orchestration Deactivate request. |

Activate/deactivate virtual server does not complete successfully after CMS crash recovery

<table>
<thead>
<tr>
<th>Issue</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>An activate or deactivate virtual server operation does not complete successfully when resumed after CMS is recovered from a crash, and the service may remain with a Partial/Down status.</td>
<td></td>
</tr>
</tbody>
</table>

| Possible cause | The activate/deactivate request does not complete and the current state of the VM is unknown. |

| Action | • Perform a manual refresh. In Matrix OE visualization, select **Tools**→**Logical Servers**→**Refresh**.  
• Manually activate or deactivate the servers that have an incorrect state. |

Create/delete virtual server does not complete successfully after CMS crash recovery

<table>
<thead>
<tr>
<th>Issue</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A create/delete virtual server operation does not complete successfully when resumed after CMS is recovered from a crash.</td>
<td></td>
</tr>
</tbody>
</table>

| Possible cause | The created VMs are not deleted and resources are not released. |

| Action | • If the service still exists, delete the service in infrastructure orchestration.  
• Perform a manual clean-up process for the logical server, including manually deleting the virtual machines from VMware vCenter. See “Manual clean-up process (virtual)” (page 197).  
• For the create operation, re-submit the infrastructure orchestration service request. |

Add Disk request for an ESX virtual server does not complete successfully after CMS crash recovery

<table>
<thead>
<tr>
<th>Issue</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add Disk request for an ESX virtual server does not complete successfully when resumed after CMS is recovered from a crash.</td>
<td></td>
</tr>
</tbody>
</table>

| Possible cause | A CMS crash occurred while vCenter was creating a virtual disk, causing an incomplete disk creation. |

| Action | • Remove the partially created virtual disk file from vCenter.  
• Refresh server resources from logical server management.  
• Re-issue the Add Disk request. |
Log files

How can I find out more details about an error?

<table>
<thead>
<tr>
<th>Issue</th>
<th>How can I find out more details about an error?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>See the hpio-controller.log file located at ..\Program Files\HP\Matrix infrastructure orchestration\logs on the CMS.</td>
</tr>
<tr>
<td>Action</td>
<td>—</td>
</tr>
</tbody>
</table>

vCenter server is not configured in Systems Insight Manager or becomes unavailable

<table>
<thead>
<tr>
<th>Issue</th>
<th>vCenter server is not configured in Systems Insight Manager or becomes unavailable. Matrix infrastructure orchestration may generate a large number of these messages causing the infrastructure orchestration log file to grow very rapidly.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>If there are ESX hosts registered with Insight Control virtual machine management, but vCenter credentials are not configured in virtual machine management, infrastructure orchestration keeps logging an error that virtual machine management is not configured to communicate with vCenter.</td>
</tr>
<tr>
<td>Action</td>
<td>• Register the system credentials of the discovered vCenter node in Systems Insight Manager and add the VME credentials using the Systems Insight Manager Options→VME Options→Add or Edit VME Credentials menu selection.</td>
</tr>
<tr>
<td></td>
<td>• Verify that the “VMware vCenter Management Webservices” service is started.</td>
</tr>
<tr>
<td></td>
<td>• As a workaround (if you are not performing VM provisioning on ESX) and this message is causing the infrastructure orchestration log file to grow rapidly, configure infrastructure orchestration to Hyper-V only mode. Change the following property in the ..\Program Files\HP\Matrix infrastructure orchestration\conf\hpio.properties file:</td>
</tr>
<tr>
<td></td>
<td># Set this value to true if the only hypervisors in the managed environment is MS Hyper-V</td>
</tr>
<tr>
<td></td>
<td>only.hyperv.hypervisors = true</td>
</tr>
<tr>
<td></td>
<td>After updating the hpio.properties file, restart the HP Matrix infrastructure orchestration.</td>
</tr>
</tbody>
</table>

Corrective procedures

Manually updating the chargeback database

Chargeback server is not running

<table>
<thead>
<tr>
<th>Issue</th>
<th>If the chargeback server is not running for any reason, the chargeback database will be out of date.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>—</td>
</tr>
<tr>
<td>Action</td>
<td>Execute the Update_Chargeback_DB.py command to force chargeback database population for a given day or sequence of days.</td>
</tr>
<tr>
<td></td>
<td>Run Update_Chargeback_DB.py located in the default location at ..\Program Files\HP\Matrix infrastructure orchestration\chargeback.</td>
</tr>
<tr>
<td></td>
<td>To run the tool, Python and pyodbc must be installed on the CMS. The tool can be executed only by a user with administrative rights to the database. The command uses Windows authentication mode to connect to the database.</td>
</tr>
<tr>
<td></td>
<td>Command usage, where start_date and end_date are specified as yyyy-MM-dd:</td>
</tr>
<tr>
<td></td>
<td>Update_Chargeback_DB.py start_date [end_date] [-force]</td>
</tr>
</tbody>
</table>
Troubleshooting communication failures

