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New and Changed Information for this Release

The following table provides an overview of the significant changes to this guide for this current release. The table does not provide an exhaustive list of all changes made to this guide or of all new features in this release.

**Table 1: New Features and Changed Behavior in Cisco HX Data Platform, Release 3.5(2a)**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
<th>Where Documented</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replication network and pairing considerations</td>
<td>Provides a list of pre-validation checks necessary for pairing.</td>
<td>Replication Network and Pairing Considerations, on page 182</td>
</tr>
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<td>Enhancement to configure replication network</td>
<td>Provision to add Cisco UCS Manager credentials for primary and secondary FIs (site A and site B) for Stretched Cluster.</td>
<td>Configuring the Replication Network in HX Connect, on page 187</td>
</tr>
</tbody>
</table>
Cisco HX Data Platform Overview

Cisco HyperFlex Data Platform (HX Data Platform) is a hyperconverged software appliance that transforms Cisco servers into a single pool of compute and storage resources. It eliminates the need for network storage and enables seamless interoperability between computing and storage in virtual environments. The Cisco HX Data Platform provides a highly fault-tolerant distributed storage system that preserves data integrity and optimizes performance for virtual machine (VM) storage workloads. In addition, native compression and deduplication reduce storage space occupied by the VMs and VM workloads.

Cisco HX Data Platform has many integrated components. These include: Cisco Fabric Interconnects (FIs), Cisco UCS Manager, Cisco HX specific servers, and Cisco compute only servers; VMware vSphere, ESXi servers, and vCenter; and the Cisco HX Data Platform Installer, controller VMs, HX Connect, vSphere HX Data Platform Plug-in, and stcli commands.

Cisco HX Data Platform is installed on a virtualized platform such as VMware vSphere. During installation, after specifying the Cisco HyperFlex HX Cluster name, and the HX Data Platform creates a hyperconverged storage cluster on each of the nodes. As your storage needs to increase and you add nodes in the HX cluster, the HX Data Platform balances the storage across the additional resources. Compute only nodes can be added to increase compute only resources to the storage cluster.

Storage Cluster Physical Components Overview

Cisco HyperFlex storage clusters contain the following objects. These objects are monitored by the HX Data Platform for the storage cluster. They can be added and removed from the HX storage cluster.
• **Converged nodes**—Converged nodes are the physical hardware on which the VM runs. They provide computing and storage resources such as disk space, memory, processing, power, and network I/O.

When a converged node is added to the storage cluster, a storage controller VM is installed. The HX Data Platform services are handled through the storage controller VM. Converged nodes add storage resources to your storage cluster through their associated drives.

Run the *Cluster Expansion* workflow from the HX Data Platform Installer to add converged nodes to your storage cluster. You can remove converged nodes using *stcli* commands.

• **Compute nodes**—Compute nodes add compute resource but not storage capacity to the storage cluster. They are used as a means to add compute resources, including CPU and memory. They do not need to have any caching (SSD) or storage (HDD) drives. Compute nodes are optional in a HX storage cluster.

When a compute node is added to the storage cluster, an agent controller VM is installed. The HX Data Platform services are handled through the agent controller VM.

Run the *Cluster Expansion* workflow from the HX Data Platform Installer to add compute nodes to your storage cluster. You can remove compute nodes using *stcli* commands.

• **Drives**—There are two types of drives that are required for any node in the storage cluster: Solid State Drive (SSD) and Hard Disk Drive (HDD). HDD typically provides the physical storage units associated with converged nodes. SSD typically supports management.

Adding HDD to existing converged nodes, also adds storage capacity to the storage cluster. When storage is added to a HX node in the storage cluster, an equal amount of storage must be added to every node in the storage cluster.

When disks are added or removed, the HX Data Platform rebalances the storage cluster to adjust for the change in storage resources.

Adding or removing disks on your converged nodes is not performed through the HX Data Platform. Before adding or removing disks, review the best practices. See the server hardware guides for specific instructions to add or remove disks in nodes.

• **Datastores**—Storage capacity and datastore capacity. This is the combined consumable physical storage available to the storage cluster through datastores, and managed by the HX Data Platform.

Datastores are logical containers that are used by the HX Data Platform to manage your storage use and storage resources.

Datastores are where the host places virtual disk files and other VM files. Datastores hide the specifics of physical storage devices and provide a uniform model for storing VM files.

**HX Data Platform Capacity Overview**

---

**Note**

Capacity addition in a cluster through the addition of disks or nodes can result in a rebalance. This background activity can cause interference with regular User IO on the cluster and increase the latency. You must note the time duration for the storage capacity at the time where performance impact can be tolerated. Also, this operation may be performed in urgent situations that may warrant capacity addition.

In the HX Data Platform the concept of capacity is applied to both datastores and storage clusters. Values are measured in base-2 (GiB/TiB), but for simplicity and consistency are labeled as GB or TB.
• **Cleaner**—A process run on all the storage cluster datastores. After it completes, all the storage cluster datastores total capacity should be in a similar range to the total storage cluster capacity, excluding the metadata. Datastore capacity listed typically will not match the HX storage cluster capacity. See the *Cisco HX Data Platform Command Line Interface Reference Guide* for information on the `cleaner` command.

• **Cluster capacity**—All the storage from all the disks on all the nodes in the storage cluster. This includes uncleaned data and the metadata overhead for each disk.

  The total/used/free capacity of cluster is based on overall storage capacity and how much storage is used.

• **Condition**—When the HX Storage Cluster enters a space event state, the **Free Space Status** fields are displayed. The **Condition** field lists the space event state. The options are: **Warning**, **Critical**, and **Alert**.

• **Available Datastore capacity**—The amount of storage available for provisioning to datastores without over-provisioning. Generally, this is similar to the cleaned storage cluster capacity, but it is not an exact match. It does not include metadata or uncleaned data.

  The provisioned/used/free capacity of each datastore is based on datastore (thin) provisioned capacity. Because the datastore is thin provisioned, the provisioned capacity (specified by the administrator when creating the datastore) can be well above the actual storage.

• **Free Capacity, storage cluster**—Same as available capacity. For the storage cluster, this is the difference between the amount available to the storage cluster and the amount used in the storage cluster.

• **Free capacity, datastore**—Same as available capacity. For all the storage cluster datastores, this is the difference between the amount provisioned to all the storage cluster datastores and the amount used on all the storage cluster datastores.

  The amount used on the whole storage cluster is not included in this datastore calculation. Because datastores are frequently over provisioned, the free capacity can indicate a large availability on all the storage cluster datastores, while the storage cluster capacity can indicate a much lower availability.

• **Multiple users**—Can have different datastores with different provisioned capacities. At any point in time, users do not fully utilize their allocated datastore capacity. When allocating datastore capacity to multiple users, it is up to the administrator to ensure that each user’s provisioned capacity is honored at all time.

• **Over-provisioning**—Occurs when the amount of storage capacity allocated to all the datastores exceeds the amount available to the storage cluster.

  It is a common practice to initially over-provision. It allows administrators to allocate the capacity now and backfill the actual storage later.

  The value is the difference between the usable capacity and provisioned capacity.

  It displays zero (0) value, unless more space has been allocated than the maximum physical amount possible.

  Review the over provisioned capacity and ensure that your system does not reach an out-of-space condition.

• **Provisioned**—Amount of capacity allowed to be used by and allocated to the storage cluster datastores.

  The provisioned amount is not set aside for the sole use of the storage cluster datastores. Multiple datastores can be provisioned storage from the same storage capacity.
• **Space Needed**—When the HX Storage Cluster enters a space event state, the **Free Space Status** fields are displayed. **Space Needed** indicates the amount of storage that needs to be made available to clear the listed **Condition**.

• **Used**—Amount of storage capacity consumed by the listed storage cluster or datastore.

HX Data Platform internal meta-data uses 0.5% to 1% space. This might cause the HX Data Platform Plug-in or HX Connect to display a **Used Storage** value even if you have no data in your datastore.

Storage Used shows how much datastore space is occupied by virtual machine files, including configuration and log files, snapshots, and clones. When the virtual machine is running, the used storage space also includes swap files.

• **Usable Capacity**—Amount of storage in the storage cluster available for use to store data.

### Understanding Capacity Savings

The Capacity portlet on the Summary tab displays the deduplication and compression savings provided by the storage cluster. For example, with 50% overall savings, a 6TB capacity storage cluster can actually store 9 TB of data.

The total storage capacity saved by the HX Data Platform system is a calculation of two elements:

• **Compression**—How much of the data is compressed.

• **Deduplication**—How much data is deduplicated. Deduplication is a method of reducing storage space by eliminating redundant data. It stores only one unique instance of the data.

Deduplication savings and compression savings are not simply added together. They are not independent operations. They are correlated using the following elements where essentially the amount of unique bytes used for storage is reduced through deduplication. Then the deduplicated storage consumption is compressed to make even more storage available to the storage cluster.

Deduplication and compression savings are useful when working with VM clones.

If the savings is showing 0%, this indicates the storage cluster is new. The total ingested data to the storage cluster is insufficient to determine meaningful storage savings. Wait until sufficient data is written to the storage cluster.

**For example:**

1. **Initial values**
   
   Given a VM of 100 GB that is cloned 2 times.
   
   \[
   \text{Total Unique Used Space (TUUS)} = 100 \text{GB} \\
   \text{Total Addressable Space (TAS)} = 100 \times 2 = 200 \text{ GB}
   \]
   
   Given, for this example:
   
   \[
   \text{Total Unique Bytes (TUB)} = 25 \text{ GB}
   \]

2. **Deduplication savings**
   
   \[
   \text{Deduplication savings} = (1 - \text{TUUS/TAS}) \times 100 \\
   = (1 - 100 \text{GB} / 200 \text{GB}) \times 100 \\
   = 50\%
   \]
3. Compression Savings
   \[ \text{Compression Savings} = (1 - \frac{TUB}{TUUS}) \times 100 \]
   \[ = (1 - \frac{25\text{GB}}{100\text{GB}}) \times 100 \]
   \[ = 75\% \]

4. Total savings calculated
   \[ \text{Total savings calculated} = (1 - \frac{TUB}{TAS}) \times 100 \]
   \[ = (1 - \frac{25\text{GB}}{200\text{GB}}) \times 100 \]
   \[ = 87.5\% \]

Storage Capacity Event Messages

Cluster storage capacity includes all the storage from all the disks on all the nodes in the storage cluster. This available capacity is used to manage your data.

Error messages are issued if your data storage needs to consume high amounts of available capacity, the performance and health of your storage cluster are affected. The error messages are displayed in vCenter Alarms panels, HX Connect, and HX Data Platform Plug-in Alarms and Events pages.

When the warning or critical errors appear:
Add additional drives or nodes to expand capacity. Additionally, consider deleting unused virtual machines and snapshots. Performance is impacted until storage capacity is reduced.

- **SpaceWarningEvent** – Issues an error. This is a first level warning.
  Cluster performance is affected.
  Reduce the amount of storage capacity used to below the warning threshold, of 70% total HX Storage Cluster capacity.

- **SpaceAlertEvent** – Issues an error. Space capacity usage remains at error level.
  This alert is issued after storage capacity has been reduced, but is still above the warning threshold.
  Cluster performance is affected.
  Continue to reduce the amount of storage capacity used, until it is below the warning threshold, of 80% total HX Storage Cluster capacity.

- **SpaceCriticalEvent** – Issues an error. This is a critical level warning.
  Cluster is in a read only state.
  Do not continue the storage cluster operations until you reduce the amount of storage capacity used to below this warning threshold, of 92% total HX Storage Cluster capacity.

- **SpaceRecoveredEvent** - This is informational. The cluster capacity has returned to normal range.
  Cluster storage space usage is back to normal.
HX Data Platform High Availability Overview

The HX Data Platform High Availability (HA) feature ensures that the storage cluster maintains at least two copies of all your data during normal operation with three or more fully functional nodes.

If nodes or disks in the storage cluster fail, the cluster's ability to function is affected. If more than one node fails or one node and disk(s) on a different node fail, it is called a simultaneous failure.

The number of nodes in the storage cluster, combined with the Data Replication Factor and Access Policy settings, determine the state of the storage cluster that results from node failures.

**Note**

Before using the HX Data Platform HA feature, enable DRS and vMotion on the vSphere Web Client.

Storage Cluster Status

HX Data Platform storage cluster status information is available through HX Connect, the HX Data Platform Plug-in, and the storage controller VM stcli commands. Storage cluster status is described through resiliency and operational status values.

Storage cluster status is described through the following reported status elements:

- **Operational Status**—Describes the ability of the storage cluster to perform the functions storage management and storage cluster management of the cluster. Describes how well the storage cluster can perform operations.

- **Resiliency Status**—Describes the ability of the storage clusters to tolerate node failures within the storage cluster. Describes how well the storage cluster can handle disruptions.

The following settings take effect when the storage cluster transitions into particular operational and resiliency status states.

- **Data Replication Factor**—Sets the number of redundant data replicas.

- **Cluster Access Policy**—Sets the level of data protection and data loss.

Operational Status Values

Cluster Operational Status indicates the operational status of the storage cluster and the ability for the applications to perform I/O.

The Operational Status options are:

- **Online**—Cluster is ready for IO.

- **Offline**—Cluster is not ready for IO.

- **Out of space**—Either the entire cluster is out of space or one or more disks are out of space. In both cases, the cluster cannot accept write transactions, but can continue to display static cluster information.

- **Readonly**—Cluster cannot accept write transactions, but can continue to display static cluster information.
• **Unknown**—This is a transitional state while the cluster is coming online.

Other transitional states might be displayed during cluster upgrades and cluster creation.

Color coding and icons are used to indicate various status states. Click icons to display additional information such as reason messages that explain what is contributing to the current state.

### Resiliency Status Values

Resiliency status is the data resiliency health status and ability of the storage cluster to tolerate failures.

Resiliency Status options are:

- **Healthy**—The cluster is healthy with respect to data and availability.
- **Warning**—Either the data or the cluster availability is being adversely affected.
- **Unknown**—This is a transitional state while the cluster is coming online.

Color coding and icons are used to indicate various status states. Click an icon to display additional information, such as reason messages that explain what is contributing to the current state.

### HX Data Platform Cluster Tolerated Failures

If nodes or disks in the HX storage cluster fail, the cluster's ability to function is affected. If more than one node fails or one node and disk(s) on a different node fail, it is called a *simultaneous failure*.

How the number of node failures affect the storage cluster is dependent upon:

- **Number of nodes in the cluster**—The response by the storage cluster is different for clusters with 3 to 4 nodes and 5 or greater nodes.

- **Data Replication Factor**—Set during HX Data Platform installation and cannot be changed. The options are 2 or 3 redundant replicas of your data across the storage cluster.

  ![Attention](image)

  **Attention**

  Data Replication Factor of 3 is recommended.

- **Access Policy**—Can be changed from the default setting after the storage cluster is created. The options are strict for protecting against data loss, or lenient, to support longer storage cluster availability.

### Cluster State with Number of Failed Nodes

The tables below list how the storage cluster functionality changes with the listed number of simultaneous node failures.

#### Cluster State in 5+ Node Cluster with Number of Failed Nodes

<table>
<thead>
<tr>
<th>Replication Factor</th>
<th>Access Policy</th>
<th>Number of Failed Nodes</th>
<th>Read/Write</th>
<th>Read-Only</th>
<th>Shutdown</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Lenient</td>
<td>2</td>
<td>--</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

Cisco HyperFlex Data Platform Administration Guide, Release 3.5
### Cluster State in 3 - 4 Node Clusters with Number of Failed Nodes

<table>
<thead>
<tr>
<th>Replication Factor</th>
<th>Access Policy</th>
<th>Number of Failed Nodes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Read/Write</td>
</tr>
<tr>
<td>3</td>
<td>Strict</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Lenient</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Strict</td>
<td>--</td>
</tr>
</tbody>
</table>

### Cluster State with Number of Nodes with Failed Disks

The table below lists how the storage cluster functionality changes with the number of nodes that have one or more failed disks. Note that the node itself has not failed but disk(s) within the node have failed. **For example:** 2 indicates that there are 2 nodes that each have at least one failed disk.

There are two possible types of disks on the servers: SSDs and HDDs. When we talk about multiple disk failures in the table below, it's referring to the disks used for storage capacity. **For example:** If a cache SSD fails on one node and a capacity SSD or HDD fails on another node the storage cluster remains highly available, even with an Access Policy strict setting.

The table below lists the worst case scenario with the listed number of failed disks. This applies to any storage cluster 3 or more nodes. **For example:** A 3 node cluster with Replication Factor 3, while self-healing is in progress, only shuts down if there is a total of 3 simultaneous disk failures on 3 separate nodes.

**Note**

HX storage clusters are capable of sustaining serial disk failures, (separate disk failures over time). The only requirement is that there is sufficient storage capacity available for support self-healing. The worst-case scenarios listed in this table only apply during the small window while HX is completing the automatic self-healing and rebalancing.

### 3+ Node Cluster with Number of Nodes with Failed Disks

<table>
<thead>
<tr>
<th>Replication Factor</th>
<th>Access Policy</th>
<th>Failed Disks on Number of Different Nodes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Read/Write</td>
</tr>
<tr>
<td>3</td>
<td>Lenient</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Strict</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Lenient</td>
<td>1</td>
</tr>
</tbody>
</table>
### Data Replication Factor Settings

Data Replication Factor cannot be changed after the storage cluster is configured.

Data Replication Factor is set when you configure the storage cluster. Data Replication Factor defines the number of redundant replicas of your data across the storage cluster. The options are 2 or 3 redundant replicas of your data.

- If you have hybrid servers (servers that contain both SSD and HDDs), then the default is 3.
- If you have all flash servers (servers that contain only SSDs), then you must explicitly select either 2 or 3 during HX Data Platform installation.

Choose a Data Replication Factor. The choices are:

- **Data Replication Factor 3** — Keep three redundant replicas of the data. This consumes more storage resources, and ensures the maximum protection for your data in the event of node or disk failure.
  
  **Attention** Data Replication Factor 3 is the recommended option.

- **Data Replication Factor 2** — Keep two redundant replicas of the data. This consumes fewer storage resources, but reduces your data protection in the event of node or disk failure.

### Cluster Access Policy

The Cluster Access Policy works with the Data Replication Factor to set levels of data protection and data loss prevention. There are two Cluster Access Policy options. The default is lenient. It is not configurable during installation, but can be changed after installation and initial storage cluster configuration.

- **Strict** - Applies policies to protect against data loss.
  
  If nodes or disks in the storage cluster fail, the cluster's ability to function is affected. If more than one node fails or one node and disk(s) on a different node fail, it is called a simultaneous failure. The strict setting helps protect the data in event of simultaneous failures.

- **Lenient** - Applies policies to support longer storage cluster availability. This is the default.
Responses to Storage Cluster Node Failures

A storage cluster healing timeout is the length of time HX Connect or HX Data Platform Plug-in waits before automatically healing the storage cluster. If a disk fails, the healing timeout is 1 minute. If a node fails, the healing timeout is 2 hours. A node failure timeout takes priority if a disk and a node fail at the same time or if a disk fails after node failure, but before the healing is finished.

When the cluster resiliency status is Warning, the HX Data Platform system supports the following storage cluster failures and responses.

Optionally, click the associated Cluster Status/Operational Status or Resiliency Status/Resiliency Health in HX Connect and HX Data Platform Plug-in, to display reason messages that explain what is contributing to the current state.

<table>
<thead>
<tr>
<th>Cluster Size</th>
<th>Number of Simultaneous Failures</th>
<th>Entity Failed</th>
<th>Maintenance Action to Take</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 nodes</td>
<td>1</td>
<td>One node.</td>
<td>The storage cluster does not automatically heal. Replace the failed node to restore storage cluster health.</td>
</tr>
<tr>
<td>Cluster Size</td>
<td>Number of Simultaneous Failures</td>
<td>Entity Failed</td>
<td>Maintenance Action to Take</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------------------------</td>
<td>---------------</td>
<td>--------------------------</td>
</tr>
</tbody>
</table>
| 3 nodes      | 2                              | Two or more disks on two nodes are blacklisted or failed. | 1. If one SSD fails, the storage cluster does not automatically heal.  
   - Replace the faulty SSD and restore the system by rebalancing the cluster  
  2. If one HDD fails or is removed, the disk is blacklisted immediately. The storage cluster automatically begins healing within a minute.  
  3. If more than one HDD fails, the system might not automatically restore storage cluster health.  
   - If the system is not restored, replace the faulty disks and restore the system by rebalancing the cluster |
| 4 nodes      | 1                              | One node.     | If the node does not recover in two hours, the storage cluster starts healing by rebalancing data on the remaining nodes.  
   To recover the failed node immediately and fully restore the storage cluster:  
  1. Check that the node is powered on and restart it if possible. You might need to replace the node.  
  2. Rebalance the cluster |
### Responses to Storage Cluster Node Failures

<table>
<thead>
<tr>
<th>Cluster Size</th>
<th>Number of Simultaneous Failures</th>
<th>Entity Failed</th>
<th>Maintenance Action to Take</th>
</tr>
</thead>
</table>
| 4 nodes      | 2                                | Two or more disks on two nodes. | If two SSDs fail, the storage cluster does not automatically heal. If the disk does not recover in one minute, the storage cluster starts healing by rebalancing data on the remaining nodes. To recover the failed node immediately and fully restore the storage cluster:  
1. Check that the node is powered on and restart it if possible. You might need to replace the node.  
2. Rebalance the cluster. |
| 5+ nodes     | 2                                | Up to two nodes. | If the node does not recover in two hours, the storage cluster starts healing by rebalancing data on the remaining nodes. |
| 5+ nodes     | 2                                | Two nodes with two or more disk failures on each node. | The system automatically triggers a rebalance after a minute to restore storage cluster health. |
### Responses to Storage Cluster Node Failures

<table>
<thead>
<tr>
<th>Cluster Size</th>
<th>Number of Simultaneous Failures</th>
<th>Entity Failed</th>
<th>Maintenance Action to Take</th>
</tr>
</thead>
</table>
| 5+ nodes     | 2                               | One node and One or more disks on a different node. | If the disk does not recover in **one minute**, the storage cluster starts healing by rebalancing data on the remaining nodes. If the node does not recover in **two hours**, the storage cluster starts healing by rebalancing data on the remaining nodes. If a node in the storage cluster fails and a disk on a different node also fails, the storage cluster starts healing the failed disk (without touching the data on the failed node) in one minute. If the failed node does not come back up after two hours, the storage cluster starts healing the failed node as well. To recover the failed node immediately and fully restore the storage cluster:  
1. Check that the node is powered on and restart it if possible. You might need to replace the node.  
2. Rebalance the cluster. |

Review the table above and perform the action listed.
HX Data Platform Ready Clones Overview

HX Data Platform Ready Clones is a pioneer storage technology that enables you to rapidly create and customize multiple cloned VMs from a host VM. It enables you to create multiple copies of VMs that can then be used as standalone VMs.

A Ready Clone, similar to a standard clone, is a copy of an existing VM. The existing VM is called the host VM. When the cloning operation is complete, the Ready Clone is a separate guest VM.

Changes made to a Ready Clone do not affect the host VM. A Ready Clone's MAC address and UUID are different from that of the host VM.

Installing a guest operating system and applications can be time consuming. With Ready Clone, you can make many copies of a VM from a single installation and configuration process.

Clones are useful when you deploy many identical VMs to a group.

HX Data Platform Native Snapshots Overview

HX Data Platform Native Snapshots is a backup feature that saves versions (states) of working VMs. VMs can be reverted back to native snapshots.

Use the HX Data Platform Plug-in to take native snapshots of your VMs. HX Data Platform native snapshot options include: create a native snapshot, revert to any native snapshot, and delete a native snapshot. Timing options include: Hourly, Daily, and Weekly, all in 15 minute increments.

A native snapshot is a reproduction of a VM that includes the state of the data on all VM disks and the VM power state (on, off, or suspended) at the time the native snapshot is taken. Take a native snapshot to save the current state of the VM, so that you can revert to the saved state.

For additional information about VMware snapshots, see the VMware KB, Understanding virtual machine snapshots in VMware ESXi and ESX (1015180) at, http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=1015180
Logging in to HX Data Platform Interfaces

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- Logging into HX Connect, on page 23
- Logging into the Controller VM (stcli) Command Line, on page 24
- Logging Into Cisco HX Data Platform Installer, on page 27
- Accessing the HX Data Platform REST APIs, on page 27
- Accessing the Cisco HX Data Platform Plug-in, on page 28
- Contacting Cisco TAC, on page 29

HyperFlex Cluster Interfaces Overview

Each HyperFlex interface provides access to information about and a means to perform actions upon the HX Storage Cluster. The HX Storage Cluster interfaces include:

- HX Connect—Monitoring, performance charts, and tasks for upgrade, encryption, replication, datastores, nodes, disks, and VM ready clones.
- HX Data Platform Plug-in—Monitoring, performance charts, and tasks for datastores, hosts (nodes), and disks.
- Storage Controller VM command line—Run HX Data Platform stcli commands.
- HyperFlex Systems RESTful APIs—Enabling authentication, replication, encryption, monitoring, and management of HyperFlex Systems through an on-demand stateless protocol.