<table>
<thead>
<tr>
<th>Issue</th>
<th>Troubleshooting communication failures.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>—</td>
</tr>
</tbody>
</table>
| Action | • Verify that the vCenter credentials are correct on Systems Insight Manager.  
• Verify that the virtual machine hosts are correctly registered to Insight Control virtual machine management usage and are not reporting issues on Systems Insight Manager  
• Verify that Matrix OE is correctly displaying the resources (physical or virtual)  
• Verify the Onboard Administrator credentials were added to enclosure node on Systems Insight Manager  
Correct any communication issues and then wait for the next synchronization cycle. The resources should display correctly in the infrastructure orchestration Unassigned Pool. |

Resources not displaying and increasing timeouts

<table>
<thead>
<tr>
<th>Issue</th>
<th>One or more types of infrastructure orchestration resources (for example, virtual networks) are not displayed in infrastructure orchestration’s user interfaces.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause</td>
<td>Due to a large number of resources to fetch, one or more of infrastructure orchestration's resource fetch operations may have timed out, waiting for completion. By default, infrastructure orchestration is configured to fetch resources of each type for up to 5 minutes.</td>
</tr>
</tbody>
</table>
| Action | On the CMS on which infrastructure orchestration is running, timeouts can be configured in the hpio.properties file, located for example at: ..\Program Files\HP\Matrix infrastructure orchestration\conf\hpio.properties.  
The primary timeout properties that might need to be increased are the following:  
• timeout.get.serverpools  
• timeout.get.subnets  
For large numbers of Software Automation (SA) or deployment images, the property is timeout.get.images.  
Other timeout properties available to configure are the following:  
• timeout.get.storagepools  
• timeout.generate.storage.entry  
• timeout.get.vmtemplates  
• timeout.get.deployment.services  
For example, to increase fetch subnets timeout from the default value of 5 minutes to 15 minutes, modify the line: timeout.get.subnets = 5 to: timeout.get.subnets = 15. |

Manual clean-up process (physical)

If an infrastructure orchestration physical server deployment or delete service request fails, perform a manual clean-up process, which includes the following:

• Fully erase the operating system from the boot disks.  
• Detach the blade from the storage.  
• Return the blade to an infrastructure orchestration server pool for a future provisioning request.  
This type of failure forces the server blade to move to the infrastructure orchestration Maintenance pool and the Matrix OE logical server is renamed with the prefix “Clean-me-“.
The server profile and boot disk are preserved, enabling an administrator to determine the cause of the failure and perform any required maintenance before returning the server blade to a user pool. Manual clean-up of the failed server blade depends on the deployment server used to provision it.

**For Insight Control server deployment:**
1. Power on the server blade.
2. Make sure that the attached boot LUN erases, by doing one of the following:
   - Run the *Erase ProLiant ML/DL/BL Array Configuration {LinuxPE}* job from the Insight Control server deployment console. This is the preferred option.
   - Alternatively power on the server blade, then press **F9**, and select *Advanced Options* → *Erase Boot Disk*.
3. Verify that the server blade is powered off after completing the preceding step. Manually power off the server blade, if needed.
4. Manually delete the server blade from the Insight Control server deployment console.

**For Ignite-UX**
1. Power on the server blade and allow it to boot the operating system.
2. From the CMS, run the mxtool *Ignite Erase Disks* by typing this command into a Windows command prompt:
   ```
   *mxexec -t "Ignite Erase Disks" -n <ip>*
   * where <ip> is the IP address of the Ignite server being cleaned
   ```

**For HP Server Automation (SA):**
1. Power on the server blade.
2. Press F9, and select *Advanced Options, Erase Boot Disk*.
3. Boot again, and press F9 again, and select the NIC as the first boot device.
4. Verify that the server blade is powered off after completing the above step. Manually power off the blade server, if needed.
5. The server blade may exist in the device list in either the *Unprovisioned Servers* list or the *Unmanaged Servers* list, identified by its MAC address (switch to the Hardware or Network view to see the MAC address). Manually delete the server blade from either list.

After completing the previous steps based on the deployment server being used, do the following to allow the storage pool entry to be selected in a future provisioning request:
1. Deactivate the associated Matrix OE logical server (if it is active) by using the Matrix OE menu: *Tools* → *Logical Servers* → *Deactivate*.
2. After the associated logical server is inactive, delete the logical server using the Matrix OE menu: *Delete* → *Delete Logical Server*.

In the *Delete Logical Server* screen, enter *Yes* for Type *YES* to proceed with this operation:

**NOTE:** Do not select the *Unmanage Logical Server* option. Doing so will cause the logical server storage pool entry to be modified to contain new WWNs without regard to presentation or zoning. Follow the procedure in “Configuring storage pool entries, FC zones, and disk array presentations” (page 197) to resolve this issue.
3. Verify that the VC profile associated with the failed server blade exists in Virtual Connect Enterprise Manager. If the profile exists, unassign and delete the VC profile associated with the failed server blade from Virtual Connect Enterprise Manager.

4. Move the server blade out of the infrastructure orchestration Maintenance pool.
   a. In the infrastructure orchestration console (accessed from Systems Insight Manager), select the original server blade pool and click Modify.
   b. Move the failed server from the infrastructure orchestration Maintenance Pool back to the server blade pool and then save the pool.

Manual clean-up process (virtual)

A Clean-me logical server appears for a virtual server when an infrastructure orchestration virtual server deployment fails or infrastructure orchestration virtual server delete service request fails. With these failures, the server blade is moved to the infrastructure orchestration maintenance pool, and the Matrix OE logical server is renamed with the prefix Clean-me.

When infrastructure orchestration deploys a virtual machine, it creates a directory structure into which the virtual machine is provisioned. The directory that is created follows the pattern: <VMFS Volume>\<Service Name>\<VM Name>. This folder contains all the folders and files corresponding to the virtual logical servers. Delete this folder and all its contents.

For ESX:
1. In Matrix OE visualization, select Tools → Logical Servers → Refresh.
2. In the Logical Server perspective, verify that the logical server no longer exists. If it exists, delete it using Delete → Delete Logical Server.
3. Use the vCenter client to browse the ESX server’s datastore.
4. Delete the VM, if it exists.
5. Browse to the ESX server’s datastore.
6. Navigate to the directory and delete the offending directory and directory contents.

For Hyper-V:
1. In Matrix OE visualization, select Tools → Logical Servers → Refresh.
2. In the Logical Server perspective, verify that the logical server no longer exists. If it exists, delete it using Delete → Delete Logical Server.
3. Connect to the Hyper-V hypervisor.
4. Delete the VM from the Hyper-V Manager.
5. Navigate to the directory and delete the offending directory and directory contents.

If Server Automation (SA) deployment was used to provision the VMs:
1. Remove the ESX and/or Hyper-V VMs using the preceding steps.
2. Connect to the SA Core Server.
3. From the SA devices list (All Managed Servers), select the VMs.
4. Perform a deactivate and a delete.

Configuring storage pool entries, FC zones, and disk array presentations

The following procedure is the HP recommended approach for configuring storage pool entries, FC zones, and disk array presentations.

1. Create a storage pool entry within the Matrix Operating Environment using the storage pool management screen from Matrix OE. In this example, the storage pool entry is defined as follows:
1. In this example, the storage pool entry name is “e5_win_BD_05”. The figure highlights the SAN which is being connected to, as well as the target, and the initiator WWNs.

2. Go to the storage fabric and create the zone. In this example, a switch which exists in “san3” above is connected. The zone should have the same name as the storage pool entry, as is shown by the highlighted entry.
3. Go to the disk array management interface (in this case CommandView managing an EVA) and create a host entry and present the LUN. In the first figure, the host entry that is created on the EVA uses the same name as the storage pool entry. The host entry is assigned the initiator WWN identified in the storage pool entry:

4. Create the vdisk on the EVA and present it to the host above:
In this example, only a single vdisk is required by the storage pool entry. The names are kept the same across the storage pool entry, the FC zone, the host entry on the array, and the vdisk. This approach supports a strong correlation of the resources in the different tools. It is also possible to define a storage pool entry with multiple LUNs. In this case, the naming of the vdisk could follow a pattern of a common prefix (for example, e10_vc_w2k_1, 2, 3, 4, and so on). HP recommends selecting a naming convention, and then following that pattern across all the tools.

Correcting a checksum error

If power is removed from the server during the power on sequence, an invalid checksum error might occur in the Fibre Channel HBA firmware. If this error occurs, the following message appears during server power up:
1. To correct this issue, press the **CTRL+Q** keys to launch the HBA Fast!UTIL utility. The following screen appears:

2. On this screen, press the **Enter** key. Pressing Enter corrects NVRAM and generates a new checksum. During this process and server reboot, Virtual Connect continues to supply the HBA configuration parameters preventing data loss.

After pressing Enter the following screen appears, indicating that the NVRAM has been corrected.
3. Press the **ESC** key to exit the utility. The following screen appears:

4. Press the **Enter** key to reboot the system. When the system reboots, all the HBA configuration parameters are resupplied by Virtual Connect and the server returns to normal operation.

**Increasing VMware Service console memory and CPU shares**

The memory and CPU shares that are allocated to the VMware Service console may be increased to obtain better performance on the VM Host. Login in to the vCenter server which is providing management for the VM Host(s) and perform the following changes:

1. Increase the amount of RAM assigned to the ESX 3.X or ESX 4.X Service console:
   a. Log in to vCenter from the Virtual Infrastructure Client with a user that has administrative rights.
   NOTE: If you do not have vCenter, log in directly to the ESX host as root.
   b. From the Inventory select the ESX Server host.
   c. Select the **Configuration** tab.
   d. Click **Memory**.
   e. Click **Properties**.
   f. On the Memory window enter a value between 256MB and 800MB for the service console parameter.
   NOTE: For troubleshooting purposes, VMware recommends increasing the service console RAM to 800MB.
g. Click **OK**. The changes do not take effect until the ESX host is rebooted.

For more information on rebooting an ESX host, see the following VMware KB article: [http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=1003501](http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=1003501).

2. Increase the number of CPU shares assigned to the ESX 3.X or ESX 4.X Service console:
   a. Log in to vCenter from the Virtual Infrastructure Client with a user that has administrative rights.
   b. Select the VM Host from the left-hand side tree browser.
   c. Select **Configuration**.
   d. From the **Software** panel, select **System Resource Allocation**.
   e. Select **Advanced**.
   f. From the System Resource Pools, select **console**.
   g. Select **Edit Settings**.
   h. Adjust the **Shares**: to **High**.
   i. If the Reservation value is less than 0.5 of Limit: value, adjust the Reservation limit to 0.7 of the Limit: value. In the example below, Limit is: 3065 MHz and 0.7 of this value is 2145.
j. Click **OK** to apply the values.