Additional interfaces include:

- Cisco HX Data Platform Installer—Installing HX Data Platform, deploying and expanding HX Storage Cluster cluster, deploying stretched cluster, and deploying Hyper-V clusters.
- Cisco UCS Manager—Tasks for networking, storage and storage access, and managing resources in the HX Storage Cluster.
- VMware vSphere Web Client and vSphere Client—Managing all the VMware ESXi servers in the vCenter cluster.
- VMware ESXi—Managing the individual ESXi host, providing host command line.
Guidelines for HX Data Platform Login Credentials

*stcli* commands prompt for login credentials.

The storage controller VM password for the predefined users *admin* and *root* are specified during HX Data Platform installer. After installation you can change passwords through the *stcli* command line.

When a user attempts to login with wrong credentials for 10 successive times, the account will be locked for two minutes. If the failed login attempts were made through SSH, the error message will not indicate that the account is locked. If the failed login attempts were made through HX Connect or REST API, the error message during the 10th attempt will indicate that the account is locked.

<table>
<thead>
<tr>
<th>Component</th>
<th>Permission Level</th>
<th>Username</th>
<th>Password</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>HX Data Platform OVA</td>
<td>root</td>
<td>root</td>
<td>Cisco123</td>
<td>Important Systems ship with a default password of Cisco123 that must be changed during installation. You cannot continue installation unless you specify a new user supplied password.</td>
</tr>
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Important
### Guidelines for HX Data Platform Login Credentials

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</tr>
</thead>
<tbody>
<tr>
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<td>root</td>
<td>root</td>
<td>Cisco123</td>
<td><strong>Important</strong> Systems shipped with a default password of Cisco123 that must be changed during installation. You cannot continue installation unless you specify a new user supplied password.</td>
</tr>
<tr>
<td>HX Connect</td>
<td>administrator or read-only</td>
<td>User defined through vCenter.</td>
<td>User defined through vCenter.</td>
<td>Optionally, you can add leading phrases local/ for login: local/admin or local/root</td>
</tr>
<tr>
<td>HX Storage Controller VM</td>
<td>admin</td>
<td>User defined during HX installation. User defined through vCenter. Predefined admin or root users.</td>
<td>As specified during HX installation.</td>
<td>Must match across all nodes in storage cluster. Use the stcli command when changing the password after installation.</td>
</tr>
<tr>
<td>vCenter</td>
<td>admin</td>
<td><a href="mailto:administrator@vsphere.local">administrator@vsphere.local</a> default. SSO enabled. As configured, MYDOMAIN*name or <a href="mailto:name@mydomain.com">name@mydomain.com</a></td>
<td>SSO enabled. As configured.</td>
<td>Ensure the vCenter credentials meet the vSphere 5.5 requirements if the ESX servers are at version 5.5. Read only users do not have access to HX Data Platform Plug-in.</td>
</tr>
</tbody>
</table>
**HX Data Platform Names, Passwords, and Characters**

Most printable and extended ASCII characters are acceptable for use in names and passwords. Certain characters are not allowed in HX Data Platform user names, passwords, virtual machine names, storage controller VM names, and datastore names. Folders and resource pools do not have character exceptions.

However, to simplify names and passwords, consider not using these special characters, as they are frequently assigned special purposes.

- `&`, `'`, `*`, `@`, `\`, `:`, `,`, `$`, `!`, `/`, `<`, `>`, `%`, `|`, `#`, `?`, `;`

When entering special characters, consider the shell being used. Different shells have different sensitive characters. If you have special characters in your names or passwords, place them in a single quote, `'specialword'`. It is not required to place passwords within single quotes in the HyperFlex Installer password form field.

**HX Storage Cluster Name**

HX cluster names cannot exceed 50 characters.

**HX Storage Cluster Host Names**

HX cluster host names cannot exceed 80 characters.

**Virtual Machine and Datastore Names**

Most characters used to create a virtual machine name, controller VM name, or datastore name are acceptable. Escaped characters are acceptable for virtual machine, controller VM names, or datastore names.

**Maximum characters**—Virtual machine names can have up to 80 characters.

**Excluded characters**—Do not use the following character in any user virtual machine name or datastore name for which you want to enable snapshots.

- accent grave (`'`)
**Special characters**—The following special characters are acceptable for user virtual machine or datastore names:

- ampersand (&), apostrophe (’), asterisk (*), at sign (@), back slash (\), circumflex (^), colon (:) comma (,), dollar sign ($), dot (.), double quotation (“), equal sign (=), exclamation (!), forward slash (/), hyphen (-), left curly brace ({), left parentheses ((), left square bracket ([), less than sign (<), more than sign (>), percent (%), pipe (|), plus sign (+), pound (#), question mark (?), right curly brace (}), right parentheses ()), right square bracket (]), semi-colon (;), tilde (~), underscore (_) 

**Username Requirements**

Usernames can be specific to the HX Data Platform component and must meet UCS Manager username requirements.

UCS Manager username requirements.

- Number of characters: between 6 and 32 characters
- Must be unique within Cisco UCS Manager.
- Must start with an alphabetic character.
- Must have: alphabetic characters (upper or lower case).
- Can have: numeric characters. Cannot be all numeric characters.
- Only special character allowed: underscore (_), dash (-), dot (.)

**Controller VM Password Requirements**

The following rules apply to controller VM root and admin user passwords.

---

**Note**

General rule about passwords: Do not include them in a command string. Allow the command to prompt for the password.

- Minimum Length: 10
- Minimum 1 Uppercase
- Minimum 1 Lowercase
- Minimum 1 Digit
- Minimum 1 Special Character
- A maximum of 3 retry to set the new password

To change a controller VM password, always use the `stcli` command. Do not use another change password command, such as a Unix password command.

1. Login to the management controller VM.
2. Run the `stcli` command.

```
stcli security password set [-h] [--user USER]
```
The change is propagated to all the controller VMs in the HX cluster.

**UCS Manager and ESX Password Format and Character Requirements**

The following is a summary of format and character requirements for UCS Manager and VMware ESXi passwords. See the Cisco UCS Manager and VMware ESX documentation for additional information.

- **Characters classes:** lower case letters, upper case letters, numbers, special characters.
  
- **Character length:** Minimum 6, maximum 80
  
  Minimum 6 characters required, if characters from all four character classes.
  
  Minimum 7 characters required, if characters from at least three character classes.
  
  Minimum 8 characters required, if characters from only one or two character classes.

- **Start and end characters:** An upper case letter at the beginning or a number at the end of the password do not count toward the total number of characters.

  If password starts with uppercase letter, then 2 uppercase letters are required. If password ends with a digit, then 2 digits are required.

  Examples that meet the requirements:
  
  h#56Nu - 6 characters. 4 classes. No starting upper case letter. No ending number.
  
  h5xj7Nu - 7 characters. 3 classes. No starting upper case letter. No ending number.
  
  XhUwPcNu - 8 characters. 2 classes. No starting upper case letter. No ending number.
  
  Xh#5*Nu - 6 characters counted. 4 characters classes. Starting upper case letter. No ending number.
  
  h#5*Nu9 - 6 characters counted. 4 characters classes. No starting upper case letter. Ending number.

- **Consecutive characters:** Maximum 2. For example, hhh###555 is not acceptable.

  Through vSphere SSO policy, this value is configurable.

- **Excluded characters:**

  UCS Manager passwords cannot contain the escape (\) character.

  ESX passwords cannot contain these characters.

  - Cannot be the username or the reverse of the username.

  - Cannot contain words found in the dictionary.

  - Cannot contain the characters escape (\), dollar sign ($), question mark (?), equal sign (=).

- **Dictionary words:**

  Do not use any words that can be found in the dictionary.

**vSphere 5.5 Password Exceptions**

Some characters, when processed by functions within vSphere are escaped. That is, the processing function applies an escape character prior to the special character before continuing to process the provided name.
Permitted special characters are specific to vSphere versions 5.5 or 6.0 and later. See VMware KB article, *Installing vCenter Single Sign-On 5.5 fails if the password for administrator@vsphere.local contains certain special character* (2060746), at https://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=2060746.

Excluded characters: Do not use the following characters with vSphere 5.5.

- Non-ASCII characters. Extended ASCII characters.
- Letters with accents. For example the accent grave, accent acute, circumflex, umlaut, tilda and cedilla (é, à, â, ô, ù, ö, ò, ç, ë).
- vSphere 5.5 and SSO: ampersand (&), apostrophe (‘), back slash (\), circumflex (^), double quotation (“), exclamation (!), percent (%), semicolon (;), space ( )

VMware has vSphere SSO password policy setting options and upgrade considerations for user names. See VMware documentation for the topics: How vCenter Single Sign-On Affects Upgrades and *Edit the vCenter Single Sign-On Password Policy*.

- Location based exception: at the beginning of a name, do not use an at sign (@), parenthesis ( )

---

**Logging into HX Connect**

Cisco HyperFlex Connect provides an HTML5 based access to HX Storage Cluster monitoring, and replication, encryption, datastore, and virtual machine tasks.

**About Sessions**

Each login to HX Connect is a session. Sessions are the period of activity between time when you log into HX Connect and when you log out. Do not manually clear cookies in a browser during a session, because this also drops the session. Do not close the browser to close a session, though dropped, the session is still counted as an open session. Default session maximums include:

- 256 concurrent sessions per user
- 300 concurrent sessions across the HX Storage Cluster

**Before you begin**

---

**Important**

- If you are a read-only user, you may not see all of the options described in the Help. To perform most actions in HX Connect, you must have administrative privileges.
- Ensure that the time on the vCenter and the controller VMs are in sync or near sync. If there is too large of a time skew between the vCenter time and the cluster time, AAA authentication will fail.

---

**Step 1**

Locate the HX Storage Cluster management IP address.

Use fully qualified domain name (FQDN) for the management IP address, rather than individual Storage Controller VM.

**Step 2**

Enter the HX Storage Cluster management IP address in a browser.
Step 3: Enter the HX Storage Cluster login credentials.

- **RBAC users**—Cisco HyperFlex Connect supports role-based access control (RBAC) login for:
  - **Administrator**—Users with administrator role have read and modify operations permissions. These users can modify the HX Storage Cluster.
  - **Read only**—Users with read only role have read (view) permissions. They cannot make any changes to the HX Storage Cluster.

  These users are created through vCenter. vCenter username format is: `<name>@domain.local` and specified in the User Principal Name Format (UPN). For example, `administrator@vsphere.local`. Do not add a prefix such as "ad:" to the username.

- **HX pre-defined users**—To login using the HX Data Platform predefined users `admin` or `root`, enter a prefix `local/`. For example: `local/root` or `local/admin`.

  Actions performed with the `local/` login only affect the local cluster.

  vCenter recognizes the session with HX Connect, therefore system messages that originate with vCenter might indicate the session user instead of `local/root`. For example, in Alarms, `Acknowledged By` might list `com.springpath.sysmgmt.domain-c7`.

  Click the eye icon to view or hide the password field text. Sometimes this icon is obscured by other field elements. Click the eye icon area and the toggle function continues to work.

---

**What to do next**

- To refresh the HX Connect displayed content, click the refresh (circular) icon. If this does not refresh the page, the clear the cache and reload the browser.

- To logout of HX Connect, and properly close the session, select User menu (top right) > Logout.

---

**Logging into the Controller VM (stcli) Command Line**

All `stcli` command are divided into commands that read HX Cluster information and commands that modify the HX Cluster.

- **Modify commands**—Require administrator level permissions. Examples:
  ```
stcli cluster create
stcli datastore create
```

- **Read commands**—Permitted with administrator or read only level permissions. Examples:
  ```
stcli <cmd> -help
stcli cluster info
stcli datastore info
```

To execute HX Data Platform `stcli` commands, login to the HX Data Platform Storage Controller VM command line.
**Important**

Do not include passwords in command strings. Commands are frequently passed to the logs as plain text. Wait until the command prompts for the password. This applies to login commands as well as `stcli` commands.

You may login to the HX Data Platform command line interface in the Storage Controller VM in the following ways:

- From a browser
- From a command terminal
- From HX Connect Web CLI page

Only direct commands are supported through HX Connect.

- Direct commands—commands that complete in a single pass and do not require responses through the command line. Example direct command: `stcli cluster info`
- Indirect commands—multi-layered commands that require live response through the command line. Example interactive command: `stcli cluster reregister`

**Note**

Administrator users created in the vCenter can login to the Storage Controller VM CLI using the full name in the following format:

```
<user>@vsphere.local/password
```

However, read-only users created in the vCenter cannot login to the Storage Controller VM CLI.

---

**Step 1**

Locate a controller VM DNS Name.

a. Select a VM > Summary > DNS Name.

b. From vSphere Web Client Home > VMs and Templates > vCenter server > datacenter > ESX Agents > VVM.

c. Click through to the storage cluster list of controller VMs.

**Step 2**

From a browser, enter the DNS Name and /cli path.

a) Enter the path.

   Example

   ```
   # cs002-stctlvm-a.eng.storvisor.com/cli
   ```

   Assumed username: `admin`, password: defined during HX Cluster creation.

b) Enter the password at the prompt.

**Step 3**

From a command line terminal using `ssh`.

**Note**  Do not include the password in an `ssh` login string. The login is passed to the logs as plain text.

a) Enter the `ssh` command string.

b) Sometimes a certificate warning is displayed. Enter `yes` to ignore the warning and proceed.
---

!!! ALERT !!!

This service is restricted to authorized users only.
All activities on this system are logged. Unauthorized access will be reported.

HyperFlex StorageController 2.5(1a)# exit
logout
Connection to 10.198.3.22 closed.)$ssh root@10.198.3.24
The authenticity of host '10.198.3.24 (10.198.3.24)' can't be established.
Are you sure you want to continue connecting (yes/no)?

**c)** Enter the password at the prompt.
```
# ssh admin@10.198.3.22
HyperFlex StorageController 2.5(1a)
admin@10.198.3.22's password:
```

**Step 4**  From HX Connect—Log in to HX Connect, select Web CLI.

**Note**  Only non-interactive commands can be executed from the HX Connect Web CLI.

---

### Changing Storage Controller Password

To reset the HyperFlex storage controller password post-installation, do the following.

**Step 1**  Log in to a storage controller VM.

**Step 2**  Change the Cisco HyperFlex storage controller password.
```
# stcli security password set
```

This command applies the change to all the controller VMs in the storage cluster.

**Note**  If you add new compute nodes and try to reset the cluster password using the `stcli security password set` command, the converged nodes get updated, but the compute nodes may still have the default password. To change the compute node password, use the following procedure.

To change the password on compute nodes:

**a.** Vmotion all the user VMs off the ESXi hosts.

**b.** Launch the storage controller VM console from vCenter and log in as the root user.

**c.** Run the `passwd` command to change the password.

**d.** Log out and re-login to confirm that the password changed successfully.

**e.** Run the `stcli node add -f` command to add the node back into the cluster.

**Step 3**  Type in the new password.

**Step 4**  Press Enter.
Logging Into Cisco HX Data Platform Installer

Next, you install the HX Data Platform software.

**Note**
Before launching the Cisco HX Data Platform Installer, ensure that all the ESXi servers that are in the vCenter cluster that you plan to include in the storage cluster are in maintenance mode.

<table>
<thead>
<tr>
<th>Step 1</th>
<th>In a browser, enter the URL for the VM where HX Data Platform Installer is installed. You must have this address from the earlier section on Deploying HX Data Platform Installer. For example <a href="http://10.64.4.254">http://10.64.4.254</a></th>
</tr>
</thead>
</table>
| Step 2 | Enter the following credentials:  
|        | • **Username**: root  
|        | • **Password** (Default): Cisco123  
|        | **Attention** Systems ship with a default password of Cisco123 that must be changed during installation. You cannot continue installation unless you specify a new user supplied password.  
|        | Read the EULA. Click I accept the terms and conditions.  
|        | Verify the product version listed in the lower right corner is correct. Click Login. |
| Step 3 | The HX Data Platform Installer Workflow page provides two options to navigate further.  
|        | • **Create Cluster** drop-down list—You can deploy a standard cluster, Stretch Cluster, or a Hyper-V cluster.  
|        | • **Cluster Expansion**—You can provide the data to add converged nodes and compute nodes to an existing standard storage cluster. |

Accessing the HX Data Platform REST APIs

Cisco HyperFlex HX-Series Systems provide a fully-contained, virtual server platform that combines all three layers of compute, storage, and network with the powerful Cisco HX Data Platform software tool resulting in a single point of connectivity for simplified management. Cisco HyperFlex Systems are modular systems designed to scale out by adding HX nodes under a single UCS management domain. The hyperconverged system provides a unified pool of resources based on your workload needs.

Cisco HyperFlex Systems RESTful APIs with HTTP verbs integrate with other third-party management and monitoring tools that can be configured to make HTTP calls. It enables authentication, replication, encryption, monitoring, and management of a HyperFlex system through an on-demand stateless protocol. The APIs allow for external applications to interface directly with the HyperFlex management plane.

These resources are accessed through URI or Uniform Resource Identifier and operations are performed on these resources using http verbs such as POST (create), GET (read), PUT (update), DELETE (delete).
The REST APIs are documented using swagger which can also generate client libraries in various languages such as python, JAVA, SCALA, and Javascript. Using libraries thus generated, you can create programs and scripts to consume HyperFlex resources.

HyperFlex also provides a built-in REST API access tool, the REST explorer. Use this tool to access HyperFlex resources in real time and observe responses. The REST explorer also generates CURL commands that can be run from command line.

**Step 1**

**Step 2**
Click **Login** and enter credentials, if needed.

---

**Accessing the Cisco HX Data Platform Plug-in**

Access the HX Data Platform Plug-in through the vSphere Web Client.

---

**Note**

- If you are using the Firefox browser, ensure that you have the latest Adobe Flash player installed.

- The HX Data Platform Plug-in is not available through the vSphere Client for Windows, also known as the vSphere thick client. Event messages generated about activities in the HX Data Platform Plug-in are included in the vSphere Client display. HX Data Platform Plug-in tasks cannot be performed through the vSphere Client for Windows.

- If you have Read Only permissions, you cannot perform any configuration related tasks. You can only view status information.

- Use the latest Java version to access the HX Data Platform Plug-in.

- The HX Data Platform Plug-in is not displayed in the vCenter HTML client. You must use the vCenter flash client.

---

**Step 1**
From the vSphere Web Client, click the Home icon (house) located at the top of the vCenter panel.

**Step 2**
Navigator Home page, select **vCenter Inventory Lists**.

**Step 3**
Scroll to the bottom of the vCenter Inventory List to access the HX Data Platform plug-in.

**Step 4**
Expand the Cisco HyperFlex Systems and click **Cisco HX Data Platform** to display the HX storage clusters available in the HX Data Platform Plug-in.

Notice that the Cisco HXDP object lists the number of HX storage clusters.

From the **Objects** tab, you can:

- Edit the storage cluster name. Click the edit icon (pencil) or select **Rename Cluster** from the Actions menu.

- Display the storage cluster configuration. Click the summary icon (green paper) or select **Summary** from the Actions menu.
Step 5  Select an **HX storage cluster** from the list in the Navigator pane.

Under the Cisco HX Data Platform is a list of storage clusters. Select one storage cluster from this list.

Step 6  Click tabs in the center pane to access the HX Data Platform Plug-in information and various actions.

<table>
<thead>
<tr>
<th>Tab Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Getting Started</strong></td>
<td>Read introductory information and access basic actions.</td>
</tr>
<tr>
<td><strong>Summary</strong></td>
<td>Monitor basic status and configuration for HX Data Platform storage objects.</td>
</tr>
<tr>
<td><strong>Monitor</strong></td>
<td>Monitor HX storage cluster, host, and datastore performance and events.</td>
</tr>
<tr>
<td><strong>Manage</strong></td>
<td>Monitor HX storage cluster details, create and manage datastores, copy and export information.</td>
</tr>
</tbody>
</table>

---

**Contacting Cisco TAC**

You can open a Cisco Technical Assistance Center (TAC) support case to reduce time addressing issues, and get efficient support directly with Cisco Prime Collaboration application.

For all customers, partners, resellers, and distributors with valid Cisco service contracts, Cisco Technical Support provides around-the-clock, award-winning technical support services. The Cisco Technical Support website provides online documents and tools for troubleshooting and resolving technical issues with Cisco products and technologies:

http://www.cisco.com/techsupport

Using the TAC Support Case Manager online tool is the fastest way to open S3 and S4 support cases. (S3 and S4 support cases consist of minimal network impairment issues and product information requests.) After you describe your situation, the TAC Support Case Manager automatically provides recommended solutions. If your issue is not resolved by using the recommended resources, TAC Support Case Manager assigns your support case to a Cisco TAC engineer. You can access the TAC Support Case Manager from this location:

https://mycase.cloudapps.cisco.com/case

For S1 or S2 support cases or if you do not have Internet access, contact the Cisco TAC by telephone. (S1 or S2 support cases consist of production network issues, such as a severe degradation or outage.) S1 and S2 support cases have Cisco TAC engineers assigned immediately to ensure your business operations continue to run smoothly.

To open a support case by telephone, use one of the following numbers:

- Asia-Pacific: +61 2 8446 7411
- Australia: 1 800 805 227
- EMEA: +32 2 704 5555
- USA: 1 800 553 2447

For a complete list of Cisco TAC contacts for Enterprise and Service Provider products, see http://www.cisco.com/c/en/us/support/web/tsd-cisco-worldwide-contacts.html.
Monitoring HX Storage Clusters

• Monitoring HyperFlex Clusters, on page 31
• Monitoring HyperFlex Clusters with HX Connect, on page 31
• Using the Cisco HX Data Platform Plug-in Interface, on page 40
• Monitoring Performance Charts, on page 41

Monitoring HyperFlex Clusters

This chapter describes the monitoring content available through the following HX Storage Cluster interfaces:

• Cisco HX Connect
• Cisco HX Data Platform Plug-in
• Storage Controller VM command line

Monitoring HyperFlex Clusters with HX Connect

The Cisco HX Connect user interface provides a view of the Cisco HX storage cluster status, components, and features, such as encryption and replication.

Key monitoring pages include information about the local Cisco HX storage cluster:

• Dashboard—Overall Cisco HX storage cluster status.
• Alarms, Events, Activity—See the Cisco HyperFlex Systems Troubleshooting Guide for details.
• Performance—Charts for IOPS, throughput, latency, and replication network bandwidth.
• System Information—System overview, plus status and tasks for nodes and disks.

See the Cisco HyperFlex Systems Troubleshooting Guide for generating support bundles, Storage Cluster Maintenance Operations Overview, on page 47 for entering and exiting maintenance mode, and Setting a Beacon, on page 49 to set a node or disk beacon.

• Datastores—Status and tasks related to datastores.
• Virtual Machines—Status and tasks related to protecting virtual machines.

Additional Cisco HX Connect pages provide management access:
• **Encryption**—For data at rest disk and node encryption tasks.

• **Replication**—For disaster recovery VM protection tasks.

The **Upgrade** page provides access to HX Data Platform and Cisco UCS Manager firmware upgrade tasks.

**Dashboard Page**

If you are a read-only user, you may not see all of the options available in the Help. To perform most actions in HyperFlex (HX) Connect, you must have administrative privileges.

Displays a status summary of your HX storage cluster. This is the first page that you see when you log in to Cisco HyperFlex Connect.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operational Status</strong></td>
<td>Provides the functional status of the HX storage cluster and application performance. Click <strong>Information</strong> to access the HX storage cluster name and status data.</td>
</tr>
<tr>
<td><strong>Cluster License Status</strong></td>
<td>Displays the following link when you log into the HX storage cluster for the first time or till the HX storage cluster license is registered:</td>
</tr>
<tr>
<td></td>
<td><strong>Cluster License not registered</strong> link—Appears when the HX storage cluster is not registered. To register a cluster license, click this link and provide product instance registration token in the <strong>Smart Software Licensing Product Registration</strong> screen. For more information on how to get a product instance registration token, refer the <strong>Registering a Cluster with Smart Licensing</strong> section in the Cisco HyperFlex Systems Installation Guide for VMware ESXi.</td>
</tr>
<tr>
<td><strong>Resiliency Health</strong></td>
<td>Provides the data health status and ability of the HX storage cluster to tolerate failures. Click <strong>Information</strong> to access the resiliency status, and replication and failure data.</td>
</tr>
<tr>
<td><strong>Capacity</strong></td>
<td>Displays a breakdown of the total storage versus how much storage is used or free. Also displays the storage optimization, compression-savings, and deduplication percentages based on the data stored in the cluster.</td>
</tr>
<tr>
<td><strong>Nodes</strong></td>
<td>Displays the number of nodes in the HX storage cluster, and the division of converged versus compute nodes. Hovering over a node icon displays that node's name, IP address, node type, and an interactive display of disks with access to capacity, usage, serial number, and disk type data.</td>
</tr>
</tbody>
</table>
### UI Element | Essential Information
---|---
**Performance** section | Displays an HX storage cluster performance snapshot for a configurable amount of time, showing IOPS, throughput, and latency data. For full details, see **Performance Page**.