**NOTE:** Increasing the reservation value for console may affect the available CPU cycles for the virtual machines on the host.
8 Support and other resources

Information to collect before contacting HP

Be sure to have the following information available before you contact HP:

- Software product name
- Hardware product model number
- Operating system type and version
- Applicable error message
- Third-party hardware or software
- Technical support registration number (if applicable)

How to contact HP

Use the following methods to contact HP technical support:

- See the Contact HP Worldwide website for contact options:
  http://www.hp.com/go/assistance
- Use the Contact hp link on the HP Support Center website:
  http://www.hp.com/go/hpsc
- In the United States, call 1-800-334-5144 to contact HP by telephone. This service is available 24 hours a day, 7 days a week. For continuous quality improvement, conversations might be recorded or monitored.

Registering for software technical support and update service

HP CloudSystem Matrix includes as standard, three or one year of 24 x 7 HP Software Technical Support and Update Service and 24 x 7 four hour response HP Hardware Support Service. This service provides access to HP technical resources for assistance in resolving software implementation or operations problems.

The service also provides access to software updates and reference manuals in electronic form as they are made available from HP. Customers who purchase an electronic license are eligible for electronic updates.

With this service, Insight Management software customers benefit from expedited problem resolution as well as proactive notification and delivery of software updates. For more information about this service, see the following website:

http://www.hp.com/services/insight

Registration for this service takes place following online redemption of the license certificate.

How to use your software technical support and update service

As HP releases updates to software, the latest versions of the software and documentation are made available to you. The Software Updates and Licensing portal gives you access to software, documentation and license updates for products on your HP software support agreement.

You can access this portal from the HP Support Center:

http://www.hp.com/go/hpsc

After creating your profile and linking your support agreements to your profile, see the Software Updates and Licensing portal at http://www.hp.com/go/hpssoftwareupdatesupport to obtain software, documentation, and license updates.
Warranty information

HP will replace defective delivery media for a period of 90 days from the date of purchase. This warranty applies to all Insight Management software products.

HP authorized resellers

For the name of the nearest HP authorized reseller, see the following sources:

- In the United States, see the HP U.S. service locator web site: http://www.hp.com/service_locator
- In other locations, see the Contact HP worldwide web site: http://welcome.hp.com/country/us/en/wwcontact.html

Documentation feedback

HP welcomes your feedback. To make comments and suggestions about product documentation, send a message to:

docsfeedback@hp.com

Include the document title and manufacturing part number in your message. All submissions become the property of HP.

Security bulletin and alert policy for non-HP owned software components

Open source software (such as OpenSSL) or third-party software (such as Java) are sometimes included in HP products. HP discloses that the non-HP owned software components listed in the Matrix Operating Environment end user license agreement (EULA) are included with Matrix OE.

To view the EULA, use a text editor to open the /opt/vse/src/README file on an HP-UX CMS, or the <installation-directory>/src/README file on a Windows CMS. (The default installation directory on a Windows CMS is C:\Program Files\HP\Virtual Server Environment, but this directory can be changed at installation time.)

HP addresses security bulletins for the software components listed in the EULA with the same level of support afforded HP products.

HP is committed to reducing security defects and helping you mitigate the risks associated with security defects when they do occur. HP has a well defined process when a security defect is found that culminates with the publication of a security bulletin. The security bulletin provides you with a high level description of the problem and explains how to mitigate the security defect.

Subscribing to security bulletins

To receive security information (bulletins and alerts) from HP:

1. Open a browser to the HP home page:
   http://www.hp.com

2. Click the Support & Drivers tab.

3. Click Sign up: driver, support, & security alerts, which appears under Additional Resources in the right navigation pane.

4. Select Business & IT Professionals to open the Subscriber’s Choice web page.

5. Do one of the following:
   - Sign in if you are a registered customer.
   - Enter your e-mail address to sign-up now. Then, select the box next to Driver and Support alerts and click Continue.
Related information

Documentation and support

The latest versions of manuals and white papers for HP Matrix Operating Environment and related products can be downloaded from the HP Web. Documents for Matrix Operating Environment software can be found at http://www.hp.com/go/matrixoe.

For more information about HP Matrix Operating Environment infrastructure orchestration and related products and solutions, visit the following HP websites:

- HP Matrix Operating Environment website at http://www.hp.com/go/matrixoe
- HP Insight Control website at http://www.hp.com/go/insightcontrol/
- HP Insight Control virtual machine management website at http://www.hp.com/go/vmmanage
- HP Insight Control server deployment website at http://www.hp.com/go/rdp
- VMware Documentation at http://www.vmware.com/support/pubs
- Ignite-UX Documentation at http://www.hp.com/go/ignite-ux-docs
- HP Server Automation (SA) Documentation at http://support.openview.hp.com/selfsolve/documents

Matrix infrastructure orchestration documentation

For more information regarding HP Matrix Operating Environment infrastructure orchestration, see the following sources which are available for the current release:

- HP Insight Management Support Matrix
- HP Matrix Operating Environment Release Notes
- HP Insight Management Installation and Configuration Guide
- HP CloudSystem Matrix How-To Guide: ESXi Cluster Provisioning
- Cloud bursting with CloudSystem Matrix infrastructure orchestration and HP Cloud Services or Amazon EC2
- Cloud bursting with CloudSystem Matrix infrastructure orchestration and Savvis
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**HP Virtual Connect Enterprise Manager**

HP’s enclosure-spanning hardware virtualization management software product.

**IE**

See Internet Explorer.

**infrastructure orchestration console**

A web application (Systems Insight Manager plug-in) that enables you to deploy, manage, and monitor the overall behavior of infrastructure orchestration and its users, templates, services, and resources.

**infrastructure orchestration designer**

A web application that enables you to plan and design multi-server, multi-tier infrastructures using a drag-and-drop interface.

**infrastructure orchestration self service portal**

A web application that enables you to create infrastructure services from published templates. You can view the available templates, select a template that meets your provisioning requirements, and submit a service request.

**infrastructure service**

A running configuration of infrastructure resources that is designed to run a business application such as a multi-tier web application. It is also referred to as a service or service instance. Infrastructure resources include server blades, virtual machines, SAN disks, networks, and IP addresses.

**Internet Explorer (IE)**

Microsoft’s web browser.

**Internet Protocol version 6**

Internet Protocol version 6 is the next-generation Internet Protocol designated as the successor to IPv4.

**IPv6**


**lease period**

The duration, or lifetime, of an infrastructure service. It is set or changed by the user.

**logical unit number**

The identifier of a SCSI, FibreChannel or iSCSI logical unit.

**LUN**

See logical unit number.

**MAC**

See Medium Access Control.

**Medium Access Control**

A unique identifier assigned by the manufacturer to most network interface cards (NICs) or network adapters. In computer networking, a Media Access Control address. Also known as an Ethernet Hardware Address (EHA), hardware address, adapter address or physical address.

**Multi-initiator NPIV**

Enables an administrator to predefine pools of SAN storage and then flexibly assign the storage to different servers over time. Each storage pool entry defines one or more LUNs, their location on the SAN, and one or more server side initiators which are permitted to access the LUNs. Using HBA port virtualization, a server is flexibly granted access to one or more storage pool entries. This approach to storage management ensures that the SAN administrator retains full management control over all of the SAN resources and provides the Server Administrator the flexibility to automate the Logical Server storage management tasks.

**private**

A subnet that is not routed outside the data center and typically contains addresses only in the 192.x.x.x or 10.x.x.x address ranges.

**provisioning**

The process of creating a service from a template. Through the infrastructure orchestration self service portal or the infrastructure orchestration console, a user submits a request to create the service and infrastructure orchestration searches its inventory allocating the computing resources to all logical resource definitions in the template.

**public**

A subnet that is accessible to the Internet and cannot contain IP addresses in the 192.x.x.x or 10.x.x.x address ranges.

**RDP**

See See HP Insight Control server deployment. Formerly HP Insight Rapid Deployment software.

**re recoverable**

Is the ability to restore your deployment to the point at which the failure occurred. The ability to recover quickly from a system failure or disaster depends not only on having current backups of your data, but also on having a predefined plan for recovering that data on new hardware.

**redundant SAN**

The duplication of components to prevent failure of the SAN solution.

**Registered State Change Notification**

In Fibre channel protocol, RSCN is a Fibre Channel fabric’s notification of any major fabric changes. RSCN is sent to all specified nodes, to enable nodes to react accordingly to the changes.
request
A self service user action requiring administrative approval. Requests are generated while performing other tasks such as a service instantiation or deletion. Requests are generated when a user wants to:
- Create a service
- Delete a service
- Deactivate a server
- Activate a server
- Update a service to add servers
- Update a service to add storage
- Change the lease period

resource pool
A group of physical and virtual resources managed by Matrix Operating Environment. An administrator controls resource utilization by allowing users access to resource pools.

RSCN
See Registered State Change Notification.

server group
A set of one or more servers that can be treated as a tier enabling the construction of a multi-tier infrastructure service. The servers in a tier must be homogeneous, and must satisfy all group attributes.

storage area network
A network (or subnetwork) that connects data storage devices with associated data servers. A storage area network is typically part of an overall network of computing resources.

storage pool entry
A means for Matrix OE to track storage within the context of a storage pool (with one storage pool for each portability group). The storage pool entry contains information on the needs/requirements (size, RAID level, tags, server initiator WWNs) as well as the storage meeting those needs (storage controller WWNs, LUN information). Matrix OE supports three storage pool entry types: one for manual storage specification and two for fulfillment via the HP Storage Provisioning Manager. As logical servers need storage, they are associated with one or more storage pool entries.

template
A design blueprint that specifies the requirements for an infrastructure service in terms of server groups, networks, storage, and contains customization points that use Operations Orchestration workflows during the execution of a request.

Uniform Resource Locator
Specifies where on the Internet/World Wide Web an identified computing resource is available and the mechanism for retrieving it.

Universally Unique Identifier
A unique identifier used to enable distributed systems to uniquely identify information with significant central coordination.

URL
See Uniform Resource Locator.

user
A user who creates infrastructure services by provisioning templates from a prioritized list of resource pools and specifies the service lease period for the start and end of the overall service through the infrastructure orchestration self service portal.

UUID
See Universally Unique Identifier.

VC
See Virtual Connect.

VCEM
See Virtual Connect Enterprise Manager.

template
VMware’s enterprise-level virtualization management product.