**Cluster Time** field | System date and time for the cluster.

---

**Table Header Common Fields**

Several tables in HX Connect provide one or more of the following three fields that affect the content displayed in the table.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Refresh</strong> field and icon</td>
<td>The table automatically refreshes for dynamic updates to the HX Cluster. The timestamp indicates the last time the table was refreshed. Click the circular icon to refresh the content now.</td>
</tr>
<tr>
<td><strong>Filter</strong> field</td>
<td>Display in the table only list items that match the entered filter text. The items listed in the <strong>current</strong> page of the table below are automatically filtered. Nested tables are not filtered. Type in the selection text in the <strong>Filter</strong> field. To empty the <strong>Filter</strong> field, click the <strong>x</strong>. To export content from other pages in the table, scroll to the bottom, click through the page numbers, and apply the filter.</td>
</tr>
<tr>
<td><strong>Export</strong> menu</td>
<td>Save out a copy of the <strong>current</strong> page of table data. The table content is downloaded to the local machine in the selected file type. If the listed items are filtered, the filtered subset list is exported. Click the down arrow to select an export file type. The file type options are: <strong>cvs</strong>, <strong>xls</strong>, and <strong>doc</strong>. To export content from other pages in the table, scroll to the bottom, click through the page numbers, and apply the export.</td>
</tr>
</tbody>
</table>

---

**Activity Page**

Displays a list of recent activity on the HX storage cluster to monitor the progress of Ready Clone and VM-power operations.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Expand All / Collapse All</strong> button</td>
<td>Toggles the view of the <strong>Activity</strong> list to display top-level task information or task details. You can also expand and collapse individual tasks.</td>
</tr>
</tbody>
</table>
### UI Element | Essential Information
--- | ---
**Activity list** | Displays a list of recent tasks including the following details:
- ID
- Description
- VM power on/off/suspend status
- Task status:
  - In Progress
  - Success
  - Failed
  For failed VM-power operations, the **Existing State** and **Required State** fields are also included.
- Date and time stamp
- Progress bar

An expanded **Activity** list shows the task's step name and status. Click the circular icon to refresh the content now and fetch recent activity. The refresh rate is five minutes.

---

### System Information Overview Page

Displays HX storage cluster system-related information, including node and disk data, and provides access to HX maintenance mode.

**HX Storage Cluster Configuration Data**

Displays the basic configuration information for this HX storage cluster.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HX storage cluster field</strong></td>
<td>Name of this storage cluster.</td>
</tr>
<tr>
<td><strong>Cluster License Status section</strong></td>
<td>Displays the <strong>Register Now</strong> link when you log into the HX storage cluster for the first time or till the HX storage cluster license is registered: <strong>Register Now</strong> link—To register a cluster license, click this link and provide product instance registration token in the <strong>Smart Software Licensng Product Registration</strong> screen. For more information on how to get a product instance registration token, refer the <strong>Registering a Cluster with Smart Licensing</strong> section in the <strong>Cisco HyperFlex Systems Installation Guide for VMware ESXi</strong>.</td>
</tr>
<tr>
<td><strong>Note</strong></td>
<td>To register a cluster license, you can also choose <strong>Register Cluster</strong> from the <strong>Actions</strong> drop-down field.</td>
</tr>
<tr>
<td>UI Element</td>
<td>Essential Information</td>
</tr>
<tr>
<td>----------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>License section</td>
<td>• License Type—Displays Evaluation, Edge, Standard, or Enterprise as the HX storage cluster license type.</td>
</tr>
<tr>
<td></td>
<td>• License Status—Displays one of the following as the HX storage cluster license status:</td>
</tr>
<tr>
<td></td>
<td>• In compliance</td>
</tr>
<tr>
<td></td>
<td>• License expires in &lt;n&gt; days. Cluster not registered - Register Now. (This status appears for Evaluation type license)</td>
</tr>
<tr>
<td></td>
<td>• License expired. Cluster not registered - Register Now. (This status appears for Evaluation type license)</td>
</tr>
<tr>
<td></td>
<td>• Out of compliance - License expired on &lt;date&gt;</td>
</tr>
<tr>
<td></td>
<td>• Out of compliance - Insufficient license</td>
</tr>
<tr>
<td></td>
<td>• Certificate expired—This status appears when ID certificate is not renewed for more than six months.</td>
</tr>
<tr>
<td></td>
<td>• Authentication expired—This status appears when HX is unable to communicate with Cisco Smart Software Manager or Smart Software Manager satellite for more than 90 days.</td>
</tr>
<tr>
<td></td>
<td>Note: To refresh license certificate or renew license authorization, choose the respective options from the Actions drop-down field.</td>
</tr>
<tr>
<td>HX storage cluster status field</td>
<td>Provides functional status of the HX storage cluster.</td>
</tr>
<tr>
<td>vCenter link</td>
<td>Secure URL to the VMware vSphere associated with this HX storage cluster. Click the link to remotely access the vSphere Web Client.</td>
</tr>
<tr>
<td>Hypervisor field</td>
<td>Hypervisor version installed on this HX storage cluster.</td>
</tr>
<tr>
<td>HXDP Version field</td>
<td>Installer package version installed on this HX storage cluster.</td>
</tr>
<tr>
<td>Data Replication Factor field</td>
<td>Number of the redundant data replicas stored on this HX storage cluster.</td>
</tr>
<tr>
<td>Uptime field</td>
<td>Length of time this HX storage cluster has been online.</td>
</tr>
<tr>
<td>Total Capacity field</td>
<td>Overall storage size of this cluster.</td>
</tr>
<tr>
<td>Available Capacity field</td>
<td>Amount of free storage in this cluster.</td>
</tr>
<tr>
<td>DNS Server(s)</td>
<td>IP address for the DNS server(s) for this HX storage cluster.</td>
</tr>
</tbody>
</table>
## Monitoring HX Storage Clusters

### System Information Overview Page

<table>
<thead>
<tr>
<th><strong>UI Element</strong></th>
<th><strong>Essential Information</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>NTP Server(s)</td>
<td>IP address for the NTP server(s) for this HX storage cluster.</td>
</tr>
</tbody>
</table>

**Controller VM Access**

You can access the controller VM using SSH as an administrator. To enable access, click **Actions** at the top of the page to enable SSH access.

**Node Data**

Displays data about individual nodes in this HX storage cluster. To see this information in tabular format, go to the **Nodes** page.

<table>
<thead>
<tr>
<th><strong>UI Element</strong></th>
<th><strong>Essential Information</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Node</td>
<td>Name of a node on this cluster.</td>
</tr>
<tr>
<td>Model</td>
<td>Physical hardware model number of this node.</td>
</tr>
<tr>
<td>Disks</td>
<td>Number of caching versus persistent disks in this node.</td>
</tr>
</tbody>
</table>
| Node status    | • Online  
                  • Offline  
                  • In Maintenance  
                  • Healthy  
                  • Warning |
| HXDP Version   | Installer package version installed on this node. |
| Type           | • Hyper Converged  
                  • Compute |
| Hypervisor Status | • Online  
                       • Offline  
                       • In Maintenance  
                       • In Progress |
| Hypervisor Address | IP address for the management network to this HX storage cluster. |

For nodes with disks, you can place your cursor over a disk to view an interactive display of information including the following:

**Table 2: Disks**

<table>
<thead>
<tr>
<th><strong>UI Element</strong></th>
<th><strong>Essential Information</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Slot Number</td>
<td>Location of the drive, for example Slot Number 2.</td>
</tr>
</tbody>
</table>
## UI Element | Essential Information
--- | ---
**Type of Disk** | System, Cache or Persistent

**Disk State** | - Claimed
- Available
- Ignored
- Blacklisted
- Ok to Remove
- Unknown

**Locator LED** | Activates a physical light on the host to help locate a disk; options are **On** and **Off**.

**Capacity** | Total disk size.

**Used / Total Capacity** *(Persistent Disks only)* | Amount of the disk used versus the total disk size.

**Serial Number** | Physical serial number of this disk.

**Storage Usage** *(Persistent Disks only)* | Percentage of disk storage used.

**Version** | Version of the disk drive.

**Disk Drive Interface** | The disk drive interface type, for example SAS or SATA.

## Nodes Page
Displays data about all of the nodes in this HX storage cluster in an 8-column table. Each column can be used to sort the data.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Enter HX Maintenance Mode</strong> button</td>
<td>Select a node to access this button. Opens the <strong>Confirm HX Maintenance Mode</strong> dialog box.</td>
</tr>
<tr>
<td><strong>Exit HX Maintenance Mode</strong> button</td>
<td>Select a node to access this button. After you complete any maintenance tasks, you must manually exit HX maintenance mode.</td>
</tr>
<tr>
<td><strong>Node</strong> column</td>
<td>Name of a node in this HX storage cluster.</td>
</tr>
<tr>
<td><strong>Hypervisor Address</strong> column</td>
<td>IP address for the management network to this HX storage cluster.</td>
</tr>
</tbody>
</table>
### Disks Page

Displays data about all of the disks in this HX storage cluster in a 7-column table. Each column can be used to sort the data.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Node</strong> column</td>
<td>Name of the node where the disk resides.</td>
</tr>
<tr>
<td><strong>Slot</strong> column</td>
<td>Location of the SED drive. This identifies the drive for maintenance procedures.</td>
</tr>
<tr>
<td><strong>Capacity</strong> column</td>
<td>Total disk size.</td>
</tr>
</tbody>
</table>

---

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
</table>
| **Hypervisor Status column** | • Online  
• Offline  
• In Maintenance  
• In Progress |
| **Controller Address column** | IP address for the HX storage controller VM. |
| **Controller Status column** | • Online  
• Offline  
• In Maintenance |
| **Model column** | Physical hardware model number of this node. |
| **Version column** | HyperFlex Data Platform installer package version installed on this node. |
| **Disks column** | Number of disks in the node.  
Click the number to open the **Disks** page filtered by the selected node name. |
<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status column</td>
<td>• <strong>Claimed</strong>—State when a disk is recognized and in use.</td>
</tr>
<tr>
<td></td>
<td>• <strong>Available</strong>—Initial state for a newly added, data-at-rest capable disk. Also, a transitional state when disks move into one of the other states.</td>
</tr>
<tr>
<td></td>
<td>• <strong>Ignored</strong>—State when a disk is not being consumed by the cluster; for example, the HX controller VM system disk, a disk with other data (valid file system partitions), or a disk where the IO is failing.</td>
</tr>
<tr>
<td></td>
<td>• <strong>Blacklisted</strong>—State when a disk is not being consumed by the cluster due to either a software error or an IO error. This could be a transitional state while the cluster attempts to repair the disk, if the disk is still available, before the state transitions to <strong>Repairing</strong>.</td>
</tr>
<tr>
<td></td>
<td>• <strong>Ok To Remove</strong>—State when an SED disk was securely erased using the <strong>Secure Erase</strong> option and can safely be removed.</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong> For Cisco HX Data Platform 2.5, a disk in the <strong>Ok to Remove</strong> state is no longer consumed by the cluster.</td>
</tr>
<tr>
<td></td>
<td>• <strong>Repairing</strong>—State when a blacklisted disk is currently being repaired.</td>
</tr>
<tr>
<td></td>
<td>• <strong>To Be Removed</strong>—State when a disk is scheduled for RMA.</td>
</tr>
<tr>
<td></td>
<td>The following states can be ignored:</td>
</tr>
<tr>
<td></td>
<td>• <strong>Invalid</strong></td>
</tr>
<tr>
<td></td>
<td>• <strong>Normal</strong></td>
</tr>
<tr>
<td></td>
<td>• <strong>Removed</strong>—State when an SED disk is removed after using the <strong>Secure Erase</strong> option.</td>
</tr>
<tr>
<td></td>
<td>• <strong>Time out</strong></td>
</tr>
<tr>
<td></td>
<td>• <strong>Unknown</strong></td>
</tr>
</tbody>
</table>

| Encrypted column | • **Enabled**—Encryption is configured for this data-at-rest-capable disk.                                                                                                                                               |
|                  | • **Disabled**—Encryption is not configured for this data-at-rest-capable disk. This occurs when a new disk is present, but the Key has not yet been applied.                                                                |
|                  | • **Locked**                                                                                                                                                                                                           |
|                  | • **Unknown**                                                                                                                                                                                                           |
Using the Cisco HX Data Platform Plug-in Interface

There are several Cisco HX Data Platform plug-in features that apply across the interface. These are described in the following topics.

Cisco HX Data Platform Plug-in Integration with vSphere Web Client

The Cisco HX Data Platform plug-in is tightly integrated with the VMware vSphere vCenter interface to provide a seamless data management experience. You can use either the vSphere Web Client or the vSphere Client vSphere vCenter interface. Most of the task examples in this guide refer to the vSphere Web Client interface.

You access the Cisco HX Data Platform plug-in through the vSphere vCenter Inventory Lists. Select storage clusters to manage from the Cisco HX Data Platform plug-in. The Cisco HX Data Platform plug-in monitors and manages storage cluster specific objects such as datastores. vSphere monitors and manages objects in the storage cluster, such as ESX servers. Tasks overlap between the Cisco HX Data Platform plug-in and vSphere.

---

**Important**
The Cisco HX Data Platform Plug-in is not compatible with the VMware vSphere vCenter HTML5 interface. You cannot perform HX-related tasks such as HX Maintenance mode using the VMware vSphere vCenter HTML5 interface. Use the vSphere Web Client flash interface instead.
Links Between the Cisco HX Data Platform Plug-in and the vSphere Interface

In the vSphere Web Client, both the Cisco HX Data Platform plug-in and vCenter provide information on component and cluster status. Selected tabs and panels provide direct links between Cisco HX Data Platform plug-in and vCenter information and actions.

Note that following a link from either the Cisco HX Data Platform plug-in or vCenter does not mean there is a single-click link to return to your starting location.

Cisco HX Data Platform Plug-in Tabs Overview

The Cisco HX Data Platform plug-in monitoring information and managing functions are distributed among three tabs. The following is a list of all the Cisco HX Data Platform plug-in tabs and panels that display Cisco HX Data Platform storage cluster status and provide options for storage cluster administrative tasks.

**Summary** tab contains a Summary area and a Portlets area. The Summary tab portlets are: Capacity, Performance, and Status.

**Monitor** tab has two sub tabs:
- Performance tab - Displays Latency, Throughput, and IOPs performance charts for Storage Clusters, Hosts, and Datacenters.
- Events tab - Displays a list Cisco HX Data Platform events and a detail panel for a selected event.

**Manage** tab has two sub tabs:
- Cluster tab - Describes storage clusters, hosts, disks, PSUs, and NICs. This includes: List of clusters and hosts, detail panels for any selected cluster or host, and additional sub tabs: Hosts, Disks, PSUs, and NICs.
- Datastores tab - Describes information about hosts from the datastore point of view. This includes: List of datastores and additional sub tabs for any selected datastore. The datastore sub tabs include: a Summary tab that includes portlets: Details, Trends, and Top VMs by Disk Usage, and a Hosts tab.

Monitoring Performance Charts

The Monitor Performance tab displays the read and write performance of the storage cluster, hosts, and datastores.

- Performance charts display a pictorial representation of the storage cluster, host, and datastore performance.
- The system updates the performance charts every 20 seconds.
- Hover your mouse over individual data points to view peak performance information and time-stamp.
- Light blue indicates write operations and dark blue indicates read operations.
- Gaps in the performance charts indicate time periods when data was not available. Gaps do not necessarily indicate a drop in performance.
## Storage Cluster Performance Chart

You must use HX Connect or HX Plug-in to view storage capacity and not vCenter.

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>From the vSphere Web Client Navigator, select <strong>vCenter Inventory Lists &gt; Cisco HyperFlex Systems &gt; Cisco HX Data Platform &gt; cluster &gt; Monitor &gt; Performance</strong>. On the left there are three options you can choose to monitor: Storage Cluster, Hosts, and Datastores.</td>
</tr>
<tr>
<td>2</td>
<td>Click <strong>Storage Cluster</strong> to view the storage cluster performance tab.</td>
</tr>
<tr>
<td>3</td>
<td>Click <strong>Hour, Day, Week, Month, Max, or Custom</strong> option, to specify the time period in which you want to view storage cluster performance.</td>
</tr>
<tr>
<td>4</td>
<td>Click <strong>IOPS, Throughput, Latency, and Show</strong> check boxes to display selected performance and objects.</td>
</tr>
</tbody>
</table>

## Hosts Performance Chart

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>From the vSphere Web Client Navigator, select <strong>vCenter Inventory Lists &gt; Cisco HyperFlex Systems &gt; Cisco HX Data Platform &gt; cluster &gt; Monitor &gt; Performance</strong>. On the left there are three options you can choose to monitor: Storage Cluster, Hosts, and/or Datastores.</td>
</tr>
<tr>
<td>2</td>
<td>Click <strong>Hosts</strong> to view the hosts performance tab.</td>
</tr>
<tr>
<td>3</td>
<td>Click <strong>Hour, Day, Week, Month, Max, or Custom</strong> option, to specify the time period in which you want to view the host performance.</td>
</tr>
<tr>
<td>4</td>
<td>Click <strong>IOPS, Throughput, Latency, and Show</strong> check boxes to display selected performance and objects.</td>
</tr>
<tr>
<td>5</td>
<td>Click <strong>host</strong> to exclude or view individual hosts. Compute nodes do not have storage cluster performance values.</td>
</tr>
</tbody>
</table>

## Datastores Performance Chart

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>From the vSphere Web Client Navigator, select <strong>vCenter Inventory Lists &gt; Cisco HyperFlex Systems &gt; Cisco HX Data Platform &gt; cluster &gt; Monitor &gt; Performance</strong>. On the left there are three options you can chose to Monitor: Storage Cluster, Hosts, and Datastores.</td>
</tr>
<tr>
<td>2</td>
<td>Click <strong>Datastores</strong> to view the datastores performance tab.</td>
</tr>
<tr>
<td>3</td>
<td>Click <strong>Hour, Day, Week, Month, Max, or Custom</strong> option, to specify the time period in which you want to view the datastore performance.</td>
</tr>
<tr>
<td>4</td>
<td>Click <strong>IOPS, Throughput, Latency, and Show</strong> check boxes to display selected performance and objects.</td>
</tr>
</tbody>
</table>
Performance Portlet

The Performance portlet provides details about the HX Data Platform storage cluster performance. It displays the past one hour of performance data plotted in 20 second intervals. The Performance portlet charts show data for the entire storage cluster.

For details on storage cluster, datastore, and host-level performance reports, select the Monitor tab.

<table>
<thead>
<tr>
<th>Step 1</th>
<th>From the vSphere Web Client Navigator, select vCenter Inventory Lists &gt; Cisco HyperFlex Systems &gt; Cisco HX Data Platform &gt; cluster &gt; Summary.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 2</td>
<td>Scroll to the Performance portlet.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IOPS</td>
<td>Input/Output Operations per Second.</td>
</tr>
<tr>
<td>Throughput</td>
<td>The rate of data transfer in the storage cluster. Measured in MBps.</td>
</tr>
<tr>
<td>Latency</td>
<td>Latency is a measure of how long it takes for a single I/O request to complete. It is the duration between issuing a request and receiving a response. Measured in millisecond.</td>
</tr>
<tr>
<td>Current</td>
<td>The most recent data point value for the chart.</td>
</tr>
<tr>
<td>Past Hour</td>
<td>A chart of the last hour of data points.</td>
</tr>
</tbody>
</table>

Datastore Trends Portlet

The Datastore Trends portlet is a chart of the IO performance of the selected datastore.

<table>
<thead>
<tr>
<th>Step 1</th>
<th>From the vSphere Web Client Navigator, select vCenter Inventory Lists &gt; Cisco HyperFlex Systems &gt; Cisco HX Data Platform &gt; cluster &gt; Manage.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 2</td>
<td>Select a datastore from the table list. The Summary tab updates to display the information for the selected datastore.</td>
</tr>
<tr>
<td>Step 3</td>
<td>Scrolls to view the Trends portlet.</td>
</tr>
<tr>
<td></td>
<td>The tab displays IOPS plotted every 20 minutes.</td>
</tr>
<tr>
<td></td>
<td>Hover your mouse over the peak values to obtain color-coded read IOPS and write IOPS.</td>
</tr>
</tbody>
</table>
Customizing Performance Charts

Procedure

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Modify the performance charts to display all or some of the listed options.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Customize Item</strong></td>
<td>Description</td>
</tr>
<tr>
<td><strong>Time period</strong></td>
<td>Choose from hour, days, week, month, all, or custom. See Specifying Performance Time Period section in this chapter.</td>
</tr>
<tr>
<td><strong>Cluster objects</strong></td>
<td>Choose from a list of storage clusters, hosts, or datastores.</td>
</tr>
<tr>
<td><strong>Chart type</strong></td>
<td>Choose from IOPS, Throughput, or Latency.</td>
</tr>
<tr>
<td><strong>Show objects</strong></td>
<td>Choose which listed object’s data to display. See Selecting Performance Charts section in this chapter.</td>
</tr>
</tbody>
</table>

Specify Performance Time Period

**Step 1** From the vSphere Web Client Navigator, select **vCenter Inventory Lists > Cisco HyperFlex Systems > Cisco HX Data Platform > cluster > Monitor > Performance**

**Step 2** Click one of the following tabs to specify the time period in which you want to view performance of the storage cluster, host, or datastore.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hour</strong></td>
<td>Displays performance in the past hour</td>
</tr>
<tr>
<td><strong>Day</strong></td>
<td>Displays performance in the past day</td>
</tr>
<tr>
<td><strong>Week</strong></td>
<td>Displays performance in the past week</td>
</tr>
<tr>
<td><strong>Month</strong></td>
<td>Displays performance in the past month</td>
</tr>
<tr>
<td><strong>All</strong></td>
<td>Displays the performance of the storage cluster since it was created</td>
</tr>
<tr>
<td><strong>Custom</strong></td>
<td>Select this tab and specify a custom range as described in Specifying Custom Range</td>
</tr>
</tbody>
</table>
Specify Custom Range

Step 1  From the vSphere Web Client Navigator, select **vCenter Inventory Lists > Cisco HyperFlex Systems > Cisco HX Data Platform > cluster > Monitor > Performance**

Step 2  Click the **Custom** tab to display the Custom Range dialog box.

Step 3  Choose a method, for the Custom Range dialog box:
   a) Click **Last**, type the number of minutes, hours, days, or months. Optionally, use the up or down arrow to increase or decrease the number.
   b) Click the drop-down list to specify the minutes, hours, days, weeks, or months.
   c) Click **From**, click the calendar icon, and select a date from which you want to start measuring the performance. Click the drop-down list to select a time.
   d) Click **To**, click the calendar icon, and select a date up to which you want to start measuring the performance. Click the drop-down list to select a time.

Step 4  Click **Apply** and then click **OK** to apply your configuration.

Selecting Performance Charts

You can select the performance charts to display for storage clusters, hosts, and datastores.

Select or deselect the check box corresponding to IOPS, Throughput, and Latency at the bottom of the tab to view specific information.

For example, to view only storage cluster IOPS performance:

a) From the vSphere Web Client Navigator, select **vCenter Inventory Lists > Cisco HyperFlex Systems > Cisco HX Data Platform > cluster > Monitor > Performance**.

b) Click either **Storage Cluster, Hosts, or Datastores** chart set. In a Hosts table, compute nodes do not display IOPS, Throughput, or Latency values, as they do not provide storage to the storage cluster.

c) Deselect chart options.

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chart types</strong></td>
<td>Click the check box to select which charts and table columns to view or hide. Options are:</td>
</tr>
<tr>
<td></td>
<td>• IOPS</td>
</tr>
<tr>
<td></td>
<td>• Throughput</td>
</tr>
<tr>
<td></td>
<td>• Latency</td>
</tr>
<tr>
<td><strong>Show</strong></td>
<td>For each storage cluster, hosts, and datastores, click the check boxes to select the specific object to include or exclude from the charts.</td>
</tr>
<tr>
<td><strong>Read/Write</strong></td>
<td>Indicates the color representation in the chart for the read and write values of each object.</td>
</tr>
<tr>
<td><strong>Storage Cluster</strong></td>
<td>Names of the storage clusters in the charts.</td>
</tr>
</tbody>
</table>
### Selecting Performance Charts

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hosts</td>
<td>Names of the hosts in the charts. This includes both converged nodes and compute nodes.</td>
</tr>
<tr>
<td>Datastores</td>
<td>Names of the datastores in the charts.</td>
</tr>
<tr>
<td>IOPS Read/Write</td>
<td>Latest data point for Input/Output Operations per Second.</td>
</tr>
<tr>
<td>Throughput Read/Write (Mbps)</td>
<td>Latest data point for the rate of data transfer in the storage cluster. Measured in Mbps.</td>
</tr>
<tr>
<td>Latency Read/Write (msec)</td>
<td>Latest data point for the Latency that is a measure of how long it takes for a single I/O request to complete. It is the duration between issuing a request and receiving a response. Measured in msec.</td>
</tr>
</tbody>
</table>
CHAPTER 5

Preparing for HX Storage Cluster Maintenance

- Storage Cluster Maintenance Operations Overview, on page 47
- Serial vs. Parallel Operations, on page 49
- Checking Cluster Status, on page 49
- Setting a Beacon, on page 49
- Verify vMotion Configuration for HX Cluster, on page 50
- Maintenance Modes for Storage Cluster Nodes, on page 51
- Entering Cisco HyperFlex Maintenance Mode, on page 52
- Exiting Cisco HyperFlex Maintenance Mode, on page 53
- Creating a Backup Operation, on page 54
- Shut Down and Power Off the Cisco HX Storage Cluster, on page 58
- Power On and Start Up the Cisco HX Storage Cluster, on page 61
- Restoring the Configuration for a Fabric Interconnect, on page 63
- Configure PCI Passthrough After Changing vNIC or vHBAs, on page 65

Storage Cluster Maintenance Operations Overview

Maintaining the Cisco HyperFlex (HX) Data Platform storage cluster tasks affect both hardware and software components of the storage cluster. Storage cluster maintenance operations include adding or removing nodes and disks, and network maintenance.

Some steps in maintenance tasks are performed from the storage controller VM of a node in the storage cluster. Some commands issued on a storage controller VM affect all the nodes in the storage cluster.

Note

Three node storage clusters. Contact Technical Assistance Center (TAC) for any task that requires removing or shutting down a node in a three node cluster. With any 3 node storage cluster, if one node fails or is removed, the cluster remains in an unhealthy state until a third node is added and joins the storage cluster.

Upgrading from vSphere 5.5 to 6.0. Before you upgrade either your ESX server or your vCenter server from 5.5 to 6.0, contact Technical Assistance Center (TAC).

Adding nodes. Nodes are added to the storage cluster through the Expand Cluster feature of the Cisco HX Data Platform Installer. All new nodes must meet the same system requirements as when you installed the Cisco HX Data Platform and created the initial storage cluster. For a complete list of requirements and steps for using the Expand Cluster feature, see the appropriate Cisco HX Data Platform Install Guide.
Online vs Offline Maintenance

Depending upon the task, the storage cluster might need to be either online or offline. Typically maintenance tasks require that all nodes in the storage cluster are online.

When storage cluster maintenance is performed in an offline mode, this means the Cisco HX Data Platform is offline, however the storage controller VMs are up and Cisco HX Data Platform management is viewable through the \texttt{stcli} command line, HX Connect, and HX Data Platform Plug-in. The vSphere Web Client can report on the storage I/O layer. The \texttt{stcli cluster info} command returns that the overall storage cluster status is offline.

Pre-Maintenance Tasks

Before you perform maintenance on the storage cluster, ensure the following.

- Identify the maintenance task to be performed.
- All maintenance operations such as remove/replace resources are done during maintenance windows when the load on the system is low.
- The storage cluster is healthy and operational before the maintenance tasks.
- Identify disks using the HX Connect or HX Data Platform Plug-in Beacon options.
  - The HX Beacon option is not available for housekeeping 120GB SSDs. Physically check the server for the location of the housekeeping SSD.
- Check the list of maintenance tasks that cannot be performed in parallel. See Serial vs. Parallel Operations, on page 49 for more information on these tasks. You can perform only some tasks serially to each other.
- Ensure that SSH is enabled on all the ESX hosts.
- Put the ESX host into HX Maintenance Mode prior to performing a maintenance task on the host. The HX maintenance mode performs additional storage cluster specific steps compared to the vSphere provided ESX maintenance mode.

Post Maintenance Tasks

After the maintenance task is completed, the nodes need to exit Cisco HX Maintenance Mode and the storage cluster needs to be restarted. In addition, some changes to the Cisco HX storage cluster require additional post maintenance tasks. For example, if you change the vNICs or vHBAs, the PCI Passthrough needs to be reconfigured. For more information describing how to reconfigure the PCI Passthrough, see Configure PCI Passthrough After Changing vNIC or vHBAs, on page 65.

Ensure the following:

- The ESX host is exited from Cisco HX maintenance mode after performing maintenance tasks on the host.
- The storage cluster is healthy and operational after any remove or replace tasks are completed.
- If vNICs or vHBAs have been added, removed, or replace on any ESX host in the Cisco HX storage cluster, reconfigure the PCI Passthrough.
Serial vs. Parallel Operations

Certain operations cannot be performed simultaneously. Ensure that you perform the following operations serially (not in parallel).

• Upgrade a storage cluster or a node.
• Create, re-create, or configure a storage cluster.
• Add or remove a node.
• Any node maintenance that requires a node be shutdown. This includes adding or removing disks or network interface cards (NICs).
• Start or shut down a storage cluster.
• Re-register a storage cluster with vCenter.

Checking Cluster Status

Step 1 Login to any controller VM in the storage cluster. Run the listed commands from the controller VM command line.

Step 2 Verify the storage cluster is healthy.

```bash
# stcli cluster info
```

Example response that indicates the storage cluster is online and healthy:

```plaintext
locale: English (United States)
state: online
upgradeState: ok
healthState: healthy
state: online
state: online
```

Step 3 Verify the number of node failures.

```
# stcli cluster storage-summary
```

Example response:

```
# of node failures tolerable to be > 0
```

Setting a Beacon

Beaconing is a method of turning on an LED to assist in locating and identifying a node (host) and a disk. Nodes have the beacon LED in the front near the power button and in the back. Disks have the beacon LED on the front face.

You set a node beacon through Cisco UCS Manager. You set a disk beacon through the Cisco HX Data Platform Plug-in or HX Connect user interface.
Step 1
Turn on and off a node beacon using UCS Manager.
   a) From the UCS Manager left panel, select Equipment > Servers > server.
   b) From the UCS Manager central panel, select General > Turn on Locator LED.
   c) After you locate the server, turn off the locator LED.

Step 2
Turn on and off a disk beacon using the Cisco HX Data Platform Plug-in.
   a) From the vSphere Web Client Navigator, select vCenter Inventory Lists > Cisco HyperFlex Systems > Cisco HX Data Platform > cluster > Manage.
   b) From Manage, select Cluster > cluster > host > Disks > disk.
   c) Locate the physical location of the object and turn on the beacon.

Step 3
Turn on and off a disk beacon using HX Connect.
   a) Log in to HX Connect.
   b) Select System Information > Disks.
   c) Select a node, and then click Turn On Locator LED or Turn Off Locator LED.

Verify vMotion Configuration for HX Cluster

Before you perform maintenance operations on the Cisco HyperFlex (HX) cluster, verify all nodes in the HX cluster are configured for vMotion. Confirm the following from your vSphere Web Client:

1. Verify that the vMotion port group is configured with vmnic3 and vmnic7 in an active/standby configuration across all of the ESXi hosts in the cluster.

2. Verify that a port group is configured for vMotion, and that the naming convention is EXACTLY the same across all ESXi hosts in the cluster.

   Note: The name is case-sensitive.

3. Verify that you have assigned a static IP to each vMotion port group, and that the static IPs for each vMotion port group are in the same subnet.

   Note: The static IP address is defined as a VMKernel interface.
4. Verify that the vMotion port group has the vMotion option checked in the properties, and that no other port groups (such as management) have this option checked, on each ESXi host in the cluster.

5. Verify in the settings that the vMotion port group is set to 9000 MTU, (if you are using jumbo frames), and the VLAN ID matches the network configuration for the vMotion subnet.

6. Verify you can ping from the vMotion port group on one ESXi host to the vMotion IP on the other host.
   Type `vmkping -I vmk2 -d -s 8972 <vMotion IP address of neighboring server>`

---

### Maintenance Modes for Storage Cluster Nodes

Maintenance mode is applied to nodes in a cluster. It prepares the node for assorted maintenance tasks by migrating all VMs to other nodes before you decommission or shut the node down.

There are two types of maintenance modes.

- Cisco HX maintenance mode
- VMware ESX maintenance mode

#### Cisco HX Maintenance Mode

Cisco HX maintenance mode performs Cisco HX Data Platform specific functions in addition to the ESX maintenance mode. Be sure to select Cisco HX maintenance mode and not ESX maintenance mode for maintenance tasks performed on storage cluster nodes after initial storage cluster creation.

This mode is the preferred maintenance mode for performing selected tasks on individual nodes in the cluster. Including:

- Shutting down an individual host for maintenance, such as disk replacement.
- Upgrading selected software on a host, such as ESX Server version.

#### Cisco HX Maintenance Mode Considerations

- Ensure that SSH is enabled in ESX on all the nodes in the storage cluster prior to using Cisco HX Maintenance Mode.
- When Cisco HX Maintenance Mode is entered to enable performing tasks on an ESX host, be sure to exit Cisco HX Maintenance Mode after the tasks on the ESX host are completed.
- Cisco HX Maintenance Mode is applied to nodes in a healthy cluster only. If the cluster is unhealthy, for example too many nodes are down, or you are shutting down the cluster, use ESX Maintenance Mode.
- See Entering Cisco HyperFlex Maintenance Mode and Exiting Cisco HyperFlex Maintenance Mode, on page 53 for steps.

#### VMware ESX Maintenance Mode

This mode is used when you are installing Cisco HX Data Platform or applying cluster wide changes.

To enter or exit vSphere maintenance mode:

- Through the vCenter GUI, select the host, then from the right-click menu select maintenance mode.
• Through the ESX command line, use the `esx maintenance mode` command.

## Entering Cisco HyperFlex Maintenance Mode

### Using the Cisco HyperFlex (HX) Connect User Interface

**Note**
Maintenance Mode is supported on Cisco HyperFlex Release 2.5(1a)/2.5(1b) and later.

1. Log in to Cisco HX Connect: `https://<cluster management ip>`.
2. In the menu, click **System Information**.
3. Click **Nodes**, and then click the row of the node you want to put in to maintenance mode.
4. Click **Enter HX Maintenance Mode**.
5. In the **Confirm HX Maintenance Mode** dialog box, click **Enter HX Maintenance Mode**.

**Note**
After you complete any maintenance tasks, you must manually exit HX maintenance mode.

### Using the vSphere Web Client

1. Log in to the vSphere web client.
2. Go to **Home > Hosts and Clusters**.
3. Expand the **Datacenter** that contains the **HX Cluster**.
4. Expand the **HX Cluster** and select the node.
5. Right-click the node and select **Cisco HX Maintenance Mode > Enter HX Maintenance Mode**.

### Using the Command-Line Interface

1. Log in to the storage controller cluster command line as a user with root privileges.
2. Move the node into HX Maintenance Mode.
   a. Identify the node ID and IP address.
      
      ```
      # stcli node list --summary
      ```
   b. Enter the node into HX Maintenance Mode.
      
      ```
      # stcli node maintenanceMode (--id ID | --ip IP Address) --mode enter
      (see also stcli node maintenanceMode --help)
      ```
3. Log in to the ESXi command line of this node as a user with root privileges.
4. Verify that the node has entered HX Maintenance Mode.

   # esxcli system maintenanceMode get

You can monitor the progress of the Enter Maintenance Mode task in vSphere Web Client, under the Monitor > Tasks tab.

If the operation fails, an error message displays. Try to fix the underlying problem and attempt to enter maintenance mode again.

## Exiting Cisco HyperFlex Maintenance Mode

### Using the Cisco HyperFlex (HX) Connect User Interface

- **Note**
  
  Maintenance Mode is supported on Cisco HyperFlex Release 2.5(1a)/2.5(1b) and later.

1. Log in to HX Connect: `https://<cluster management ip>`.
2. In the menu, click System Information.
3. Click Nodes, and then click the row of the node you want to remove from maintenance mode.
4. Click Exit HX Maintenance Mode.

### Using the vSphere Web Client

1. Log in to the vSphere web client.
2. Go to Home > Hosts and Clusters.
3. Expand the Datacenter that contains the HX Cluster.
4. Expand the HX Cluster and select the node.
5. Right-click the node and select Cisco HX Maintenance Mode > Exit HX Maintenance Mode.

### Using the Command-Line Interface

1. Log in to the storage controller cluster command line as a user with root privileges.
2. Exit the node out of HX Maintenance Mode.
   a. Identify the node ID and IP address.
      
      # stcli node list --summary
   b. Exit the node out of HX Maintenance Mode.
      
      # stcli node maintenanceMode (--id ID | --ip IP Address) --mode exit
      (see also stcli node maintenanceMode --help)
3. Log in to the ESXi command line of this node as a user with root privileges.
4. Verify that the node has exited HX Maintenance Mode.

    # esxcli system maintenanceMode get

You can monitor the progress of the Exit Maintenance Mode task in vSphere Web Client, under the Monitor > Tasks tab.

If the operation fails, an error message displays. Try to fix the underlying problem and attempt to exit maintenance mode again.

## Creating a Backup Operation

Before you shutdown your HX storage cluster, backup the configuration. Perform both the Full-State and All Configuration type backups with the Preserve Identities attribute.

### Before you begin

1. Login to UCS Manager.
2. Obtain the backup server IPv4 address and authentication credentials.

### Note

All IP addresses must be IPv4. HyperFlex does not support IPv6 addresses.

### Steps

- **Step 1** In the Navigation pane, click Admin.
- **Step 2** Click the All node.
- **Step 3** In the Work pane, click the General tab.
- **Step 4** In the Actions area, click Backup Configuration.
- **Step 5** In the Backup Configuration dialog box, click Create Backup Operation.
- **Step 6** In the Create Backup Operation dialog box, complete the following fields:

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admin State field</td>
<td>This can be one of the following:</td>
</tr>
<tr>
<td></td>
<td>- <strong>Enabled</strong>—Cisco UCS Manager runs the backup operation as soon as you click OK.</td>
</tr>
<tr>
<td></td>
<td>- <strong>Disabled</strong>—Cisco UCS Manager does not run the backup operation when you click OK. If you select this option, all fields in the dialog box remain visible. However, you must manually run the backup from the Backup Configuration dialog box.</td>
</tr>
</tbody>
</table>
The informationsaved in the backup configuration file. This can be one of the following:

- **Full state**—A binary file that includes a snapshot of the entire system. You can use the file generated from this backup to restore the system during disaster recovery. This file can restore or rebuild the configuration on the original fabric interconnect, or recreate the configuration on a different fabric interconnect. You cannot use this file for an import.

  **Note** You can only use a full state backup file to restore a system that is running the same version as the system from which the backup file was exported.

- **All configuration**—An XML file that includes all system and logical configuration settings. You can use the file generated from this backup to import these configuration settings to the original fabric interconnect or to a different fabric interconnect. You cannot use this file for a system restore. This file does not include passwords for locally authenticated users.

- **System configuration**—An XML file that includes all system configuration settings such as usernames, roles, and locales. You can use the file generated from this backup to import these configuration settings to the original fabric interconnect or to a different fabric interconnect. You cannot use this file for a system restore.

- **Logical configuration**—An XML file that includes all logical configuration settings such as service profiles, VLANs, VSANs, pools, and policies. You can use the file generated from this backup to import these configuration settings to the original fabric interconnect or to a different fabric interconnect. You cannot use this file for a system restore.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type field</strong></td>
<td>The information saved in the backup configuration file. This can be one of the following:</td>
</tr>
<tr>
<td></td>
<td>• <strong>Full state</strong>—A binary file that includes a snapshot of the entire system. You can use the file generated from this backup to restore the</td>
</tr>
<tr>
<td></td>
<td>system during disaster recovery. This file can restore or rebuild the configuration on the original fabric interconnect, or recreate the</td>
</tr>
<tr>
<td></td>
<td>configuration on a different fabric interconnect. You cannot use this file for an import.</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong> You can only use a full state backup file to restore a system that is running the same version as the system from which the backup</td>
</tr>
<tr>
<td></td>
<td>file was exported.</td>
</tr>
<tr>
<td></td>
<td>• <strong>All configuration</strong>—An XML file that includes all system and logical configuration settings. You can use the file generated from this</td>
</tr>
<tr>
<td></td>
<td>backup to import these configuration settings to the original fabric interconnect or to a different fabric interconnect. You cannot use</td>
</tr>
<tr>
<td></td>
<td>this file for a system restore. This file does not include passwords for locally authenticated users.</td>
</tr>
<tr>
<td></td>
<td>• <strong>System configuration</strong>—An XML file that includes all system configuration settings such as usernames, roles, and locales. You can use</td>
</tr>
<tr>
<td></td>
<td>the file generated from this backup to import these configuration settings to the original fabric interconnect or to a different fabric</td>
</tr>
<tr>
<td></td>
<td>interconnect. You cannot use this file for a system restore.</td>
</tr>
<tr>
<td></td>
<td>• <strong>Logical configuration</strong>—An XML file that includes all logical configuration settings such as service profiles, VLANs, VSANs, pools,</td>
</tr>
<tr>
<td></td>
<td>and policies. You can use the file generated from this backup to import these configuration settings to the original fabric interconnect or</td>
</tr>
<tr>
<td></td>
<td>to a different fabric interconnect. You cannot use this file for a system restore.</td>
</tr>
</tbody>
</table>
### Preserve Identities check box

This checkbox remains selected for **All Configuration** and **System Configuration** type of backup operation, and provides the following functionality:

- **All Configuration**—The backup file preserves all identities derived from pools, including vHBAs, WWPNs, WWNN, vNICs, MACs, and UUIDs. Also, the identities for Chassis, FEX, Rack Servers, and user labels for Chassis, FEX, Rack Servers, IOMs, and Blade Servers are preserved.

  **Note** If this check box is not selected the identities will be reassigned and user labels will be lost after a restore.

- **System Configuration**—The backup file preserves identities for Chassis, FEX, Rack Servers, and user labels for Chassis, FEX, Rack Servers, IOMs, and Blade Servers.

  **Note** If this check box is not selected the identities will be reassigned and user labels will be lost after a restore.

If this checkbox is selected for **Logical Configuration** type of backup operation, the backup file preserves all identities derived from pools, including vHBAs, WWPNs, WWNN, vNICs, MACs, and UUIDs.

**Note** If this check box is not selected the identities will be reassigned and user labels will be lost after a restore.

### Location of the Backup File field

Where the backup file should be saved. This can be one of the following:

- **Remote File System**—The backup XML file is saved to a remote server. Cisco UCS Manager GUI displays the fields described below that allow you to specify the protocol, host, filename, username, and password for the remote system.

- **Local File System**—The backup XML file is saved locally.

  HTML-based Cisco UCS Manager GUI displays the **Filename** field. Enter a name for the backup file in `<filename>.xml` format. The file is downloaded and saved to a location depending on your browser settings.
### Protocol field

The protocol to use when communicating with the remote server. This can be one of the following:

- **FTP**
- **TFTP**
- **SCP**
- **SFTP**
- **USB A** — The USB drive inserted into fabric interconnect A. This option is only available for certain system configurations.
- **USB B** — The USB drive inserted into fabric interconnect B. This option is only available for certain system configurations.

### Hostname field

The hostname, IPv4 address of the location where the backup file is stored. This can be a server, storage array, local drive, or any read/write media that the fabric interconnect can access through the network.

**Note**

If you use a hostname rather than an IPv4 address, you must configure a DNS server. If the Cisco UCS domain is not registered with Cisco UCS Central or DNS management is set to `local`, configure a DNS server in Cisco UCS Manager. If the Cisco UCS domain is registered with Cisco UCS Central and DNS management is set to `global`, configure a DNS server in Cisco UCS Central.

**Note**

All IP addresses must be IPv4. HyperFlex does not support IPv6 addresses.

### Remote File field

The full path to the backup configuration file. This field can contain the filename as well as the path. If you omit the filename, the backup procedure assigns a name to the file.

### User field

The username the system should use to log in to the remote server. This field does not apply if the protocol is TFTP or USB.

### Password field

The password for the remote server username. This field does not apply if the protocol is TFTP or USB.

Cisco UCS Manager does not store this password. Therefore, you do not need to enter this password unless you intend to enable and run the backup operation immediately.

---

**Step 7**

Click **OK**.

**Step 8**

If Cisco UCS Manager displays a confirmation dialog box, click **OK**.

If you set the **Admin State** field to enabled, Cisco UCS Manager takes a snapshot of the configuration type that you selected and exports the file to the network location. The backup operation displays in the **Backup Operations** table in the **Backup Configuration** dialog box.
Shut Down and Power Off the Cisco HX Storage Cluster

Some storage cluster maintenance tasks require that the storage cluster be shut down. This is different than the storage cluster being in an offline state. It is also separate from shutting down a node in the storage cluster. Powering down the storage cluster affects all the physical components of the cluster.

- **A powered-off cluster** has all the physical components of the storage cluster removed from electrical power.
  - Very rarely would a storage cluster need to have all the components powered off. No regular maintenance or upgrade processes require that the entire storage cluster be completely powered off.
- **A shut-down cluster** has all storage cluster processes, including the working VMs, powered down. This does not include powering down the nodes in the cluster or shutting down the vCenter or FI cluster.
- **An offline cluster** is one of the storage cluster operational states. A storage cluster can be offline if there is an unknown or specific error, or if the storage cluster has been shutdown.

To shut down the Cisco HX storage cluster, perform the following steps:

**Before you begin**

- The storage cluster must be in a healthy state.
- Perform both the Full-State and All Configuration type backups with the Preserve Identities attribute. See Creating a Backup Operation, on page 54.

**Step 1**

Gracefully shut down all workload VMs on all the Cisco HX datastores.

Alternatively, use vMotion to migrate the workload VMs to another cluster.

**Note** Do not shut down or move the storage controller VMs (stCtlVMs).

**Step 2**

Gracefully shut down the Cisco HX storage cluster.

a) From any controller VM command line, run the command and wait for the shell prompt to return.

**Note** For clusters with a nested vCenter, performing an stcli cluster shutdown may have certain limitations. For more details, see Known Constraints with vCenter Deployment. For the procedure on how to shutdown nested vCenter, see Shut Down Nested vCenter, on page 60.
# stcli cluster shutdown

b) Run the cluster information command. Confirm the storage cluster is offline.

# stcli cluster info

In the command response text, check the cluster subsection and verify the `healthstate` is `unknown`.

This Cisco HX cluster shutdown procedure does not shut down the ESXi hosts.

If the maintenance or upgrade task does not require the physical components be powered off, exit these steps and proceed to **What to do next:**

### Step 3  To power off the HX storage cluster

Complete Step 2 and Step 3, then complete the rest of the following steps.

### Step 4  To power off the HX storage cluster

On each storage cluster ESX host, shutdown the controller VM (`stCtlVM`).

Choose a method:

Using vCenter VM Power Off

a) From vCenter client, locate the controller VM on each ESX host.
b) Right-click the controller VM and select **Power > Power Off**.

This method performs a graceful guest VM shutdown.

Using vCenter ESX Agent Manager

a) From vCenter client, open the ESX Agent Manager console.
b) Locate the controller VM on each ESX host, and select **Power > Power Off**.

This method performs a graceful shutdown of agent VMs. The controller VM is an agent VM.

Using vCenter ESX Maintenance Mode

a) From vCenter client, locate each ESX host.
b) Right-click the ESX host and select **Maintenance Mode > Enter Maintenance Mode**.

This method performs a hard shutdown on every VM in the ESX host, including the controller VM.

### Step 5  Shutdown each storage cluster ESX host

a) From the vCenter client, locate the host.
b) Right-click the host and select **Power > Shut Down**.

### Step 6  Power off the FIs, if this is needed for your maintenance task.

Cisco UCS FIs are designed for continuous operation. In a production environment, there is no need to shut down or reboot Fabric Interconnects. Therefore, there is no power button on UCS Fabric Interconnects.

**To power off Cisco UCS Fabric Interconnect**, pull the power cable manually. Alternatively, if you have the FI power cables connected to a smart PDUs, use the provided remote control to turn off the power from the electrical outlet.

a) Verify all the storage cluster servers on the FI do not have a green power LED.
b) Power off the secondary FI.
c) Power off the primary FI.

---

The HX storage cluster is now safely powered off.
What to do next

1. Complete the task that required the storage cluster shutdown or power off. For example, an offline upgrade, physically moving the storage cluster, or performing maintenance on nodes.
   - For upgrade tasks, see the Cisco HyperFlex Systems Upgrade Guide.
   - For hardware replacement tasks, see the server hardware guides.

Sometimes these tasks require that the host is shutdown. Follow the steps in the server hardware guides for migrating VMs, entering Cisco HX Maintenance Mode, and powering down the servers, as directed.

Note Most hardware maintenance tasks do not require the Cisco HX cluster is shutdown.

2. To restart the Cisco HX storage cluster, proceed to Power On and Start Up the Cisco HX Storage Cluster, on page 61.

Shut Down Nested vCenter

This section captures the procedure to shutdown a nested vCenter within a cluster.

Step 1: Shutdown all VMs on a cluster.
Step 2: Shutdown vCenter.
Step 3: Note down the name of host on which vCenter is running as the host has to be manually started.
Step 4: Stop Storf on all controllers using Mobaxterm, by running the following command:
        stop storfs
Step 5: Shutdown controllers using Mobaxterm, by running the following command:
        shutdown -P now
Step 6: Put all individual hosts in maintenance mode, by running the following command:
        esxcli system maintenanceMode set -e true
Step 7: Shutdown the ESX hosts.
Step 8: Boot up the ESX hosts.
Step 9: Exit all hosts from maintenance mode, by running the following command:
        esxcli system maintenanceMode set -e false
Step 10: Manually start the sCTLVMs (as vCenter is down, they may not start automatically).
Step 11: Verify if Storf is running on each controller, by running the following command:
        # pidof storfs
        If the pidof command does not return any output, start Storf by running the following command:
        # start storfs
Step 12: From the controller, check for the cluster status by running the following command:
sysmtool --ns cluster --cmd info

Wait for cluster to be healthy.

**Step 13**

Power on vCenter from the host (use the host name note down in step 3).
Wait for vCenter to be up. Check if the cluster is healthy by running the following command:
`stcli cluster info | grep \-A 1 vcluster`

After vCenter is up and running, you will get a state of online from this command.

**Note** If the `stcli cluster storage-summary` command fails and the cluster is in the healthy state, start the cluster using the `stcli cluster start` command.