Virtual Connect
HP’s hardware virtualization product, primarily for blade servers.

virtual interface
An IP address that is used as the single network address to multiple clustered servers executing an application package. A virtual interface is also known as a service IP.

Windows Internet Name Service
Microsoft’s name server and service (similar to DNS for domain names) - mapping between host names and network addresses.

WINS
See Windows Internet Name Service.

workflow
Defines a set of linked actions that automate customer-specific IT tasks in an infrastructure orchestration-provisioned service. Operations Orchestration workflows are created, modified, and saved using Operations Orchestration Studio, the workflow designer embedded in infrastructure orchestration. You can use workflows to define integration with your IT processes,
including approvals, manual operating system deployment, manual storage provisioning, and sending notifications. You can also associate workflows with infrastructure orchestration templates. These service action workflows are executed before and after the associated request. They are intended to perform actions specific to the template and services created from it. Sample workflows are available in the folder Library/Hewlett-Packard/infrastructure orchestration/Service Actions/Samples. You can use these sample workflows as-is, copy, or modify them.

**World Wide Name**  
A unique identifier which identifies a particular Fibre Channel (FC), Advanced Technology Attachment (ATA) or Serial Attached SCSI (SAS) target. Each World Wide Name is an 8 byte identifier.

**WWN**  
See World Wide Name.
A Customizable allocation process

Overview

Matrix infrastructure orchestration performs automated resource allocation using a built-in allocation mechanism, as described above. This built in allocator is the default allocation mechanism. In addition, a customizable allocation mechanism can be used instead of the built in allocator for some parts of the resource customizable allocation process. The customizable allocator supports a flexible, rule based fitting process using the JBoss Drools rule engine (http://www.jboss.org/drools). You can configure infrastructure orchestration to enable selective rule based fitting processes, which can be customized as needed. By default, all of the rule based fitting processes are disabled — the built in allocator’s fitting process is used. This section describes how to enable rule based fitting processes.

Policy configuration file

The customizable allocation process uses pre-defined policy hooks in the ..\Program Files\HP\Matrix infrastructure orchestration\conf\policy configuration file. The policy file (policy.xml) contains multiple pre-defined entry points (or hooks), enabled state, and the corresponding rule files. A sample entry in the policy.xml file is shown in the following figure.

```xml
<policy enabled="false" name="PhysicalServerPolicyCheck.applyFitting">
  <policy-rule-file>
    ServerCheck.drl,
    PhysicalServerCheck.drl
  </policy-rule-file>
</policy>
```

- The name PhysicalServerPolicyCheck.applyFitting in the figure indicates the entry point or hook for the physical server fitting process.
- The enabled flag, enables or disables the rule-based fitting for this hook.
- The <policy-rule-file> provides the list of rule files to apply during the fitting process.

When the customizable allocation process initiates, infrastructure orchestration reads the policy.xml file and uses this information to locate the fitting process to use by referencing the corresponding hook status. If the hook is enabled, the hook uses the rule-based fitting process, otherwise it continues to use the default fitting process.

Restart the infrastructure orchestration Windows service to reflect any changes made to the policy file.

Rule file

A rule file is typically a text file with a .drl extension. In a .drl file, there can be multiple rules, queries, and functions, as well as resource declarations assigned and used by the rules and queries. Separate rules into multiple rule files to help manage large numbers of rules.

The overall structure of a rule file is:
- package package-name
- imports
- globals
- functions
- queries
- rules
The order in which the elements are declared is not important, except for the package name. If declared, the package name must be the first element in the rule file.

**Example: Rule to verify server memory criteria**

```java
package com.hp.hpio.controller.policy;
import java.util.List;
import java.lang.Integer;
import com.hp.hpio.controller.wrapper.LogicalServerWrapper;
import com.hp.hpio.common.messages.HPIOBundleKey;
import com.hp.hpio.common.messages.HPIOMessage;
dialect *"java* // Since we are using Java syntax with drools

/* INIT should be the first rule in a drl file which inserts service
 * entity, resource list and result map into working memory by reading
 * from PolicyExecutionVO passed to rule engine.
 */
rule "INIT"
salience 1000
when
pVO : PolicyExecutionVO();
then
insert(pVO.getAllocationEntry().getServiceEntity());
insert(pVO.getResultMap());
insert(pVO.getResourceList());
end

/* Rule to check memory criteria for a given service entity
 * (LogicalServer) compared to list of physical resources available
 * (ComputeServer)
 */
rule "MemorySizeCriteria"
when
$pVO : PolicyExecutionVO( );
$resList : List();
$logicalServer : LogicalServer();
$computeServer : ComputeServer() from $resList;
 eval(memorySizeCriteria($logicalServer, $computeServer, $pVO));
then
$pVO.match($computeServer, HPIOMessage.get(HPIOBundleKey.ALLOCATION_CRITERIA_MEMORY));
end

function boolean memorySizeCriteria(
 LogicalServer logicalServer,
 ComputeServer computeServer,
 PolicyExecutionVO pVO) {
 pVO.doesNotMatch(computeServer,HPIOMessage.get(HPIOBundleKey.ALLOCATION_CRITERIA_MEMORY));

  /* -------------- CUSTOM LOGIC ----------------------*/
  if (computeServer.getMemoryConsumedMB() == null) {
    computeServer.setMemoryConsumedMB(0);
  }
  Integer logicalMemorySizeMB = LogicalServerWrapper.getMemorySizeMi(logicalServer);
  Integer resourceMemorySizeMB = computeServer.getMemorySizeMB() - computeServer.getMemoryConsumedMB();
  if(logicalMemorySizeMB.doubleValue() <= resourceMemorySizeMB.doubleValue()){
    return true;
  }else{
    return false;
  } /* -------------- CUSTOM LOGIC ----------------------*/
```