---

**Power On and Start Up the Cisco HX Storage Cluster**

The steps here are for use in restarting the Cisco HX storage cluster after a graceful shutdown and power off. Typically, this is performed after maintenance tasks are completed on the storage cluster.

**Before you begin**

Complete the steps in [Shut Down and Power Off the Cisco HX Storage Cluster](#), on page 58.

---

**Step 1**

Plug in to power up the FIs.

a) Power on the primary FI. Wait until you can gain access to UCS Manager.
b) Power on the secondary FI. Verify it is online in UCS Manager.

In some rare cases, you might need to reboot the Fabric Interconnects.

a. Log in to each Fabric Interconnect using SSH.
b. Issue the commands:

```
FI# connect local-mgmt
FI# reboot
```

**Step 2**

Connect all the ESX hosts to the FIs.

a) Power on each node in the storage cluster, if it does not power on automatically.

The node should automatically power on and boot into ESX. If any node does not, then connect to the UCS Manager and power up the servers (nodes) from UCS Manager.

b) Verify each ESX host is up and associated with its respective service profile in UCS Manager.

**Step 3**

Verify all the ESXi hosts are network reachable.

Ping all the management addresses.

**Step 4**

Exit each node from maintenance mode.

**Note** This is automatically completed by the `stcli cluster start` command.
Step 5  If all the controller VMs are not automatically powered on, power on all the controller VMs (stCtlVM) using one of the following methods:

Using vSphere Client  
   a) From the vSphere Client, view a storage controller host.  
   b) Right-click the stCtlVM and select **Power > Power On**.  
   c) Repeat for each host.

Using ESXi host command line  
   a) Login to a host.  
   b) Identify the VMID of the stCtlVM.  
      ```bash  
      # vim-cmd vmsvc/getallvms  
      ```  
   c) Using the VMID power on the controller VM.  
      ```bash  
      # vim-cmd vmsvc/power.on VMID  
      ```  
   d) Repeat for each host.

Step 6  Wait for all the controller VMs to boot and become network reachable. Then verify.  
Ping the management addresses of each of the controller VMs.

Step 7  Verify the storage cluster is ready to be restarted.  
   a) SSH to any controller VM, run the command:  
      ```bash  
      # stcli about  
      ```  
   b) If the command returns full storage cluster information, including build number, the storage cluster is ready to be started. Proceed to restarting the storage cluster.  
   c) If the command does not return full storage cluster information, wait until all the services have started on the host.

Step 8  Start the storage cluster.  
From the command line of any controller VM, run the command.  
   ```bash  
   # stcli cluster start  
   ```  
Depending upon the maintenance or upgrade task performed while the HX cluster was shutdown, the nodes might be exited from HX maintenance mode or ESX maintenance mode. Ignore any error messages about an unknown host exception.

Step 9  Wait until the storage cluster is online and returns to a healthy state.  
   a) From any controller VM, run the command.  
      ```bash  
      # stcli cluster info  
      ```  
   b) In the command response text, check the cluster subsection and verify the **healthstate** is **online**.  
This could take up to 30 minutes, it could take less time depending upon the last known state.

Step 10  Through vCenter, verify that ESX remounted the datastores.  
Once the cluster is available, the datastores are automatically mounted and available.  
If ESX does not recognize the datastores, from the ESX command line, run the command.  
   ```bash  
   # esxcfg-nas -r  
   ```
Step 11  When the storage cluster is healthy and the datastores are remounted, power on the workload VMs. Alternatively, use vMotion to migrate the workload VMs back to the storage cluster.

Restoring the Configuration for a Fabric Interconnect

It is recommended that you use a full state backup file to restore a system that is running the same version as the system from which the backup file was exported. You can also use a full state backup to restore a system if they have the same release train. For example, you can use a full state backup taken from a system running Release 2.1(3a) to restore a system running Release 2.1(3f).

To avoid issues with VSAN or VLAN configuration, a backup should be restored on the fabric interconnect that was the primary fabric interconnect at the time of backup.

Before you begin

Collect the following information to restore the system configuration:

- Fabric interconnect management port IPv4 address and subnet mask.
- Default gateway IPv4 address.

Note  All IP address must be IPv4. IPv6 addresses are not supported.

- Backup server IPv4 address and authentication credentials.
- Fully-qualified name of a Full State backup file

Note  You must have access to a Full State configuration file to perform a system restore. You cannot perform a system restore with any other type of configuration or backup file.

SUMMARY STEPS

1. Connect to the console port.
2. If the fabric interconnect is off, power on the fabric interconnect.
3. At the installation method prompt, enter gui.
4. If the system cannot access a DHCP server, you may be prompted to enter the following information:
5. Copy the web link from the prompt into a web browser and go to the Cisco UCS Manager GUI launch page.
6. On the launch page, select Express Setup.
7. On the Express Setup page, select Restore From Backup and click Submit.
8. In the Protocol area of the Cisco UCS Manager Initial Setup page, select the protocol you want to use to upload the full state backup file:
9. In the Server Information area, complete the following fields:

10. Click Submit.

DETAILED STEPS

Step 1 Connect to the console port.
Step 2 If the fabric interconnect is off, power on the fabric interconnect.
You will see the power on self-test message as the fabric interconnect boots.
Step 3 At the installation method prompt, enter gui.
Step 4 If the system cannot access a DHCP server, you may be prompted to enter the following information:
   - IPv4 address for the management port on the fabric interconnect
   - Subnet mask or prefix for the management port on the fabric interconnect
   - IPv4 address for the default gateway assigned to the fabric interconnect
Step 5 Copy the web link from the prompt into a web browser and go to the Cisco UCS Manager GUI launch page.
Step 6 On the launch page, select Express Setup.
Step 7 On the Express Setup page, select Restore From Backup and click Submit.
Step 8 In the Protocol area of the Cisco UCS Manager Initial Setup page, select the protocol you want to use to upload the full state backup file:
   - SCP
   - TFTP
   - FTP
   - SFTP
Step 9 In the Server Information area, complete the following fields:

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server IP</td>
<td>The IPv4 address of the computer where the full state backup file is located. This can be a server, storage array, local drive, or any read/write media that the fabric interconnect can access through the network.</td>
</tr>
<tr>
<td>Backup File Path</td>
<td>The file path where the full state backup file is located, including the folder names and filename. You can only use a full state backup file to restore a system that is running the same version as the system from which the backup file was exported.</td>
</tr>
</tbody>
</table>
### Configure PCI Passthrough After Changing vNIC or vHBAs

**Description**

After vNIC or vHBA are manually added to an Cisco HyperFlex (HX) service profile or service profile template, the PCI devices are re-enumerated and the VMware directpath I/O configuration is lost. When the service profile is changed, the host hardware is updated and the PCI passthrough must be reconfigured. Perform the following steps on each ESX host with a modified service profile.

Perform the following steps on the storage controller VM of the modified ESX host:

**Action:** Update the vSphere Service Profile on the ESX Host

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Put the ESX host into HX Maintenance mode.</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>Make or confirm the changes, such as adding hardware, in the Service Profile.</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>Reboot the ESX host.</td>
</tr>
</tbody>
</table>
| **Step 4** | Login to vCenter and select the DirectPath I/O Configuration page.  
From vCenter Client: Select the ESX host > Configuration tab > Hardware pane > Advanced Settings > Edit.  
From vCenter Web Client: From the vCenter Inventory, select Resources > Hosts > ESX host > Manage > Settings > Hardware > PCI Devices > Edit. |
| **Step 5** | Select the LSI card for passthrough.  
a) From the DirectPath I/O Configuration page, select Configure Passthrough.  
b) From the Mark devices for passthrough list, select the LSI card for the pass through.  
c) Click OK. |
| **Step 6** | Reboot the ESX host. |
Step 7  Re-map the PCI device to the HX storage controller VM (StCtlVM), by editing the storage controller VM settings.
   a) Locate and remove the unknown PCI Device.
      From vCenter Client: Right-click the *HX storage controller VM*, select *Edit Settings* > *PCI device 0* > *Remove* > *OK*.
      From vCenter Web Client: Right-click the *HX storage controller VM*, select *Edit Settings* > *Remove PCI device 0* > *OK*.
   b) Locate and re-add the LSI Logic PCI device.
      From vCenter Client: Right-click the *HX storage controller VM*, select *Edit Settings* > *Add* > *PCI Device* > *LSI Logic PCI device* > *OK*.
      From vCenter Web Client: Right-click the *HX storage controller VM*, select *Edit Settings* > *PCI Device* > *Add* > *LSI Logic PCI device* > *OK*.

Step 8  Remove the ESX host from HX Maintenance mode.

When the host is active again, the HX storage controller VM properly boots and rejoins the storage cluster.
Managing HX Storage Clusters

• Changing the Cluster Access Policy Level, on page 67
• Rebalancing the Cluster, on page 67
• Handling Out of Space Errors, on page 69
• Planning to Move a Storage Cluster Between vCenters, on page 70
• Renaming Clusters, on page 74
• Replacing Self-Signed Certificate on a vCenter Server, on page 74

Changing the Cluster Access Policy Level

Step 1
The storage cluster must be in a healthy state prior to changing the Cluster Access Policy to strict.

Step 2
From the command line of a storage controller VM in the storage cluster, type:

```
# stcli cluster get-cluster-access-policy
# stcli cluster set-cluster-access-policy --name {strict,lenient}
```

Rebalancing the Cluster

The storage cluster is rebalanced on a regular schedule. It is used to realign the distribution of stored data across changes in available storage and to restore storage cluster health. If you add or remove a node in the storage cluster, you can manually initiate a storage cluster rebalance using the `stcli rebalance` command.

Note
Rebalancing might take some time depending on the disk capacity used on the failed node or disk.

Step 1
Start rebalancing the storage cluster.

a) Login to a controller VM in the storage cluster.
b) From the controller VM command line, run the command:
# stcli rebalance start --force

**Step 2** Verify rebalancing status from the storage controller VM.

a) Enter the following on the command line:

```bash
# stcli rebalance status
rebalanceStatus: rebalanceState: cluster_rebalance_ongoing
percentComplete: 10
rebalanceEnabled: True
```

b) Reenter the command line to confirm the process completes:

```bash
# stcli rebalance status
rebalanceStatus: rebalanceState: cluster_rebalance_not_running
rebalanceEnabled: True
```

This sample indicates that rebalance is enabled, and ready to perform a rebalance, but is not currently rebalancing the storage cluster.

---

### Checking Cluster Rebalance and Self Healing Status

The storage cluster is rebalanced on a regular schedule and when the amount of available storage in the cluster changes. A rebalance is also triggered when there is a change in the amount of available storage. This is an automatic self healing function.

---

**Important**

Rebalance typically occurs only when a single disk usage exceeds 50% or cluster aggregate disk usage is greater than 50%.

You can check rebalance status through the HX Data Platform plug-in or through the storage controller VM command line.

---

**Step 1** Check the rebalance status through HX Data Platform plug-in.

a) From the vSphere Web Client Navigator, select `vCenter Inventory Lists > Cisco HyperFlex Systems > Cisco HX Data Platform > cluster > Summary`. The Status portlet lists the Self healing status.

b) Expand the 'Resiliency Status' to see the 'Self Healing status' section. The Self healing status field lists the rebalance activity or N/A, when rebalance is not currently active.

**Step 2** Check the rebalance status through the storage controller VM command line.

a) Login to a controller VM using `ssh`.

b) From the controller VM command line, run the command.

```
# stcli rebalance status
```

The following output indicates that rebalance is not currently running on the storage cluster.
rebalanceStatus:
percentComplete: 0
rebalanceState: cluster_rebalance_not_running
rebalanceEnabled: True

The Recent Tasks tab in the HX Data Platform plug-in displays a status message.

### Handling Out of Space Errors

If your system displays an Out of Space error, you can either add a node to increase free capacity or delete existing unused VMs to release space.

When there is an Out of Space condition, the VMs are unresponsive.

**Note**

Do not delete storage controller VMs. Storage controller VM names have the prefix `stCtlVM`.

<table>
<thead>
<tr>
<th>Step 1</th>
<th>To add a node, use the Expand Cluster feature of the HX Data Platform Installer.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 2</td>
<td>To delete unused VMs, complete the following:</td>
</tr>
<tr>
<td></td>
<td>a) Determine which guest VMs you can delete. You can consider factors such as disk space used by the VM or naming conventions.</td>
</tr>
<tr>
<td></td>
<td>b) Go to vCenter &gt; Virtual Machines to display the virtual machines in the inventory.</td>
</tr>
<tr>
<td></td>
<td>c) Double-click a VM that you want to delete.</td>
</tr>
<tr>
<td></td>
<td>d) Select the Summary &gt; Answer Questions to display a dialog box.</td>
</tr>
<tr>
<td></td>
<td>e) Click the Cancel radio button and click OK.</td>
</tr>
<tr>
<td></td>
<td>f) Power off the VM.</td>
</tr>
<tr>
<td></td>
<td>g) Delete the VM.</td>
</tr>
<tr>
<td>Step 3</td>
<td>After the Out of Space condition is cleared, complete the following:</td>
</tr>
<tr>
<td></td>
<td>a) Go to vCenter &gt; Virtual Machines to display the VM in the inventory.</td>
</tr>
<tr>
<td></td>
<td>b) Double-click a VM that you want to use.</td>
</tr>
<tr>
<td></td>
<td>c) Select the Summary &gt; Answer Questions to display a dialog box.</td>
</tr>
<tr>
<td></td>
<td>d) Click the Retry radio button and click OK.</td>
</tr>
</tbody>
</table>

### Checking Cleaner Schedule

The `stcli cleaner` command typically runs in the background continuously. Cleaner goes into sleep mode when it is not needed and wakes when policy defined conditions are met. For example, if your storage cluster is experiencing ENOSPC condition, the cleaner automatically runs at High Priority.

Do not expand the cluster while the cleaner is running. Check the cleaner schedule or adjust the schedule, as needed.
Planning to Move a Storage Cluster Between vCenters

When you rename the vCenter datacenter or vCenter cluster, you must re-register the HX storage cluster. Moving a storage cluster from one vCenter cluster to another requires the listed steps. See the following topics for detailed information.

1. Meet the prerequisites to this task. See Moving the Storage Cluster from a Current vCenter Server to a New VCenter Server, on page 70.

2. Delete the cluster from the old vCenter, create a new cluster on the new vCenter. Use the same cluster name. See Moving the Storage Cluster from a Current vCenter Server to a New VCenter Server, on page 70.

3. Unregister HX Data Platform using the vCenter Extension Manager. See Unregistering a Storage Cluster from a vCenter Cluster, on page 71.

4. Use the `stcli cluster reregister` command to associate the HX Storage Cluster with a new vCenter. See Registering a Storage Cluster with a New vCenter Cluster, on page 73.

Moving the Storage Cluster from a Current vCenter Server to a New VCenter Server

Before you begin

- If your HX Cluster is running HX Data Platform version older than 1.8(1c), upgrade before attempting to reregister to a new vCenter.
- Perform this task during a maintenance window.
- Ensure the cluster is healthy and upgrade state is OK and Healthy. You can view the state using the `stcli` command from the controller VM command line.

```bash
# stcli cluster info
```

Check response for:
upgradeState: ok
healthState: healthy

• Ensure vCenter must be up and running.
• Snapshot schedules are not moved with the storage cluster when you move the storage cluster between vCenter clusters.

Step 1
From the current vCenter, delete the cluster.
This is the vCenter cluster specified when the HX storage cluster was created.

Step 2
On the new vCenter, create a new cluster using the same cluster name.

Step 3
Add ESX hosts to new vCenter in the newly created cluster.

What to do next
Proceed to Unregistering a Storage Cluster from a vCenter Cluster, on page 71.

Unregistering a Storage Cluster from a vCenter Cluster

This step is optional and not required. It is recommended to leave the HX Data Platform Plug-in registration alone in the old vCenter.

Before you begin
As part of the task to move a storage cluster from one vCenter server to another vCenter server, complete the steps in Moving the Storage Cluster from a Current vCenter Server to a New vCenter Server, on page 70.

Note
• If multiple HX clusters are registered to the same vCenter, do not attempt this procedure until all HX clusters have been fully migrated to different vCenter. Running this procedure is disruptive to any existing HX clusters registered to the vCenter.

Step 1
Complete the steps in Removing HX Data Platform Files from the vSphere Client, on page 71.
Step 2
Complete the steps in Verifying HX Cluster is Unregistered from vCenter, on page 72.

What to do next
Proceed to Registering a Storage Cluster with a New vCenter Cluster, on page 73.

Removing HX Data Platform Files from the vSphere Client

This task is a step in unregistering a HX Storage Cluster from vCenter.
Remove the HX Data Platform files from the vSphere Client. Select a method.

**Linux vCenter**

a) Login to the Linux vCenter server using `ssh` as a root user.
b) Change to the folder containing the HX Data Platform Plug-in folder.
   
   For vCenter 6.0
   
   ```
   # cd /etc/vmware/vsphere-client/vc-packages/vsphere-client-serenity/
   ```
   
   For vCenter 5.5
   
   ```
   # cd /var/lib/just/vmware/vsphere-client/vc-packages/vsphere-client-serenity/
   ```
c) Remove the HX Data Platform Plug-in folder and files.
   
   ```
   # rm -rf com.springpath*
   ```
d) Restart the vSphere Client.
   
   ```
   # service vsphere-client restart
   ```

**Windows vCenter**

a) Login to the Windows vCenter system command line using Remote Desktop Protocol (RDP).
b) Change to the folder containing the HX Data Platform Plug-in folder.
   
   ```
   # cd "%PROGRAMDATA%\VMware\vSphere Web Client\vc-packages\vsphere-client-serenity
   ```
c) Remove the HX Data Platform Plug-in folder and files.
   
   ```
   # rmdir /com.springpath*
   ```
d) Open the Service screen.
   
   ```
   # services.msc
   ```
e) Restart the vSphere Web Client to logout of vCenter.
   
   ```
   # serviceLogout
   ```

---

**Verifying HX Cluster is Unregistered from vCenter**

This task is a step in unregistering a HX Storage Cluster from vCenter.

Verify that the HX cluster is no longer on the old vCenter.

**Before you begin**

Complete the steps in:

- Removing HX Data Platform Files from the vSphere Client, on page 71

---

**Step 1**

Clear your cache before logging back into vCenter.

**Step 2**

Log out of the old vCenter.

**Step 3**

Log in again to the old vCenter and verify the HX Data Platform Plug-in has been removed.
Registering a Storage Cluster with a New vCenter Cluster

Before you begin
As part of the task to move a storage cluster from one vCenter server to another vCenter server, complete the steps in Unregistering a Storage Cluster from a vCenter Cluster, on page 71.

---

**Step 1**
Login to a controller VM.

**Step 2**
Run the `stcli cluster reregister` command.

```
```

Apply additional listed options as needed.

**Syntax Description**

<table>
<thead>
<tr>
<th>Option</th>
<th>Required or Optional</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>--vcenter-cluster</td>
<td>Required</td>
<td>Name of the new vCenter cluster.</td>
</tr>
<tr>
<td>NEWVCENTERCLUSTER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--vcenter-datacenter</td>
<td>Required</td>
<td>Name of the new vCenter datacenter.</td>
</tr>
<tr>
<td>NEWDATACENTER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--vcenter-sso-url</td>
<td>Optional</td>
<td>URL of the new vCenter SSO server. This is inferred from --vcenter-url, if not specified.</td>
</tr>
<tr>
<td>NEWVCENTERSSOURL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--vcenter-url</td>
<td>Required</td>
<td>URL of the new vCenter, <code>&lt;vcentername&gt;</code>. Where <code>&lt;vcentername&gt;</code> can be FQDN or IP.</td>
</tr>
<tr>
<td>NEWVCENTERURL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--vcenter-user</td>
<td>Required</td>
<td>User name of the new vCenter administrator. Enter vCenter administrator password when prompted.</td>
</tr>
<tr>
<td>NEWVCENTERUSER</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Example response:

Reregister StorFS cluster with a new vCenter ...
Enter NEW vCenter Administrator password:
Waiting for Cluster creation to finish ...

If, after your storage cluster is re-registered, your compute only nodes fail to register with EAM, or are not present in the EAM client, and not under the resource pool, then contact TAC to complete the compute node reregister.

**Step 3**
If you have compute nodes on your cluster, after completing the reregister, re-add the compute nodes.

```
# stcli node add --node-ips <computeNodeIP> --controller-root-password <ctlvm-pwd> --esx-username <esx-user> --esx-password <esx-pwd>
```

**Step 4**
Re-enter your snapshot schedules.

Snapshot schedules are not moved with the storage cluster when you move the storage cluster between vCenter clusters.
Renaming Clusters

After you create a HX Data Platform storage cluster, you can rename it without disrupting any processes.

Note: These steps apply to renaming the HX Cluster, not the vCenter cluster.

Step 1: From the vSphere Web Client Navigator, select **vCenter Inventory Lists > Cisco HyperFlex Systems > Cisco HX Data Platform > cluster** to rename.

Step 2: Open the **Rename Cluster** dialog box. Either right-click on the storage cluster or click the **Actions** drop-down list at the top of the tab.

Step 3: Select **Rename Cluster**.

Step 4: Enter a new name for the storage cluster in the text field. HX cluster names cannot exceed 50 characters.

Step 5: Click **OK** to apply the new name.

Replacing Self-Signed Certificate on a vCenter Server

Step 1: Remove the HyperFlex cluster from the vCenter server.

Step 2: Remove the Plugin and the MOB entries.

For information, see **Planning to Move a Storage Cluster Between vCenters**.

Step 3: Install the custom certificate on the vCenter Platform Services Controller (PSC) or vCenter Server Appliance (VCSA).

Step 4: Add the cluster and the hosts back into the vCenter server.

Step 5: Register the HX cluster again.

For information, see **Registering a Storage Cluster with a New vCenter Cluster**.
Managing Encryption

- Self-Encrypting Drives Overview, on page 75
- Verify if the HyperFlex Cluster Is Encryption Capable, on page 76
- Configuring Local Encryption Key, on page 76
- Modifying Local Encryption Key, on page 77
- Disabling Local Encryption Key, on page 77
- Secure Erase an Encrypted Disk, on page 78
- Remote Key Management, on page 78
- Configuring Remote Encryption Key, on page 78
- Generating Certificate Signing Requests, on page 79
- Configuring a Key Management Server Using CSRs (Certificate Signing Requests), on page 81
- Generating Self-Signed Certificates, on page 82
- Configuring a key management server using SSCs (Self-Signed Certificates), on page 83
- Restart Encryption, on page 84

Self-Encrypting Drives Overview

Self-Encrypting Drives (SEDs) have special hardware that encrypts incoming data and decrypts outgoing data in real-time. The data on the disk is always stored in encrypted form. A media encryption key controls this encryption and decryption. This key is never stored in the processor or memory.

A security key, also known as Key-Encryption Key or an authentication passphrase, is used to encrypt the media encryption key. To enable SED, you must provide a security key. No key is required to fetch the data, if the disk is not locked.

Cisco HyperFlex Systems enables you to configure security keys locally or remotely. When you configure the key locally, you must remember the key. In case you forget the key, it cannot be retrieved, and the data is lost if the drive power cycles. You can configure the key remotely by using a key management server (also known as KMIP server). This method addresses the issues related to safe-keeping and retrieval of the keys in the local management.

The encryption and decryption for SEDs is done through the hardware. Thus, it does not affect the overall system performance. SEDs reduce the disk retirement and redeployment costs through instantaneous cryptographic erasure. Cryptographic erasure is done by changing the media encryption key. When the media encryption key of a disk is changed, the data on the disk cannot be decrypted, and is immediately rendered unusable.
Verify if the HyperFlex Cluster Is Encryption Capable

Verify Using the HX Data Platform Plug-in

1. From the HX Data Platform Plug-in, log in to vSphere Web Client.
2. Select Global Inventory Lists > Cisco Hyperflex Systems > Cisco HX Data Platform > Cluster_Name > Summary > .
3. If the HyperFlex cluster has SED drives and is encryption capable, Data At Rest Encryption-Capable is listed at the top of the Summary tab.

Verify Using the HX Connect User Interface

1. From the HX Connect UI, select Encryption.
2. If the HX cluster has SED drives and is encryption capable, Data At Rest Encryption-Available is listed on the Encryption page.

Configuring Local Encryption Key

Step 1 On the Cisco HyperFlex Connect Navigation Pane, choose Encryption.
Step 2 On the Encryption Page, click Configure encryption.
Step 3 Enter the following Cisco UCS Manager credentials.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
</table>
| UCS Manager host name field | Cisco UCS Manager cluster host name. Enter an IP address or FQDN.  
|                      | <eng-fi12.eng.storvisor.com> |
| User name field      | <admin> username                                           |
| Password field       | <admin> password                                           |

Click Next.

Step 4 To secure the HyperFlex cluster using an encryption key generated and stored locally, select Local Key.
Click Next.

Step 5 Enter the encryption key (passphrase) for this cluster.
Note Enter exactly 32 alphanumeric characters.

Step 6 Click Enable Encryption.
Modifying Local Encryption Key

Step 1 On the Cisco HyperFlex Connect Navigation Pane, choose Encryption.
Step 2 On the Encryption Page, click Re-key.
Step 3 Enter the following Cisco UCS Manager credentials.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>UCS Manager host name field</td>
<td>For example, 10.193.211.120.</td>
</tr>
<tr>
<td>User name field</td>
<td>&lt;admin&gt; username.</td>
</tr>
<tr>
<td>Password field</td>
<td>&lt;admin&gt; password.</td>
</tr>
</tbody>
</table>

Click Next.

Step 4 Enter the Existing Encryption Key and the New Encryption Key for the cluster.

Note Enter exactly 32 alphanumeric characters.

Step 5 Click Re-key.

Disabling Local Encryption Key

Step 1 On the Cisco HyperFlex Connect Navigation Pane, choose Encryption.
Step 2 On the Encryption Page, from the Edit configuration drop-down menu, choose Disable encryption.
Step 3 Enter the following Cisco UCS Manager credentials.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>UCS Manager host name field</td>
<td>Cisco UCS Manager cluster host name.</td>
</tr>
<tr>
<td></td>
<td>Enter an IP address or FQDN.</td>
</tr>
<tr>
<td></td>
<td>&lt;eng-fi12.eng.storvisor.com&gt;</td>
</tr>
<tr>
<td>User name field</td>
<td>&lt;admin&gt; username</td>
</tr>
<tr>
<td>Password field</td>
<td>&lt;admin&gt; password</td>
</tr>
</tbody>
</table>

Click Next.

Step 4 To disable the encryption key on the cluster, enter the encryption key in use for the cluster.

Step 5 Click Disable encryption.
Secure Erase an Encrypted Disk

Step 1
On the Cisco HyperFlex Connect Navigation Pane, choose System Information.

Step 2
From the Disks tab, select the disk from which you want to securely erase the local key.

Step 3
Click the Secure erase button.

Step 4
To securely erase the encrypted disk on the cluster, enter the encryption key in use on the cluster.

Step 5
Click Secure erase.

Step 6
In the Erase this disk? dialog box, click Yes, erase this disk to securely erase the encrypted disk.

Remote Key Management

The generic steps for remote KMIP certificate handling are as follows:

- If you are self-signing, specify local certificate authority in the configuration and get a root certificate.
- If you are using a trusted third-party CA, then specify that in the configuration and use their root certificate.
- Enter the root certificate in the HX encryption field that asks for the cluster key.
- Create an SSL server certificate and generate a Certificate Signing Request (CSR).
- Sign the CSR with whatever root certificate you are using.
- Update the KMIP server settings to use the client certificate.
- With the SSL certs and root CAs available, proceed with the KMIP service configuration specific to the vendor you have chosen.

SafeNet Key Management

For details on managing encryption keys using a SafeNet key management server, see the HyperFlex Encryption and SafeNet Key Management TechNote and the SafeNet Admin Guide.

Vormetric Key Management

For details on managing encryption keys using a vormetric key management server, see the Vormetric support portal documentation downloads section.

Configuring Remote Encryption Key

Step 1
On the Cisco HyperFlex Connect navigation Pane, choose Encryption.
Step 2  On the Encryption Page, click **Configure encryption**.

Step 3  Enter the following Cisco UCS Manager credentials.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UCS Manager host name</strong></td>
<td>Cisco UCS Manager cluster host name.</td>
</tr>
<tr>
<td><strong>hostname</strong></td>
<td>Enter an IP address or FQDN.</td>
</tr>
<tr>
<td></td>
<td><em>eng-f12.eng.storvisor.com</em></td>
</tr>
<tr>
<td><strong>User name</strong></td>
<td><em>admin</em> username</td>
</tr>
<tr>
<td><strong>Password</strong></td>
<td><em>root</em> password</td>
</tr>
</tbody>
</table>

Click **Next**.

Step 4  To secure the HyperFlex cluster using a remote security key generated by the key management (KMIP) server, select **Key Management Server**.

You can configure a server with Self-Encrypting Drives in the cluster to use one of the following certificates.

- **Use certificate authority signed certificates**—Generate Certificate Signing Requests (CSRs) signed by an external certificate authority.
- **Use self-signed certificates**—Generate self-signed certificates.

Click **Next**.

**Step 5**

---

**What to do next**

You can generate certificate signing requests or self-signed certificates.

---

**Generating Certificate Signing Requests**

**Step 1**  On the Cisco HyperFlex Connect navigation Pane, choose **Encryption**.

**Step 2**  On the Encryption Page, click **Configure encryption**.

**Step 3**  Enter the following Cisco UCS Manager credentials.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UCS Manager host name</strong></td>
<td>Cisco UCS Manager cluster host name.</td>
</tr>
<tr>
<td><strong>hostname</strong></td>
<td>Enter an IP address or FQDN.</td>
</tr>
<tr>
<td></td>
<td><em>eng-f12.eng.storvisor.com</em></td>
</tr>
<tr>
<td><strong>User name</strong></td>
<td><em>admin</em> username</td>
</tr>
<tr>
<td><strong>Password</strong></td>
<td><em>admin</em> password</td>
</tr>
</tbody>
</table>
Click Next.

**Step 4**  
Select **Key Management Server > Use certificate authority signed certificates**.  
Click Next.

**Step 5**  
To generate the remote encryption key for configuring the key management (KMIP) server, complete the following details.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email address field</td>
<td>&lt;admin&gt; email address.</td>
</tr>
<tr>
<td>Organization name field</td>
<td>The organization requesting the certificate. Enter up to 32 characters.</td>
</tr>
<tr>
<td>Organization unit name field</td>
<td>The organizational unit. Enter up to 64 characters.</td>
</tr>
<tr>
<td>Locality field</td>
<td>The city or town in which the company requesting the certificate is headquartered. Enter up to 32 characters.</td>
</tr>
<tr>
<td>State field</td>
<td>The state or province in which the company requesting the certificate is headquartered. Enter up to 32 characters.</td>
</tr>
<tr>
<td>Country field</td>
<td>The country in which the company resides. Enter two alphabetic characters in uppercase.</td>
</tr>
<tr>
<td>Valid for (days) field</td>
<td>The validity period of the certificate.</td>
</tr>
</tbody>
</table>

**Step 6**  
To generate Certificate Signing Requests (CSRs) for all the HyperFlex nodes and download them, click **Generate certificates**.

**Step 7**  
Download the certificates to get them signed by a certificate authority. Click **Close**.

---

**What to do next**

1. Upload the signed certificates.
2. Configure KMIP server (key management server).
Configuring a Key Management Server Using CSRs (Certificate Signing Requests)

Before you begin

Ensure that you have downloaded the generated CSRs on your local machine, signed it by a certificate authority and uploaded through the Cisco HX Data Platform UI for configuring the KMIP (key management) server.

Step 1
On the Cisco HyperFlex Connect navigation Pane, choose Encryption.

Step 2
On the Encryption Page, click Continue configuration.

Step 3
From the Continue configuration drop-down list, select Manage certificates to upload the CSRs.

Step 4
Enter the following Cisco UCS Manager credentials.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>UCS Manager host name</td>
<td>Cisco UCS Manager cluster host name.</td>
</tr>
<tr>
<td></td>
<td>Enter an IP address or FQDN.</td>
</tr>
<tr>
<td></td>
<td>&lt;eng-f12.eng.storvisor.com&gt;</td>
</tr>
<tr>
<td>User name</td>
<td>&lt;admin&gt; username</td>
</tr>
<tr>
<td>Password</td>
<td>&lt;root&gt; password</td>
</tr>
</tbody>
</table>

Click Next.

Step 5
Select Upload certificate authority signed certificates. Click Next.

Step 6
Upload the CA signed certificate under Upload new certificate. Click Upload.

Step 7
From the Continue configuration drop-down list select Configure key management server to configure the KMIP server.

Step 8
Enter Cisco UCS Manager credentials to set up a primary key management server (KMIP) server and optionally a secondary KMIP server.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary key management server field</td>
<td>Enter the primary Key Management Server IP address.</td>
</tr>
<tr>
<td>(Optional) Secondary key management server field</td>
<td>If you have a secondary key management server set up for redundancy, enter the details here.</td>
</tr>
<tr>
<td>Port number field</td>
<td>Enter the port number you wish to use for the key management servers.</td>
</tr>
<tr>
<td>Public key field</td>
<td>Enter the public root certificate of the certificate authority that you generated during KMIP server configuration.</td>
</tr>
</tbody>
</table>
Step 9  Click **Save** to encrypt the cluster with remotely managed keys.

---

**Example**

### Generating Self-Signed Certificates

**Step 1**  On the Cisco HyperFlex Connect navigation Pane, choose **Encryption**.

**Step 2**  On the Encryption Page, click **Configure encryption**.

**Step 3**  Enter the following Cisco UCS Manager credentials.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>UCS Manager host name</td>
<td>Cisco UCS Manager cluster host name. Enter an IP address or FQDN.</td>
</tr>
<tr>
<td></td>
<td>&lt;eng-fi12.eng.storvisor.com&gt;</td>
</tr>
<tr>
<td>User name field</td>
<td>&lt;admin&gt; username</td>
</tr>
<tr>
<td>Password field</td>
<td>&lt;root&gt; password</td>
</tr>
</tbody>
</table>

Click **Next**.

**Step 4**  Select **Key Management Server > Use self-signed certificates**.

Click **Next**.

**Step 5**  To generate the remote encryption key for configuring the key management (KMIP) server, complete the following details.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email address field</td>
<td>&lt;admin&gt; email address.</td>
</tr>
<tr>
<td>Organization name field</td>
<td>The organization requesting the certificate. Enter up to 32 characters.</td>
</tr>
<tr>
<td>Organization unit name field</td>
<td>The organizational unit. Enter up to 64 characters.</td>
</tr>
<tr>
<td>Locality field</td>
<td>The city or town in which the company requesting the certificate is headquartered. Enter up to 32 characters.</td>
</tr>
<tr>
<td>State field</td>
<td>The state or province in which the company requesting the certificate is headquartered. Enter up to 32 characters.</td>
</tr>
</tbody>
</table>
Configuring a key management server using SSCs (Self-Signed Certificates)

Before you begin
Ensure that you have downloaded the generated SSCs on your local machine to configure the KMIP (key management) server.

Step 1 On the Cisco HyperFlex Connect navigation Pane, choose Encryption.
Step 2 On the Encryption Page, click Edit configuration.
Step 3 From the Edit configuration drop-down list, select Manage certificates.
Step 4 Enter the following Cisco UCS Manager credentials, to set up a primary key management (KMIP) server and optionally a secondary KMIP server.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UCS Manager host name</strong> field</td>
<td>Cisco UCS Manager cluster host name. Enter an IP address or FQDN.</td>
</tr>
<tr>
<td>&lt;eng-f12.eng.storvisor.com&gt;</td>
<td></td>
</tr>
<tr>
<td><strong>User name</strong> field</td>
<td>&lt;admin&gt; username</td>
</tr>
<tr>
<td><strong>Password</strong> field</td>
<td>&lt;admin&gt; password</td>
</tr>
</tbody>
</table>

Click Next.

Step 5 Enter the primary and secondary key management (KMIP) server credentials.
Essential Information

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary key management server</strong> field</td>
<td>Enter the primary Key Management Server IP address.</td>
</tr>
<tr>
<td>(Optional) <strong>Secondary key management server</strong></td>
<td>If you have a secondary key management server set up for redundancy, enter the details</td>
</tr>
<tr>
<td><strong>Port number</strong> field</td>
<td>Enter the port number you wish to use for the key management servers.</td>
</tr>
<tr>
<td><strong>Public key</strong> field</td>
<td>Enter the public root certificate of the certificate authority that you generated</td>
</tr>
<tr>
<td></td>
<td>during KMIP server configuration.</td>
</tr>
</tbody>
</table>

**Step 6**

Click **Save** to encrypt the cluster with remotely managed keys.

---

**Restart Encryption**

Enter Cisco UCS Manager credentials to restart configuring the key management server or local key, for securely encrypting the HyperFlex cluster.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UCS Manager host name</strong> field</td>
<td>Cisco UCS Manager cluster host name. Enter an IP address or FQDN.</td>
</tr>
<tr>
<td></td>
<td><em>&lt;eng-fi12.eng.storvisor.com&gt;</em></td>
</tr>
<tr>
<td><strong>User name</strong> field</td>
<td><em>&lt;admin&gt;</em> username</td>
</tr>
<tr>
<td><strong>Password</strong> field</td>
<td><em>&lt;admin&gt;</em> password</td>
</tr>
</tbody>
</table>
Managing Datastores

- Managing Datastores, on page 85
- Adding Datastores, on page 86
- Editing Datastores, on page 86
- Mounting Datastores, on page 87
- Unmounting Datastores, on page 88
- Deleting Datastores, on page 88
- Recovering from Partially Unmounted Datastores, on page 89

Managing Datastores

Datastores are logical containers used by the HX Data Platform to manage your storage usage and storage resources. Datastores are where the host places virtual disk files and other VM files. Datastores hide the specifics of physical storage devices and provide a uniform model for storing VM files.

You can add, refresh the list, edit name and size, delete, mount and unmount datastores from either the HX Connect UI or the HX Data Platform Plug-in UI. You can only rename an unpaired datastore that is unmounted. Do not rename a datastore using the vCenter administrator interface.

Important

- Keep the number of datastores to as few as possible to avoid startup delay and to keep clone savings high.
- Configuring more than 10 datastores could result in excessive startup delay.

Step 1

Choose an interface.

- From the vSphere Web Client Navigator, select vCenter Inventory Lists > Cisco HyperFlex Systems > Cisco HX Data Platform > cluster > Manage > Datastores.
- From HX Connect, select Datastores.

Step 2

Create a new or select an existing datastore, to view options.

- Create a new datastore
- Refresh the datastore list
• Edit the datastore name and size
• Delete the datastore
• Mount the datastore on the host
• Unmount the datastore from the host

---

**Adding Datastores**

Datastores are logical containers, similar to file systems, that hide specifics of physical storage and provide a uniform model for storing VM files. You can also use datastores to store ISO images and VM templates.

**Step 1** Choose an interface.

- From the vSphere Web Client Navigator, select vCenter Inventory Lists > Cisco HyperFlex Systems > Cisco HX Data Platform > cluster > Manage > Datastores.
- From HX Connect, select Datastores.

**Step 2** Select the create datastore.

**Step 3** Enter a name for the datastore. vSphere Web Client enforces a 42 character limit for the datastore name. Assign each datastore a unique name.

**Step 4** Specify the datastore size. Choose GB or TB from the drop-down list.

**Step 5** Specify the data blocksize. From HX Connect, choose 8K or 4K. Default is 8K. In the HX Data Platform Plug-in, the default is assumed. For VDI workloads, default is 4k.

**Step 6** Click OK to accept your changes or Cancel to cancel all changes.

**Step 7** Verify the datastore. Click the Refresh icon if needed to display your new datastore.

From HX Data Platform Plug-in, Click the Manage > Datastores > Hosts tab to see the mount status of the new datastore.

If you check the datastore through the vSphere Client application, host > Configuration > Datastores, the Drive Type is listed as Unknown. This is expected vSphere behavior, to list NFS datastores as Unknown.

---

**Editing Datastores**

A HX Data Platform datastore can be modified using the edit (pencil) option. Edit options are: 1. Change the datastore name, or 2. Change the datastore storage allocation. That is, the size of the datastore.

---

**Note**

Do not rename datastores with controller VMs.
• From the vSphere Web Client Navigator, select vCenter Inventory Lists > Cisco HyperFlex Systems > Cisco HX Data Platform > cluster > Manage > Datastores.

• From HX Connect, select Datastores.

Step 2  Select a datastore.

Step 3  Unmount the datastore.

If you are only resizing the datastore, you do not need to unmount the datastore. Skip this step.

Step 4  Click the Edit (pencil icon) datastore.

Step 5  Change the datastore name and/or size, as needed. Click OK.

Step 6  Remount the datastore, if you previously unmounted it.

---

Mounting Datastores

Prepare to mount a datastore.

• No VM, template, snapshot, or CD/DVD image resides on the datastore. This is the most common error while unmounting.

• Storage I/O Control is disabled for the datastore.

• The datastore is not used for vSphere HA heartbeat.

• The datastore is not used to host RDM metadata files. RDM is not supported.

• The datastore is not used as a scratch location.

**Note**  You can not select an NFS datastore as a destination for the persistent scratch location on ESXi. If you select the HX datastore for the persistent scratch location, it will be removed after the ESXi host reloads.

For all M5 servers, M.2 boot SSD is automatically selected for use as scratch. This is configured out of the box on any new install.

For HX240M4 (non-SED), Intel SSD is used for persistent logs/scratch (same applies on 220M5/240M5, but on a different local SSD).

For HX220M4 and HX240M4 (SED), there is no location to store the scratch partition. So, the only option is to use syslog for persistent logging over the network.

Mount a datastore.

Step 1  Choose an interface.

• From the vSphere Web Client Navigator, select vCenter Inventory Lists > Cisco HyperFlex Systems > Cisco HX Data Platform > cluster > Manage > Datastores.
• From HX Connect, select **Datastores**.

| Step 2 | Select a **datastore**. |
| Step 3 | Click the **Mount**. |
| Step 4 | Confirm to mount the datastore, click **OK**. |

### Unmounting Datastores

**Unmount a datastore.**

- **Prepare to unmount a datastore.**
  - No VM, template, snapshot, or CD/DVD image resides on the datastore. This is the most common error while unmounting.
  - Storage I/O Control is disabled for the datastore.
  - The datastore is not used for vSphere HA heartbeat.
  - The datastore is not used to host RDM metadata files. RDM is not supported.
  - The datastore is not used as a scratch location.

| Step 1 | Choose an interface. |
| Step 2 | Select a **datastore**. |
| Step 3 | Click the **Unmount**. |
| Step 4 | Confirm to unmount the datastore, click **OK**. |
| Step 5 | If needed, recover from partial unmounts. |
| | a) Go through the above checklist and unmount or delete through one of the UIs or CLI again. |
| | b) Use the UI or CLI to re-mount the datastore. |

For additional information on recovering from partial unmounts, see **Recovering from Partially Unmounted Datastores**, on page 89.

### Deleting Datastores

**Prepare to delete the datastores.**

- Power off all VMs.
• Close all open shells on the datastore mount point.
• Disable HA on the datastore.
• Close all applications that use the datastore.

**Delete datastores.**

**Step 1**
Choose an interface.

- From the vSphere Web Client Navigator, select **vCenter Inventory Lists > Cisco HyperFlex Systems > Cisco HX Data Platform > cluster > Manage > Datastores.**
- From HX Connect, select **Datastores.**

**Step 2**
Select a **datastore.**

**Step 3**
Click **Delete.**

**Step 4**
Confirm to delete the datastore, click **OK.**

---

**Recovering from Partially Unmounted Datastores**

When mounting, unmounting, or deleting datastores, sometimes a datastore can become partially unmounted. If this occurs, complete the following as needed.

**Step 1**
Depending upon the task you are attempting, complete the items in Prepare to mount a datastore, Prepare to unmount a datastore, or Prepare to delete the datastores.

**Step 2**
Retry to mount, unmount, or delete the datastore through the HX Connect or HX Data Platform Plug-in UI or CLI again.

**Step 3**
If the datastore is not in the desire mount, unmount, or deleted state, complete the following.

a) Ensure VMs are not running on the datastore.

b) From ESX host, check to see if the HX Data Platform datastore is being used by VMware service, `storageRM`.

```bash
# ls -ltr /vmfs/volumes/stfs-ds1/ | grep -i iorm
```

Sample response

```
-rwxr-xr-x 1 root root 16511 Jan 20 20:05 .iormstats.sf
drwxr-xr-x 1 root root 1125 Jan 20 20:06 .iorm.sf
```

c) Check the `storagerm` status.

```bash
# /etc/init.d/storageRM status
```

Sample response

`storageRM is running`

d) Stop the `storagerm` service.

```bash
# /etc/init.d/storageRM stop
```
Sample response

watchdog-storageRM: Terminating watchdog process with PID 34096
storageRM stopped

e) Try to mount, unmount, or delete the datastore again.
f) This is one possible solution, if this doesn't resolve the issue, contact Technical Assistance Center (TAC).
Managing Disks

- Managing Disks in the Cluster, on page 91
- Disk Requirements, on page 91
- Replacing Self Encrypted Drives (SEDs), on page 96
- Replacing SSDs, on page 98
- Replacing NVMe SSDs, on page 99
- Replacing Housekeeping SSDs, on page 100
- Replacing or Adding Hard Disk Drives, on page 102

Managing Disks in the Cluster

Disks, SSDs or HDDs, might fail. If this occurs, you need to remove the failed disk and replace it. Follow the server hardware instructions for removing and replacing the disks in the host. The HX Data Platform identifies the SSD or HDD and incorporates it into the storage cluster.

To increase the datastore capacity of a storage cluster add the same size and type SSDs or HDDs to each converged node in the storage cluster. For hybrid servers, add hard disk drives (HDDs). For all flash servers, add SSDs.

When performing a hot-plug pull and replace on multiple drives from different vendors or of different types, pause for a few moments (30 seconds) between each action. Pull, pause for about 30 seconds and replace a drive, pause for 30 seconds. Then, pull, pause for 30 seconds and replace the next drive.

Sometimes, when a disk is removed it continues to be listed in cluster summary information. To refresh this, restart the HX cluster.

Disk Requirements

The disk requirements vary between converged nodes and compute-only nodes. To increase the available CPU and memory capacity, you can expand the existing cluster with compute-only nodes as needed. These compute-only nodes provide no increase to storage performance or storage capacity.

Alternatively, adding converged nodes increase storage performance and storage capacity alongside CPU and memory resources.
Servers with only Solid-State Disks (SSDs) are All-Flash servers. Servers with both SSDs and Hard Disk Drives (HDDs) are hybrid servers.

The following applies to all the disks in a HyperFlex cluster:

- All the disks in the storage cluster must have the same amount of storage capacity. All the nodes in the storage cluster must have the same number of disks.
- All SSDs must support TRIM and have TRIM enabled.
- All HDDs can be either SATA or SAS type. All SAS disks in the storage cluster must be in a pass-through mode.
- Disk partitions must be removed from SSDs and HDDs. Disks with partitions are ignored and not added to your HX storage cluster.
- Optionally, you can remove or backup existing data on disks. All existing data on a provided disk is overwritten.

**Note**

New factory servers are shipped with appropriate disk partition settings. Do not remove disk partitions from new factory servers.

- Only the disks ordered directly from Cisco are supported.
- On servers with Self Encrypting Drives (SED), both the cache and persistent storage (capacity) drives must be SED capable. These servers support Data at Rest Encryption (DARE).

**Converged Nodes**

In addition to the disks listed in the table below, all M4 converged nodes have 2 x 64-GB SD FlexFlash cards in a mirrored configuration with ESX installed. All M5 converged nodes have M.2 SATA SSD with ESXi installed.

**Note**

Do not mix storage disks type or storage size on a server or across the storage cluster. Mixing storage disk types is not supported.

- When replacing cache or persistent disks, always use the same type and size as the original disk.
- Do not mix any of the persistent drives. Use all HDD or SSD and the same size drives in a server.
- Do not mix hybrid and All-Flash cache drive types. Use the hybrid cache device on hybrid servers and All-Flash cache devices on All-Flash servers.
- Do not mix encrypted and non-encrypted drive types. Use SED hybrid or SED All-Flash drives. On SED servers, both the cache and persistent drives must be SED type.
- All nodes must use same size and quantity of SSDs. Do not mix SSD types.

The following tables list the compatible drives for each HX server type. Drives are located in the front slots of the server, unless otherwise indicated. Multiple drives listed are options. Use one drive size for capacity per server. Minimum and maximum number of drives are listed for each component.
### HX240 M5 Servers

<table>
<thead>
<tr>
<th>Component</th>
<th>Qty</th>
<th>Hybrid</th>
<th>All Flash</th>
<th>Hybrid SED</th>
<th>All Flash SED</th>
</tr>
</thead>
<tbody>
<tr>
<td>System SSD for logs</td>
<td>1</td>
<td>240 GB SSD</td>
<td>240 GB SSD</td>
<td>240 GB SSD</td>
<td>240 GB SSD</td>
</tr>
<tr>
<td>Cache SSD</td>
<td>1</td>
<td>1.6 TB SSD</td>
<td>1.6 TB NVMe</td>
<td>1.6 TB SSD</td>
<td>800 GB SSD</td>
</tr>
<tr>
<td>Persistent</td>
<td>6-23</td>
<td>1.2 TB HDD</td>
<td>960 GB SSD</td>
<td>1.2 TB HDD</td>
<td>800 GB SSD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.8 TB HDD</td>
<td>3.8 TB SSD</td>
<td></td>
<td>960 GB SSD</td>
</tr>
</tbody>
</table>

For information on disk requirements for HX240 M5 LFF servers, see Disk Requirements for LFF Converged Nodes Hardware and Software Requirements, on page 94.