**Customizing existing rules**

The advantage of providing a rules based allocation fitting process is the rule customization and business logic changes it allows, through modifying the CUSTOM LOGIC portion of the code.
You can modify or delete existing rules, or add new custom rules. Rules are written in Java and the Drools syntax.

Available hooks for customizing:

- `SubnetPolicyCheck.applyFitting`
- `AttributeBasedSubnetPolicyCheck.applyFitting`
- `SpecifiedSubnetPolicyCheck.applyFitting`
- `AutomaticIpAddressPolicyCheck.applyFitting`
- `StaticIpAddressPolicyCheck.applyFitting`
- `DhcpIpAddressPolicyCheck.applyFitting`
- `PhysicalServerPolicyCheck.applyFitting`
- `PhysicalBootDiskPolicyCheck.applyFitting`
- `NPIVDataDiskPolicyCheck.applyFitting`
- `VirtualServerPolicyCheck.applyFitting`
- `EsxDiskPolicyCheck.applyFitting`
- `HypervDiskPolicyCheck.applyFitting`
- `DasDiskPolicyCheck.applyFitting`
- `SoftwarePolicyCheck.applyFitting`

Writing a new rule file

Open a new `drl` file in a text editor, add the different sections of a rule file (as shown in “Rule file” (page 212)), and add the new rule logic.

- Package—The name of the package and is always `com.hp.hpio.controller.policy`.
- Import—Declares the use of any other Java classes required to write the rule business logic.
- Rules:
  - Define multiple rules in a single rule (.drl) file.
  - Each rule contains the business logic to be executed.
  - The INIT rule is a sample structure you can duplicate and use as a starting point to define custom rules.

Tools such as Eclipse (http://downloads.jboss.com/drools/updatesite3.3/) can be used to write rule files by including the Drools Eclipse plug-in to the create rule project and including the required infrastructure orchestration libraries to the project. Using Eclipse helps with syntax highlighting and auto code completion.

For more information, see the following documentation:


Example: Custom rule

```
rule "CustomRule1"
when
  $pVO : PolicyExecutionVO( );
  $resList : List();

  /* ----------------- CUSTOM LOGIC ----------------*/
  // Get service entity and resource objects.
  $logicalSubnet : LogicalSubnet();
  $subnet : Subnet() from $resList;
  // call new user defined function with required arguments
  // function has to return true in case of success or false
```
// in case of failure.
eval(customRule1($logicalSubnet, $subnet, $pVO));

/* --------------- CUSTOM LOGIC ------------------ */

then

/* --------------- CUSTOM LOGIC ------------------ */
// Since this is a custom rule/criteria construct HP1O message
// using ALLOCATION_CRITERIA_CUSTOM bundle key and providing
// allocation failure message (string) to be displayed. In case
// this rule fails. NOTE same information should be used while
// calling doesNotMatch in the custom function below.
$pVO.match($subnet, HPIOMessage.get(HPIOBundleKey.ALLOCATION_CRITERIA_CUSTOM, "Failure message"));

end

/* --------------- CUSTOM LOGIC ------------------ */

Deploying rules

1. Make sure that the rule file is valid (using the iopolicyassist tool).
2. Copy the validated rule file to ..\Program Files\HP\Matrix infrastructure orchestration\conf\policy directory.
3. Wherever applicable, update the hook <policy-rule-file> information in the policy.xml file by modifying or adding the recently defined rule file.
   <policy enabled="false" name="SubnetPolicyCheck.applyFitting">
      <policy-rule-file>
         SubnetCheck.drl,
         newrulefile.drl
      </policy-rule-file>
   </policy>
4. Do one of the following:
   - To enable any policy, modify the corresponding enabled flag to true in the policy file.
   - To disable any policy, modify the corresponding enabled flag to false in the policy file.
5. Restart the infrastructure orchestration Windows service for the changes to take effect.
This appendix describes the security of the interaction between Matrix infrastructure orchestration and HP Operations Orchestration.

Matrix infrastructure orchestration integrates with Operations Orchestration. Operations Orchestration provides customizable workflows that can be called at various points during the life of an infrastructure service. Information about the infrastructure service is exchanged between infrastructure orchestration and Operations Orchestration using HTTPS and (in some cases) SMTP. By default, IO and OO run on the same Central Management Server (CMS), however IO and OO may be configured to run on different servers and exchange data across a potentially hostile network.

Actions taken by infrastructure orchestration and Operations Orchestration are logged.