### HX240 M4 Servers

<table>
<thead>
<tr>
<th>Component</th>
<th>Qty</th>
<th>Hybrid</th>
<th>All Flash</th>
<th>Hybrid SED</th>
<th>All Flash SED</th>
</tr>
</thead>
<tbody>
<tr>
<td>System SSD for logs</td>
<td>1</td>
<td>120 GB SSD</td>
<td>120 GB SSD</td>
<td>120 GB SSD</td>
<td>120 GB SSD</td>
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<tr>
<td></td>
<td></td>
<td>240 GB SSD</td>
<td>240 GB SSD</td>
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<td>240 GB SSD</td>
</tr>
<tr>
<td>Cache SSD</td>
<td>1</td>
<td>1.6 TB SSD</td>
<td>1.6 TB NVMe</td>
<td>1.6 TB SSD</td>
<td>1.6 TB NVMe</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>400 GB SSD</td>
<td></td>
<td>800 GB SSD</td>
</tr>
<tr>
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<td>6-23</td>
<td>1.2 TB HDD</td>
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<td>1.2 TB HDD</td>
<td>800 GB SSD</td>
</tr>
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<td></td>
<td></td>
<td>1.8 TB HDD</td>
<td>3.8 TB SSD</td>
<td></td>
<td>960 GB SSD</td>
</tr>
</tbody>
</table>

### HX220 M5 Servers

<table>
<thead>
<tr>
<th>Component</th>
<th>Qty</th>
<th>Hybrid</th>
<th>All Flash</th>
<th>Hybrid SED</th>
<th>All Flash SED</th>
</tr>
</thead>
<tbody>
<tr>
<td>System SSD for logs</td>
<td>1</td>
<td>240 GB SSD</td>
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<td></td>
<td></td>
<td>800 GB SSD</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Persistent</td>
<td>6-8</td>
<td>1.2 TB HDD</td>
<td>960 GB SSD</td>
<td>1.2 TB HDD</td>
<td>800 GB SSD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.8 TB HDD</td>
<td>3.8 TB SSD</td>
<td></td>
<td>960 GB SSD</td>
</tr>
</tbody>
</table>

### HX 220 M4 Servers

<table>
<thead>
<tr>
<th>Component</th>
<th>Qty</th>
<th>Hybrid</th>
<th>All Flash</th>
<th>Hybrid SED</th>
<th>All Flash SED</th>
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</thead>
<tbody>
<tr>
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<td>1</td>
<td>240 GB SSD</td>
<td>240 GB SSD</td>
<td>240 GB SSD</td>
<td>240 GB SSD</td>
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<tr>
<td>Cache SSD</td>
<td>1</td>
<td>480 GB SSD</td>
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<td></td>
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</tr>
<tr>
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<td>1.2 TB HDD</td>
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<td>800 GB SSD</td>
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<td></td>
<td>1.8 TB HDD</td>
<td>3.8 TB SSD</td>
<td></td>
<td>960 GB SSD</td>
</tr>
</tbody>
</table>
## Disk Requirements for LFF Converged Nodes

The following table lists the supported HX240 M5 Server Large-Form-Factor (LFF) converged node configurations:

<table>
<thead>
<tr>
<th>Component</th>
<th>Qty</th>
<th>Hybrid</th>
<th>All Flash</th>
<th>Hybrid SED</th>
<th>All Flash SED</th>
</tr>
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<tbody>
<tr>
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<td>1</td>
<td>120 GB SSD</td>
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<td>1.2 TB HDD</td>
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<td></td>
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</tr>
<tr>
<td>HX220 M5 Servers for Edge Clusters</td>
<td></td>
<td>800 GB SSD</td>
<td>1.6 TB NVMe</td>
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<td>240 GB SSD</td>
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<tr>
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<td>3.8 TB SSD</td>
<td>3.8 TB SSD</td>
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<td>960 GB SSD</td>
</tr>
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<td></td>
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<td></td>
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<td></td>
<td>3.8 TB SSD</td>
</tr>
</tbody>
</table>

## HX 220 M4 Servers for Edge Clusters

The following table lists the supported HX220 M4 Server Large-Form-Factor (LFF) converged node configurations:

<table>
<thead>
<tr>
<th>Component</th>
<th>Qty</th>
<th>Hybrid</th>
<th>All Flash</th>
<th>Hybrid SED</th>
<th>All Flash SED</th>
</tr>
</thead>
<tbody>
<tr>
<td>System SSD for logs</td>
<td>1</td>
<td>120 GB SSD</td>
<td>120 GB SSD</td>
<td>120 GB SSD</td>
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<td>3.8 TB SSD</td>
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</tr>
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</tr>
</tbody>
</table>

## Disk Requirements for LFF Converged Nodes

The following table lists the supported HX240 M5 Server Large-Form-Factor (LFF) converged node configurations:
### Table 3: HX240 M5 Server Large-Form-Factor (LFF) Configuration

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory</td>
<td>16GB or 32GB or 64GB or 128GB DDR4-2666-MHz</td>
<td>HX-MR-X16G1RS-H</td>
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<td>HX-MR-X32G2RS-H</td>
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<tr>
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<td>HX-MR-X64G4RS-H</td>
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<tr>
<td></td>
<td></td>
<td>HX-MR-128G8RS-H</td>
</tr>
<tr>
<td>Processor</td>
<td>Processor Choices: Supported Skylake parts on HX 240 M5</td>
<td>Varies</td>
</tr>
<tr>
<td>Drive Controller</td>
<td>Cisco 12Gbps Modular SAS HBA</td>
<td>HX-SAS-M5</td>
</tr>
<tr>
<td>SSD1 (Boot SSD)</td>
<td>240GB 2.5 inch Enterprise Value 6G SATA SSD</td>
<td>HX-SD240G61X-EV</td>
</tr>
<tr>
<td>SSD2 (Cache/WL)</td>
<td>3.2TB 2.5 inch Enterprise Performance 12G SAS SSD(3X)</td>
<td>HX-SD32T123X-EP</td>
</tr>
<tr>
<td>HDD (Capacity/Data)</td>
<td>6TB 12G SAS 7.2K RPM LFF HDD (4K) OR 8TB 12G SAS 7.2K RPM LFF HDD (4K)</td>
<td>HX-HD6T7KL4KN OR HX-HD8T7KL4KN</td>
</tr>
<tr>
<td>Network</td>
<td>Cisco VIC 1387 Dual Port 40GB QSFP CNA MLOM</td>
<td>HX-MLOM-C40Q-03</td>
</tr>
<tr>
<td>Boot Device</td>
<td>240GB SATA M.2</td>
<td>HX-M2-240GB</td>
</tr>
<tr>
<td>Software</td>
<td>Cisco HX Data Platform 1, 2, 3, or 4 or 5yr SW subscription</td>
<td>HXDP-001-xYR</td>
</tr>
<tr>
<td>Optional VMware License</td>
<td>Factory Installed – VMware vSphere6 Enterprise Plus/Standard SW License &amp; Subscription</td>
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<tr>
<td>FI Support</td>
<td>2G FI and 3G FI</td>
<td></td>
</tr>
</tbody>
</table>

### Hardware and Software Requirements

**Hardware**

- Memory Configurable
- CPU Configurable
- HDD Storage Quantity

**Software**

- Storage Controller
  - Reserves 72GB RAM
  - Reserves 8 vCPU, 10.800 GHz CPU
Compute-Only Nodes

The following table lists the supported compute-only node configurations for compute-only functions. Storage on compute-only nodes is not included in the cache or capacity of storage clusters.

When adding compute nodes to your HyperFlex cluster, the compute-only service profile template automatically configures it for booting from an SD card. If you are using another form of boot media, update the local disk configuration policy. See the Cisco UCS Manager Server Management Guide for server-related policies.

<table>
<thead>
<tr>
<th>Supported Compute-Only Node Servers</th>
<th>Supported Methods for Booting ESXi</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Cisco B200 M3/M4/M5</td>
<td>Choose any method.</td>
</tr>
<tr>
<td>• B260 M4</td>
<td>Important Ensure that only one form of boot media is exposed to the server for ESXi installation. Post install, you may add in additional local or remote disks. USB boot is not supported for HX Compute-only nodes.</td>
</tr>
<tr>
<td>• B420 M4</td>
<td>• SD Cards in a mirrored configuration with ESXi installed.</td>
</tr>
<tr>
<td>• B460 M4</td>
<td>• Local drive HDD or SSD.</td>
</tr>
<tr>
<td>• C240 M3/M4/M5</td>
<td>• SAN boot.</td>
</tr>
<tr>
<td>• C220 M3/M4/M5</td>
<td>• M.2 SATA SSD Drive.</td>
</tr>
<tr>
<td>• C460 M4</td>
<td>Note HW RAID M.2 (UCS-M2-HWRAID and HX-M2-HWRAID) is not supported on Compute-only nodes.</td>
</tr>
<tr>
<td>• C480 M5</td>
<td></td>
</tr>
<tr>
<td>• B480 M5</td>
<td></td>
</tr>
</tbody>
</table>

Replacing Self Encrypted Drives (SEDs)

Cisco HyperFlex Systems offers Data-At-Rest protection through Self-Encrypting Drives (SEDs) and Enterprise Key Management Support.

• Servers that are data at rest capable refer to servers with self encrypting drives.
• All servers in an encrypted HX Cluster must be data at rest capable.
• Encryption is configured on a HX Cluster, after the cluster is created, using HX Connect.
• Servers with self encrypting drives can be either solid state drive (SSD) or hybrid.
To ensure the encrypted data remains secure, the data on the drive must be **securely erased** prior to removing the SED.

### Before you begin

Determine if the encryption is applied to the HX Cluster.

- **Encryption not configured**—No encryption related prerequisite steps are required to remove or replace the SED. See [Replacing SSDs](#) on page 98 or [Replacing or Adding Hard Disk Drives](#) on page 102 and the hardware guide for your server.

- **Encryption is configured**—Ensure the following:
  1. If you are replacing the SED, obtain a Return to Manufacturer Authorization (RMA). Contact TAC.
  2. If you are using a local key for encryption, locate the key. You will be prompted to provide it.
  3. To prevent data loss, ensure the data on the disk is not the last primary copy of the data.
     If needed, add disks to the servers on the cluster. Initiate or wait until a rebalance completes.
  4. Complete the steps below before removing any SED.

### Step-by-Step Instructions

**Step 1** Ensure the HX Cluster is healthy.

**Step 2** Login to HX Connect.

**Step 3** Select **System Information > Disks** page.

**Step 4** Identify and verify the disk to remove.

  a. Use the Turn On Locator LED button.
  b. Physically view the disks on the server.
  c. Use the Turn Off Locator LED button.

**Step 5** Select the corresponding **Slot** row for the disk to be removed.

**Step 6** Click **Secure erase**. This button is available only after a disk is selected.

**Step 7** If you are using a local encryption key, enter the **Encryption Key** in the field and click **Secure erase**.

If you are using a remote encryption server, no action is needed.

**Step 8** Confirm deleting the data on this disk, click **Yes, erase this disk**.

**Warning** This deletes all your data from the disk.

**Step 9** Wait until the **Status** for the selected **Disk Slot** changes to **Ok To Remove**, then physically remove the disk as directed.
Revisar el estado de los SEDs desmontados y reemplazados.

Cuando el SED es removido:
- **Status**—Rinde **Ok To Remove**.
- **Encryption**—Cambia de **Enabled** a **Unknown**.

Cuando el SED es reemplazado, el nuevo SED se consumirá automáticamente por el HX Cluster. Si la cifrado no se aplica, el disco está listado de la misma manera como cualquier otro disco consumible. Si la cifrado se aplica, la clave de seguridad se aplica al nuevo disco.
- **Status**—Transiciones de **Ignored > Claimed > Available**.
- **Encryption**—Transiciones de **Disabled > Enabled** después de que se aplique la clave de cifrado.

### Replacing SSDs

- **Note**: No mezclar tipos o tamaños de almacenamiento en un servidor o a lo largo del cluster de almacenamiento.
  - Use todos los HDD, o todos los SSD de 3.8 TB, o todos los SSD de 960 GB.
  - Use el dispositivo de caché en los servidores de almacenamiento y todos los dispositivos de caché en los servidores de almacenamiento.
  - Cuando se reemplacen discos de caché o persistentes, siempre use el mismo tipo y tamaño que el disco original.

### Step 1
Identificar el SED fallido:
- Para discos de caché o persistentes, realice un chequeo de beca. Consulte **Setting a Beacon, on page 49**.
Only cache and persistent SSDs respond to the beacon request. NVMe cache SSDs and housekeeping SSDs do not respond to beacon requests.

- For cache NVMe SSDs, perform a physical check. These drives are in Drive Bay 1 of the HX servers.
- For housekeeping SSDs on HXAF240c or HX240c servers, perform a physical check at the back of the server.
- For housekeeping SSDs on HXAF220c or HX220c servers, perform a physical check at Drive Bay 2 of the server.

Step 2  If the failed SSD is a housekeeping SSD, proceed based on the type of server.
- For HXAF220c or HX220c servers, proceed to Step 3.
- For HXAF240c or HX240c servers, contact Technical Assistance Center (TAC).

Step 3  If a failed SSD is a cache or persistent SSD, proceed based on the type of disk.
- For NVMe SSDs, see Replacing NVMe SSDs, on page 99.
- For all other SSDs, follow the instructions for removing and replacing a failed SSD in the host, per the server hardware guide.

After the cache or persistent drive is replaced, the HX Data Platform identifies the SDD and updates the storage cluster. When disks are added to a node, the disks are immediately available for HX consumption.

Step 4  To enable the Cisco UCS Manager to include new disks in the UCS Manager > Equipment > Server > Inventory > Storage tab, re-acknowledge the server node. This applies to cache and persistent disks.

Note  Re-acknowledging a server is disruptive. Place the server into HX Maintenance Mode before doing so.

Step 5  If you replaced an SSD, and see a message Disk successfully scheduled for repair, it means that the disk is present, but is still not functioning properly. Check that the disk has been added correctly per the server hardware guide procedures.

---

## Replacing NVMe SSDs

The procedures for replacing an SSD vary depending upon the type of SSD. This topic describes the steps for replacing NVMe cache SSDs.

**Note**  Mixing storage disks type or size on a server or across the storage cluster is not supported. When replacing NVMe disks, always use the same type and size as the original disk.

**Before you begin**

Ensure the following conditions are met when using NVMe SSDs in HX Cluster servers.

- NVMe SSDs are supported in HX240 and HX220 All-Flash servers.
- Replacing NVMe SSDs with an HGST SN200 disk requires HX Data Platform version 2.5.1a or later.
• NVMe SSDs are only allowed in slot 1 of the server. Other server slots do not detect NVMe SSDs.
• NVMe SSDs are only used for cache.
  • Using them for persistent storage is not supported.
  • Using them as the housekeeping drive is not supported.
  • Using them for hybrid servers is not supported.

---

**Step 1** Confirm the failed disk is an NVMe cache SSD.
Perform a physical check. These drives are in Drive Bay 1 of the HX servers. NVMe cache SSDs and housekeeping SSDs do not respond to beacon requests.

If the failed SSD is not an NVMe SSD, see Replacing SSDs, on page 98.

**Step 2** Put ESXi host into HX Maintenance Mode.
   a) Login to HX Connect.
   b) Select **System Information > Nodes > node > Enter HX Maintenance Mode**.

**Step 3** Follow the instructions for removing and replacing a failed SSD in the host, per the server hardware guide.

**Note** When you remove an HGST NVMe disk, the controller VM will fail until you reinsert a disk of the same type into the same slot or reboot the host.

After the cache or persistent drive is replaced, the HX Data Platform identifies the SDD and updates the storage cluster.

When disks are added to a node, the disks are immediately available for HX consumption.

**Step 4** Reboot the ESXi host. This enables ESXi to discover the NVMe SSD.

**Step 5** Exit ESXi host from HX Maintenance Mode.

**Step 6** To enable the Cisco UCS Manager to include new disks in the **UCS Manager > Equipment > Server > Inventory > Storage** tab, re-acknowledge the server node. This applies to cache and persistent disks.

**Note** Re-acknowledging a server is disruptive. Place the server into HX Maintenance Mode before doing so.

**Step 7** If you replaced an SSD, and see a message **Disk successfully scheduled for repair**, it means that the disk is present, but is still not functioning properly. Check that the disk has been added correctly per the server hardware guide procedures.

---

**Replacing Housekeeping SSDs**

**Note** This procedure applies to HXAF220c M4, HX220c M4, HXAF220c M5, HX220c M5, HXAF240c M5, HX240c M5, servers only. To replace the housekeeping SSD on an HXAF240c M4 or HX240c M4 servers, contact Cisco TAC.

Identify the failed housekeeping SSD and perform the associated steps.
### Managing Disks

#### Replacing Housekeeping SSDs

**Step 1** Identify the failed housekeeping SSD. Physically check the SSD drives, as housekeeping drives are not listed through a beacon check.

**Step 2** Remove the SSD and replace with a new SSD of the same kind and size. Follow the steps in the server hardware guide. The server hardware guide describes the physical steps required to replace the SSD.  

**Note** Before performing the hardware steps, enter the node into Cisco HX Maintenance Mode. After performing the hardware steps, exit the node from Cisco HX Maintenance Mode.

**Step 3** Using SSH, login into the storage controller VM of the affected node and run the following command.  

```bash
# /usr/share/springpath/storfs-appliance/config-bootdev.sh -r -y
```

This command consumes the new disk, adding it into the storage cluster.

**Sample response**

```
Creating partition of size 65536 MB for /var/stv ...  
Creating ext4 filesystem on /dev/sdg1 ...  
Creating partition of size 24576 MB for /var/zookeeper ...  
Creating ext4 filesystem on /dev/sdg2 ...  
Model: ATA INTEL SSDSC2BB12 (scsi)  
Disk /dev/sdg: 120034MB  
Sector size (logical/physical): 512B/4096B  
Partition Table: gpt ....  
discovered. Rebooting in 60 seconds
```

**Step 4** Wait for the storage controller VM to automatically reboot.

**Step 5** When the storage controller VM completes its reboot, verify that partitions are created on the newly added SSD. Run the command.  

```bash
# df -ah
```

**Sample response**

```
..........  
/dev/sdb1 63G 324M 60G 1%  
/var/stv /dev/sdb2 24G 173M 23G 1% /var/zookeeper
```

**Step 6** Identify the HX Data Platform installer package version installed on the existing storage cluster.  

```bash
# stcli cluster version
```

The same version must be installed on all the storage cluster nodes. Run this command on the controller VM of any node in the storage cluster, but not the node with the new SSD.

**Step 7** Copy the HX Data Platform installer packages into the storage controller VM in /tmp folder.  

```bash
# scp <hxdp_installer_vm_ip>:/opt/springpath/packages/storfs-packages-<hxdp_installer>.tgz /tmp  
# cd /tmp  
# tar xzvf storfs-packages-<hxdp_installer>.tgz
```

**Step 8** Run the HX Data Platform installer deployment script.  

```bash
# ./inst-packages.sh
```

For additional information on installing the HX Data Platform, see the appropriate [Cisco HX Data Platform Install Guide](#).
Step 9

After the package installation, HX Data Platform starts automatically. Check the status.

```
# status storfs
```

Sample response

```
storfs running
```

The node with the new SSD re-joins the existing cluster and the cluster returns to a healthy state.

---

**Replacing or Adding Hard Disk Drives**

*Note*  
Mixing storage disks type or size on a server or across the storage cluster is not supported.

- Use all HDD, or all 3.8 TB SSD, or all 960 GB SSD
- Use the hybrid cache device on hybrid servers and all flash cache devices on all flash servers.
- When replacing cache or persistent disks, always use the same type and size as the original disk.

---

**Step 1**  
Refer to the hardware guide for your server and follow the directions for adding or replacing disks.

**Step 2**  
Add HDDs of the same size to each node in the storage cluster.

**Step 3**  
Add the HDDs to each node within a reasonable amount of time.

The storage starts being consumed by storage cluster immediately.

The vCenter Event log displays messages reflecting the changes to the nodes.

*Note*  
When disks are added to a node, the disks are immediately available for HX consumption although they will not be seen in the UCSM server node inventory. This includes cache and persistent disks. To include the disks in the UCS Manager > Equipment > Server > Inventory > Storage tab, re-acknowledge the server node.

*Note*  
Re-acknowledging a server is disruptive. Place the server into HX Maintenance Mode before doing so.
Managing Nodes

Nodes are initially added to a storage cluster using the Create Cluster feature of the HX Data Platform Installer. Nodes are added to an existing storage cluster using the Expand Cluster feature of the HX Data Platform Installer. When nodes are added or removed from the storage cluster, the HX Data Platform adjusts the storage cluster status accordingly.

- Tasks for node maintenance with a failed nodes.
  - The ESXi or HX software needs to be reinstalled.
  - A node component needs to be replaced.
  - The node needs to be replaced.
  - The node needs to be removed.

- Tasks for node maintenance with a non-failed nodes.
  - Putting the node into maintenance mode.
  - Changing the ESX password.
Though there are subtle differences, the terms server, host, and node are used interchangeably throughout the HyperFlex documentation. Generally a server is a physical unit that runs software dedicated to a specific purpose. A node is a server within a larger group, typically a software cluster or a rack of servers. Cisco hardware documentation tends to use the term node. A host is a server that is running the virtualization and/or HyperFlex storage software, as it is 'host' to virtual machines. VMware documentation tends to use the term host.

### Step 1
Monitor the nodes in the cluster.

HX storage cluster, node, and node component status is monitored and reported to HX Connect, HX Data Platform Plug-in, vCenter UI, and assorted logs as Operational status (online, offline) and Resiliency (healthy, warning) status values.

**Note** Functional state distinctions contribute to, but are separate from, the storage cluster operational and resiliency status reported in the HX Connect and HX Data Platform Plug-in views. For each Data Replication Factor (2 or 3), Cluster Access Policy (lenient or strict), and given number of nodes in the storage cluster, the storage cluster shifts between Read and Write, Read Only, or Shutdown state, depending on the number of failed nodes or failed disks in nodes.

**Note** A replication factor of three is highly recommended for all environments except HyperFlex Edge. A replication factor of two has a lower level of availability and resiliency. The risk of outage due to component or node failures should be mitigated by having active and regular backups.

### Step 2
Analyze the node failure and determine the action to take.

This frequently requires monitoring the node state through HX Connect, HX Data Platform Plug-in, vCenter, or ESXi; checking the server beacons; and collecting and analyzing logs.

### Step 3
Complete the identified tasks.

- **Reinstall or upgrade software.**
  
  For steps to reinstall ESXi or the HX Data Platform see *Cisco HyperFlex Systems Installation Guide for VMware ESXi*. For steps to upgrade software, see the *Cisco HyperFlex Systems Upgrade Guide*.

- **Repair a component in the node.**

  Node components, such as solid state drives (SSD), hard disk drives (HDD), power supply units (PSU), and network interface cards (NIC) components are not configurable through HX Connect or HX Data Platform Plug-in, but the HX Data Platform monitors them and adjusts the storage cluster status when any of these items are disrupted, added, removed, or replaced.

  The steps to add or remove disks, depends upon the type of disk. Field replaceable units (FRUs), such as PSUs and NICs are replaced following steps described in the server hardware guides.

- **Replace a node in the cluster.**

  Replacing a node in a storage cluster typically requires TAC assistance. Provided the requirements are met, nodes can be replaced without TAC assistance while the storage cluster is online (5+ node clusters only) or offline (4+ node clusters). To replace a node in a 3 node cluster always requires TAC assistance. For more information, see *Removing a Node, on page 112*.

- **Remove a node from the cluster.**

Removing the node must not reduce the number of available nodes below the minimum 3 nodes, as this makes the storage cluster unhealthy. To remove a node in a 3 node cluster always requires TAC assistance. You can remove a maximum of 2 nodes from an offline cluster. For more information, see Replacing a Node, on page 120.

**Identify Node Maintenance Methods**

When performing maintenance tasks on nodes, some of these tasks are performed while the storage cluster is offline, others can be performed while the cluster is online and only require that the node is in HX maintenance mode.

- **Online tasks** - require that the storage cluster is healthy before the task begins.
- **Offline tasks** - require that the storage cluster will be shutdown. If 2 or more nodes are down, then the storage cluster is automatically offline.
- **TAC assisted tasks** - typically require steps that are performed by the TAC representative.

There are several considerations to keep in mind before replacing a node. For more information, see Replacing a Node, on page 120.

The following tables lists the methods available to perform the associated node maintenance task.

**Repair Node Software**

ESX and HX Data Platform software is installed on every node in the storage cluster. If it is determined after node failure analysis that either software item needs to be re-installed, see the *Cisco HyperFlex Systems Installation Guide for VMware ESXi*. For steps to upgrade software, see the *Cisco HyperFlex Systems Upgrade Guide*.

**Repair Node Hardware**

A reparable item on node fails. This includes FRUs and disks. Some node components require TAC assistance. Replacing a node's mother board, for example, requires TAC assistance.

<table>
<thead>
<tr>
<th>No. Nodes in Cluster</th>
<th>No. Failed Nodes in Cluster</th>
<th>Method</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1 or more</td>
<td>TAC assisted only node repair.</td>
<td>Node does not need to be removed to perform repair. Includes replacing disks on node.</td>
</tr>
<tr>
<td>4-8</td>
<td>1</td>
<td>Online or Offline node repair.</td>
<td>Node does not need to be removed to perform repair. Includes replacing disks on node.</td>
</tr>
</tbody>
</table>
Remove Node

A non-reparable item on node fails. Disks on the removed node are not reused in the storage cluster.