HP recommends:

• Only trusted administrators have a login on the CMS (default behavior)
• The infrastructure orchestration and Operations Orchestration configuration files are available only to trusted administrators (default behavior)
• Matrix infrastructure orchestration template creation and Operations Orchestration flow customization be limited to trusted architects (this is default behavior)
• Matrix infrastructure orchestration and Operations Orchestration are connected by a trusted corporate network and not a public or potentially hostile internet (by default infrastructure orchestration and Operations Orchestration are installed on the same server)

Matrix infrastructure orchestration and Operations Orchestration interaction

There are two types of interactions between infrastructure orchestration and Operations Orchestration.

• Administrative Actions
  Operations Orchestration workflows invoked during the lifecycle of an infrastructure service that perform administrative actions and are configured in ..\Program Files\HP\Matrix infrastructure orchestration\conf\hpio.properties.

• Service Actions
  Operations Orchestration workflows assigned to an infrastructure service template by the infrastructure orchestration architect. The architect assigns workflows at specific points of the infrastructure service lifecycle.

Data passed by infrastructure orchestration to Operations Orchestration

The data exchanged between infrastructure orchestration and Operations Orchestration includes:

• Date – The date the Operations Orchestration flow was invoked.
• User Token – A unique string used to authenticate a response from the user.
• Request XML – Data about an infrastructure service including the servers, disks, networks and storage it uses, as well as the name of the user of the service.
• User XML – Data about an infrastructure orchestration user including username, email address, last login time and user token (this token cannot be used to connect to infrastructure orchestration without username and password).
• Disk or Server identifier
• Server Group Name
• Network Interface Card (NIC) identifier

Service action workflows must receive the following parameters:

• Request XML – The XML that represents the infrastructure; for example:
• User Token – The security token to be used in calls back to infrastructure orchestration.
• Date – Date and time at which the flow was triggered by infrastructure orchestration.

NOTE: These parameters are required in the workflow definition even if the parameters are not used within the workflow.

Matrix infrastructure orchestration and Operations Orchestration communication

Matrix infrastructure orchestration uses HTTPS communication with the Operations Orchestration Server to invoke Operations Orchestration workflows and pass any data needed by the workflow. The Operations Orchestration Server may be located on the same CMS as infrastructure orchestration, or may be on a separate server. HP recommends that infrastructure orchestration and Operations Orchestration be on the same trusted corporate network.

The Operations Orchestration workflow runs with Windows Local System privilege and can be customized to run arbitrary actions such as file system reads, open network connections or send email.

For some Operations Orchestration flows, infrastructure orchestration waits for a user response before moving to the next step of an infrastructure’s lifecycle. Matrix infrastructure orchestration passes a unique, one time use User Token to these Operations Orchestration flows to Administrator-defined email recipients. This token is used to authenticate the user response. Matrix infrastructure orchestration waits until the User Token is passed back to the infrastructure orchestration Service with the correct request ID before moving to the next step of the infrastructure service’s lifecycle.

By default, these flows send email containing the URL of a response page to the infrastructure orchestration administrator. This URL contains the User Token and the ID of the request. The administrator opens the URL in a web browser, and is given a form that allows them to Continue or Reject the request. Clicking either Continue or Reject opens a HTTPS connection to the infrastructure orchestration service and passes the user token, request ID and requested action. If infrastructure orchestration confirms that the user token for the request ID is correct, then infrastructure orchestration Continues or Cancels the request as appropriate.

If the User Token was intercepted, it is possible for an unauthorized user to approve, reject, continue or cancel a step of a request on an infrastructure service. However, an administrator will notice that the infrastructure service continued without his direct action and could then take steps to correct the problem.

Administrative actions

Administrative Actions are Operations Orchestration Workflow processes invoked during lifecycle of an infrastructure service.

• Manual OS Deployment—infrastructure orchestration waits for Continued or Canceled response from user
• Manual Storage Provisioning—infrastructure orchestration waits for Continued or Canceled response from user
• Manual Storage Removal—infrastructure orchestration waits for Continued or Canceled response from user
• Manual Disk Scrubbing—infrastructure orchestration waits for Continued or Canceled response from user
• Request Approval—infrastructure orchestration waits for Approved or Rejected response from user
• Service Begin Action
• Service End Action
• Global Service End Action
• User Notification
• User Pool Notification
• Service Lease Notification
• Service Recovery
• Service Fail Action

**Service actions**

Service actions are the stages of infrastructure service that may invoke an Operations Orchestration workflow.

• Create Service Begin (or End)
• Add Servers Begin (or End)
• Add Data Disk Begin (or End)
• Change Lease Begin (or End)
• Standby Servers or Service Begin (or End)
• Resume Servers or Service Begin (or End)
• Delete Service Begin (or End)

**Configuration files and URLs used by infrastructure orchestration and Operations Orchestration**

• URL of the Operations Orchestration service:
  https://localhost:16443/PAS/services/WSCentralService

• URL of the response HTML page for approvals:
  https://localhost:51443/hpio/ooflows/ApprovalResponse.html

• URL of the HP Matrix infrastructure orchestration Service:
  https://localhost:51443/hpio/controller/

• Matrix infrastructure orchestration configuration file which specifies Operations Orchestration server and Operations Orchestration flows for administrative actions:
  ..\Program Files\HP\Matrix infrastructure orchestration\conf\hpio.properties

• Operations Orchestration logs:
  ..\Program Files\HP\Operations Orchestration\Central\logs

• Matrix infrastructure orchestration logs:
  ..\Program Files\HP\Matrix infrastructure orchestration\logs
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