<table>
<thead>
<tr>
<th>No. Nodes in Cluster</th>
<th>No. Failed Nodes in Cluster</th>
<th>Method</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>1</td>
<td>Offline node remove.</td>
<td>A 4 node cluster with 2 nodes down, requires TAC assistance.</td>
</tr>
<tr>
<td>5 or more</td>
<td>1</td>
<td>Online or Offline node remove.</td>
<td></td>
</tr>
<tr>
<td>5 or more</td>
<td>2</td>
<td>Offline 2 node remove.</td>
<td>A 5 node cluster with 3 nodes down, requires TAC assistance.</td>
</tr>
</tbody>
</table>

Replace Node and Discard Storage

A non-reparable item on node fails. Disks on the removed node are not reused in the storage cluster.

<table>
<thead>
<tr>
<th>No. Nodes in Cluster</th>
<th>No. Failed Nodes in Cluster</th>
<th>Method</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>TAC assisted only node replace.</td>
<td>TAC assisted node replacement required to return cluster to minimum 3 nodes. A 3 node cluster with 1 node down, requires TAC assistance.</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>Offline replace node.</td>
<td>Use Expand cluster to add new nodes. All other nodes must be up and running. A 4 node cluster with 2 nodes down, requires TAC assistance.</td>
</tr>
<tr>
<td>5 or more</td>
<td>1</td>
<td>Online or offline replace node.</td>
<td>Use Expand cluster to add new nodes. All other nodes must be up and running.</td>
</tr>
<tr>
<td>5 or more</td>
<td>2</td>
<td>Offline replace 1 or 2 nodes.</td>
<td>Use Expand cluster to add new nodes. All other nodes must be up and running. Replacing up to 2 nodes is supported. Replacing 3 or more nodes requires TAC assistance.</td>
</tr>
</tbody>
</table>

Replace Node and Reuse Storage

A non-reparable item on node fails. Disks on the removed node are reused in the storage cluster.
### Searching by DNS Address or Host Name

Sometimes for troubleshooting purposes it is useful to be able to search by the DNS server address or DNS server host name. This is an optional task.

#### Step 1
Assign DNS search addresses

a) Login to the HX Data Platform Installer virtual machine. Use either `ssh` or the vSphere console interface.

b) Edit the `resolv.conf.d` file.

```
vi /etc/resolvconf/resolv.conf.d/base
```

c) Confirm the change.

```
resolvconf -u
resolvconf
```

d) Confirm the DNS server can be queried from either the IP address or the host name.

```
nslookup ip_address
nslookup newhostname
```

#### Step 2
Assign a DNS host name.

a) Login to the HX Data Platform Installer virtual machine. Use either `ssh` or the vSphere console interface.

b) Open the hosts file for editing.

```
vi /etc/hosts
```

c) Add the following line and save the file.

```
ip_address ubuntu newhostname
```

For each host `ip_address`, enter the host `newhostname`.

a) Add the `newhostname` to `hostname`.

```
hostname newhostname
```
Changing ESXi Host Root Password

You can change the default ESXi password for the following scenarios:

- During creation of a standard and stretch cluster (supports only converged nodes)
- During expansion of a standard cluster (supports both converged or compute node expansion)
- During Edge cluster creation

In the above cases, the ESXi root password is secured as soon as installation is complete. In the event a subsequent password change is required, the procedure outlined below may be used after installation to manually change the root password.

As the ESXi comes up with the factory default password, you should change the password for security reasons. To change the default ESXi root password post-installation, do the following.

**Note**

If you have forgotten the ESXi root password, for password recovery please contact Cisco TAC.

**Step 1**
Log in to the ESXi host service control using SSH.

**Step 2**
Acquire root privileges.

```
su -
```

**Step 3**
Enter the current root password.

**Step 4**
Change the root password.

```
passwd root
```

**Step 5**
Enter the new password, and press Enter. Enter the password a second time for confirmation.

**Note**
If the password entered the second time does not match, you must start over.

Reinstalling Node Software

To re-install software on a node that is a member of an existing storage cluster, contact TAC. This task must be performed with TAC assistance.

**Step 1**
Reinstall ESX following the directions from TAC.

Ensure the server meets the required hardware and configuration listed in Host ESX Server Setting Requirements. HX configuration settings are applied during the HX Data Platform process.
Step 2  Reinstall HX Data Platform, following the directions from TAC.
The HX Data Platform must always be re-installed after ESX is re-installed.

---

**Changing Node Identification Form in vCenter Cluster from IP to FQDN**

This task describes how to change how vCenter identifies the nodes in the cluster, from IP address to Fully Qualified Domain Name (FQDN).

---

**Step 1**  Schedule a maintenance window to perform this task.

**Step 2**  Ensure the storage cluster is healthy.
Check the storage cluster status through either HX Connect, HX Data Platform Plug-in, or from the `stcli cluster info` command on the storage controller VM.

**Step 3**  Lookup the FQDN for each ESXi host in the storage cluster.

a) From the ESXi host command line.

```
# cat /etc/hosts
```

In this example, the FQDN is `sjs-hx-3-esxi-01.sjs.local`.

```
# Do not remove the following line, or various programs that require network functionality will fail.
127.0.0.1 localhost.localdomain localhost
::1 localhost.localdomain localhost
172.16.67.157 sjs-hx-3-esxi-01.sjs.local sjs-hx-3-esxi-01
```

b) Repeat for each ESXi host in the storage cluster.

**Step 4**  Verify the FQDNs for each ESXi host are resolvable from vCenter, each other ESXi host, and the controller VMs.

a) From the vCenter command line.

```
# nslookup <fqdn_esx_host1>
# nslookup <fqdn_esx_host2>
# nslookup <fqdn_esx_host3>
...
```

b) Repeat for each ESXi host from an ESXi host.

c) Repeat for each ESXi host from each controller VM.

**Step 5**  If the FQDN name is not resolvable, then verify the DNS configuration on each ESXi host and each controller VM.

a) Check that the controller VMs have the correct IP address for the DNS server.

From a controller VM command line.

```
# stcli services dns show
10.192.0.31
```

a) Check the ESXi hosts have the same DNS configuration as the controller VMs.

From vCenter, select each ESXi host then **Configuration > DNS Servers**.
Recreating the cluster in vCenter.
   a) From vCenter, right-click the datacenter. Select New Cluster.
   b) Enter the exact same name for the Cluster Name as the cluster you deleted. This is the name you wrote down from Step 6.

Step 9
Add ESXi hosts (nodes) to the cluster using the FQDN name. Perform these steps for all ESXi hosts.
   a) From vCenter, right-click the datacenter > cluster. Select Add Host.
   b) Select an ESXi host using their FQDN.
   c) Repeat for each ESXi host in the cluster.

Step 10
Reregister the cluster with vCenter.
   # stcli cluster reregister
   --vcenter-datacenter <datacenter_name>
   --vcenter-cluster <hx_cluster_name>
   --vcenter-url <FQDN_name>
   --vcenter-user <vCenter_username>
   --vcenter-password <vCenter_Password>

The SSO URL is not required for HX version 1.8.1c or later. See Registering a Storage Cluster with a New vCenter Cluster, on page 73 for additional information on reregistering a cluster.

---

Replacing Node Components

Selected components on a node can be replaced. Some components can be replaced while the node is up and running. Replacing some components requires that the node be placed into a maintenance mode and shutdown. Refer to the hardware installation guide for your specific server for a complete list of field replaceable units (FRUs). Some components cannot be replaced or can only be replaced with TAC assistance. The following is a general list of components than can be replaced in a node.

- Components that do not require the node be shutdown. These are hot-swappable.
  - HDD data drives. Front bays

When disks are removed, the disk UUIDs continue to be listed, even when not physically present. To reuse disks on another node in the same cluster see TAC for assistance.
• SSD cache drive. Front bay 1

See Managing Disks for the storage cluster tasks and the hardware installation guides for the hardware focused tasks. Both sets of tasks are required to replace this component.

• Fan Modules

See the hardware installation guides to replace this component.

• Power Supplies

See the hardware installation guides to replace this component.

• Components that do required the node be put into maintenance mode and shutdown.

For all of the following components, see the hardware installation guides.

• Housekeeping SSD

Both the storage cluster tasks and hardware focused tasks are required to replace this component.

• RTC Battery on motherboard

Note The motherboard itself is not a replaceable component. You must purchase a battery from your local hardware store and replace it.

• DIMMS
• CPUs and Heatsinks
• Internal SD Card
• Internal USB Port
• Modular HBA Riser (HX 220c servers)
• Modular HBA Card
• PCIe Riser Assembly
• PCIe Card
• Trusted Platform Module
• mLOM Card
• RAID Controller
• Virtual Interface Card (VIC)
• Graphic Processing Unit (GPU)
Removing a Node

Depending upon the node maintenance task, removing a node can be while the storage cluster is online or offline. Ensure you have completed the preparation steps before removing a node.

Note
It is highly recommended that you work with your account team when removing a converged node in a storage cluster.

Do not reuse the removed converged node or its disks in the original or another cluster.

The affecting context is based on the number of converged nodes. The number of compute nodes does not affect the replacing a node workflow.

Table 4: Removing a Node Workflows

<table>
<thead>
<tr>
<th>Cluster Size</th>
<th>Nodes Removed</th>
<th>Workflow</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 node cluster</td>
<td>1 or more</td>
<td>Workflow requires TAC assistance.</td>
</tr>
<tr>
<td>4 node cluster</td>
<td>1</td>
<td>1. Cluster is healthy.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Affected node in Cisco HX Maintenance mode.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Shutdown the cluster (take cluster offline).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use the stcli cluster shutdown command.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Remove the node.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use the stcli node remove command.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Restart the cluster.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use the stcli cluster start command.</td>
</tr>
<tr>
<td>4 node cluster</td>
<td>2 or more</td>
<td>Workflow requires TAC assistance.</td>
</tr>
<tr>
<td>5 node cluster</td>
<td>1</td>
<td>1. Cluster is healthy.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Affected node in Cisco HX Maintenance mode.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Cluster remains online.</td>
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<tr>
<td></td>
<td></td>
<td>4. Remove the node.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use the stcli node remove command.</td>
</tr>
</tbody>
</table>
### Preparing to Remove a Node

Before you remove a node from a storage cluster, whether the cluster is online or offline, complete the following steps.

#### Note
For all 3 node clusters, see TAC to assist with preparing, removing, and replacing a node.

<table>
<thead>
<tr>
<th>Cluster Size</th>
<th>Nodes Removed</th>
<th>Workflow</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 node cluster</td>
<td>2</td>
<td>1. Cluster is healthy.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Affected node in Cisco HX Maintenance mode.</td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Use the <code>stcli cluster shutdown</code> command.</td>
</tr>
<tr>
<td></td>
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<td>4. Remove the nodes.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use the <code>stcli node remove</code> command.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Specify both nodes.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Restart the cluster.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use the <code>stcli cluster start</code> command.</td>
</tr>
<tr>
<td>5 node cluster</td>
<td>3 or more</td>
<td>Workflow requires TAC assistance.</td>
</tr>
</tbody>
</table>

#### Step 1
Ensure the cluster is healthy.

```bash
# stcli cluster info
```

Example response that indicates the storage cluster is online and healthy:

```plaintext
locale: English (United States)
state: online
upgradeState: ok
healthState: healthy
state: online
state: online
```

#### Step 2
Ensure that SSH is enabled in ESX on all the nodes in the storage cluster.

#### Step 3
Ensure that the Distributed Resource Scheduler (DRS) is enabled.

DRS migrates only powered-on VMs. If your network has powered-off VMs, you must manually migrate them to a node in the storage cluster that will not be removed.

**Note**  
If DRS is not available then manually move the Virtual Machines from the node.

#### Step 4
Rebalance the storage cluster.

This ensures that all datastores associated with the node will be removed.
The rebalance command is used to realign the distribution of stored data across changes in available storage and to restore storage cluster health. If you add or remove a node in the storage cluster, you can manually initiate a storage cluster rebalance using the `stcli rebalance` command.

**Note**  
Rebalancing might take some time depending on the disk capacity used on the failed node or disk.

a) Login to a controller VM in the storage cluster.  
b) From the controller VM command line, run the command:

```
# stcli rebalance start --force
```

**Step 5**  
Put the node to be removed into Cisco HX Maintenance mode. Choose a method: vSphere GUI or controller VM command line (CLI).

**GUI**

a) From vSphere web client, select **Home > Hosts and Clusters > Hosts > host**.

b) Right-click each host, scroll down the list, and select **Cisco HX Maintenance Mode > Enter HX Maintenance Mode**.

The vSphere Maintenance Mode option is at the top of the host right-click menu. Be sure to scroll to the bottom of the list to select Cisco HX Maintenance Mode.

**CLI**

a) On the ESX host, log in to a controller VM as a user with root privileges.

b) Identify the node.

```
# stcli node info
```

```
stNodes:
----------------------------------------
type: node
id: 689324b2-b30c-c440-a08e-5b37c7e0eefe
name: 192.168.92.144
----------------------------------------
type: node
id: 9314ac70-77aa-4345-8f35-7854f71a0d0c
name: 192.168.92.142
----------------------------------------
type: node
id: 9e6ba2e3-4bb6-214c-8723-019fa483a308
name: 192.168.92.141
----------------------------------------
type: node
id: 575ace48-1513-0b4f-bfe1-e6abd5ff6895
name: 192.168.92.143
---------------------------------------
```

Under `stNodes` section the `id` is listed for each node in the cluster.

c) Move the ESX host into Maintenance mode.

```
# stcli node maintenanceMode (--id ID | --ip NAME) --mode enter
```

(see also `stcli node maintenanceMode --help`)

**Step 6**  
Open a command shell and login to the storage controller VM. For example, using `ssh`.

```
# ssh root@controller_vm_ip
```
At the prompt, enter password, Cisco123.

What to do next

Proceed to Removing a Node. Choose the Online or Offline method per the condition of your storage cluster and the desired results listed in Managing Nodes.

Removing a Node from an Online Storage Cluster

Use the `stcli node remove` to clean up a deployment or remove a node from a storage cluster.

Removing a node from a storage cluster while the cluster remains online has slightly different requirements from removing a node while the cluster is offline.

Note

It is highly recommended that you work with TAC when removing a converged node in a storage cluster.

The affecting context is based on the number of converged nodes. The number of compute nodes does not affect the replacing a node workflow.

<table>
<thead>
<tr>
<th>Number of nodes in cluster</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 node cluster</td>
<td>See TAC to remove and replace the node.</td>
</tr>
<tr>
<td>4 node cluster</td>
<td>Cluster must be offline. See Removing a Node from an Offline Storage Cluster, on page 117.</td>
</tr>
<tr>
<td>5 node cluster, removing 2 nodes</td>
<td>Cluster must be offline. See Removing a Node from an Offline Storage Cluster, on page 117.</td>
</tr>
<tr>
<td>5 node cluster, removing 1 node from a healthy cluster</td>
<td>Cluster can be online. Continue with the steps listed here.</td>
</tr>
</tbody>
</table>

Note

Do not remove the controller VM or other HX Data Platform components before you complete the steps in this task.

Step 1

Complete the steps in Preparing for Maintenance Operations and Preparing to Remove a Node. This includes:

a) Ensure the cluster is healthy.

   For 3 node clusters see TAC, as any node failure in a 3 node cluster means the cluster is not healthy.

b) Ensure DRS is enabled or manually move the VMs from the node.

c) Rebalance the storage cluster.

d) Put the node being removed into HX maintenance mode.

e) Login to the controller VM of a node that is not being removed.
**Step 2**  
Rebalance the storage cluster.

a) Run the rebalance command.

```
# stcli rebalance start -f
```

b) Wait and confirm that rebalance has completed.

**Step 3**  
Remove the desired node using the `stcli node remove` command.

```
stcli node remove [-h] [--id-1 ID1 | --ip-1 NAME1] [[--id-2 ID2 | --ip-2 NAME2]] [-f]
```

<table>
<thead>
<tr>
<th>Syntax Description</th>
<th>Option</th>
<th>Required or Optional</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>--id-1 ID1</td>
<td></td>
<td>One of set required.</td>
<td>A unique ID number for the storage cluster node. The ID is listed in the <code>stcli cluster info</code> command under the <code>stNode field id</code>.</td>
</tr>
<tr>
<td>--ip-1 NAME1</td>
<td></td>
<td>One of set required.</td>
<td>IP address of storage cluster node. The IP is listed in the <code>stcli cluster info</code> command under the <code>stNode field name</code>.</td>
</tr>
<tr>
<td>--id-2 ID2</td>
<td>Optional.</td>
<td>A unique ID number for the storage cluster node. The ID is listed in the <code>stcli cluster info</code> command under the <code>stNode field id</code>.</td>
<td></td>
</tr>
<tr>
<td>--ip-2 NAME2</td>
<td>Optional.</td>
<td>IP address of storage cluster node. The IP is listed in the <code>stcli cluster info</code> command under the <code>stNode field name</code>. The <code>--ip</code> option is currently not supported.</td>
<td></td>
</tr>
<tr>
<td>-f, --force</td>
<td>Optional.</td>
<td>Forcibly remove storage cluster nodes.</td>
<td></td>
</tr>
</tbody>
</table>

**Example:**

For stNodes for a 5 node cluster:

```
-------------------------------------------------------------
type: node
id: 569c03dc-9af3-c646-8ac5-34bf7e04b5c
name: example1
-------------------------------------------------------------
type: node
id: 0e070112-2452-8242-b6d4-bce8d29f8f17
name: example2
-------------------------------------------------------------
type: node
id: a2b43640-cf94-b042-a091-341358fdd3f4
name: example3
-------------------------------------------------------------
type: node
id: c2d43691-fab5-30b2-a092-741368dee3c4
name: example4
-------------------------------------------------------------
type: node
id: d2d43691-daf5-50c4-d096-941358fede374
name: example5
```

The `stcli node remove` command to remove nodes from the 5 node cluster are:

- To remove 1 node
Removing a Node from an Offline Storage Cluster

Use the `stcli node remove` command to clean up a deployment or remove a node from a storage cluster.

```plaintext
• stcli node remove –ip-1 example5 or
• stcli node remove –id-1 d2d43691-daf5-50c4-d096-941358fede374

• To remove 2 nodes at the same time:
  • stcli node remove –ip-1 example5 –ip-2 example4 or
  • stcli node remove –id-1 d2d43691-daf5-50c4-d096-941358fede374 –id-2
c2d43691-fab5-30b2-a092-741368dee3c4

This command unmounts all datastores, removes from the cluster ensemble, resets the EAM for this node, stops all services (stores, cluster management IP), and removes all firewall rules.

This command does not: remove the node from the vCenter and it does not remove the installed HX Data Platform elements, such as the controller VM.

After the `stcli node remove` command completes successfully, the system rebalances the storage cluster until the storage cluster state is Healthy. Do not perform any failure tests during this time. The storage cluster remains healthy.

Because the node is no longer in the storage cluster, you do not need to exit HX maintenance mode.

**Note** If you want to reuse a removed node in another storage cluster, contact Technical Assistance Center (TAC).

Additional steps are required to prepare the node for another storage cluster.

**Step 4** Confirm the node is removed from the storage cluster.

a) Check the storage cluster information.

```
# stcli cluster info
```

b) Check the `ActiveNodes` entry in the response to verify the cluster has one less node.

**Step 5** Confirm all the node-associated datastores are removed.

**Note** If any node-associated datastores are listed, then manually unmount and delete those datastores.

**Step 6** Remove the host from the vCenter `Hosts and Cluster` view.

a) Log in to vSphere Web Client Navigator. Navigate to `Host` in the vSphere Inventory.

b) Right-click the host and select `Enter Maintenance Mode`. Click `Yes`.

c) Right-click the host and select `All vCenter Actions > Remove from Inventory`. Click `Yes`.

**Step 7** Decommission the host from UCS Manager.

a) Log in to UCS Manager. In the Navigation pane, click `Equipment`.

b) Expand `Equipment > Chassis > Chassis Number > Servers`.

c) Choose the HX server you want to decommission. In the work pane, click the `General` tab.

d) In the `Actions` area, click `Server Maintenance`. In the `Maintenance` dialog box, click `Decommission`. Click `OK`.

---

Removing a Node from an Offline Storage Cluster

Use the `stcli node remove` command to clean up a deployment or remove a node from a storage cluster.
It is highly recommended that you work with TAC when removing a converged node in a storage cluster.

The affecting context is based on the number of converged nodes. The number of compute nodes does not affect the replacing a node workflow.

<table>
<thead>
<tr>
<th>Number of nodes in cluster</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 node cluster</td>
<td>See TAC to remove and replace the node.</td>
</tr>
<tr>
<td>4 node cluster</td>
<td>Cluster must be offline.</td>
</tr>
<tr>
<td>5 node cluster, removing 2 nodes</td>
<td>Cluster must be offline.</td>
</tr>
<tr>
<td>5 node cluster, removing 1 node from a healthy cluster</td>
<td>Cluster can be online. See Removing a Node from an Online Storage Cluster, on page 115.</td>
</tr>
</tbody>
</table>

Note

Do not remove the controller VM or other HX Data Platform components before you complete the steps in this task.

You can remove a maximum of 2 nodes from an offline cluster.

---

**Step 1**

Complete the steps in Preparing for Maintenance Operations and Preparing to Remove a Node. This includes:

a) Ensure the cluster is healthy.

   For 3 node clusters see TAC, as any node failure in a 3 node cluster means the cluster is not healthy.

b) Ensure DRS is enabled or manually move the VMs from the node.

c) Rebalance the storage cluster.

d) Put the node being removed into HX maintenance mode.

e) Login to the controller VM of a node that is not being removed.

**Step 2**

Prepare to shutdown, then shutdown the storage cluster.

This step is needed only for either of the following conditions:

- The cluster is less than 5 nodes.
- Removing 2 nodes from a 5 node cluster.

a) Gracefully shutdown all resident VMs on all the HX datastores.

   Optionally, vMotion the VMs.

b) Gracefully shutdown all VMs on non-HX datastores on HX storage cluster nodes, and unmount.

c) From any controller VM command line, issue the `stcli cluster shutdown` command.

   ```
   # stcli cluster shutdown
   ```

**Step 3**

Remove the desired node using the `stcli node remove` command.
For example, you can specify the node to be removed by either IP address or domain name.

```
# stcli node remove --ip-1 10.10.2.4 --ip-2 10.10.2.6
```
or

```
# stcli node remove --name-1 esx.SVHOST144A.complab --name-2 esx.SVHOST144B.complab.lab
```

**Note** Enter the second IP address if you are removing a second node from a 5+ node storage cluster.

**Response**

```
Successfully removed node: EntityRef(type=3, id='', name='10.10.2.4' name='10.10.2.6')
```

This command unmounts all datastores, removes from the cluster ensemble, resets the EAM for this node, stops all services (stores, cluster management IP), and removes all firewall rules.

This command does not:

- Remove the node from vCenter. The node remains in vCenter.
- Remove the installed HX Data Platform elements, such as the controller VM.

After the `stcli node remove` command completes successfully, the system rebalances the storage cluster until the storage cluster state is Healthy. Do not perform any failure tests during this time. The storage cluster health remains Average.

Because the node is no longer in the storage cluster, you do not need to exit HX maintenance mode.

**Note** If you want to reuse a removed node in another storage cluster, contact Technical Assistance Center (TAC). Additional steps are required to prepare the node for another storage cluster.

---

**Step 4** Confirm the node is removed from the storage cluster.

a) Check the storage cluster information.

```
# stcli cluster info
```

b) Check the `ActiveNodes` entry in the response to verify the cluster has one less node.

**Step 5** Confirm all the node-associated datastores are removed.

**Note** If any node-associated datastores are listed, then manually unmount and delete those datastores.

**Step 6** Restart the cluster.

```
# stcli cluster start
```

---

**Removing a Compute Node**

**Step 1** Migrate all the VMs from a compute node that needs to be removed.

**Step 2** Unmount the datastore from the compute node.

**Step 3** Check if the cluster is in the healthy state, by running the following command:

```
stcli cluster info --summary
```

**Step 4** Put ESXi host in the HX Maintenance mode.
Step 5  Remove the compute node using the `stcli node remove` command, from CMIP (use the Cisco HX connect IP address as it is the cluster IP address).

```
stcli node remove --ip=<IP>
```

Where, IP is the IP address of the node to be removed.

Step 6  Remove any DVS from the ESXi host in vCenter, if there is a DVS.

Step 7  Remove the ESXi host from vCenter.

Step 8  Check if the cluster is in the healthy state, by running the following command:

```
stcli cluster info --summary
```

Step 9  Clear stale entries in the compute node by logging out of Cisco HX Connect and then logging into Cisco HX Connect.

Step 10 Disable and re-enable the High Availability (HA) and Distributed Resource Scheduler (DRS) services to reconfigure the services after node removal.

---

Deleting the Removed Node Data from a Disk and a Storage Controller VM

After removing a node from a storage cluster, you have to delete the removed node details from the disk and storage controller VM using the following procedure.

⚠️ **Warning**

Be aware that once the data is deleted you cannot recover it.

---

Step 1  Destroy the cluster by running the following command:

```
run destroycluster -sxy
```

Step 2  Remove the `stvboot.cfg` configuration file from the `/etc/` folder.

Step 3  Reboot the controller VM.

**Note**  The reboot process takes few minutes.

Step 4  After rebooting the controller VM, run the following command:

```
# for d in $(/bin/lsblk -dpn -e 1,2,7,11 | awk '{ print $1 }');do grep -qE "$d[0-9]" /proc/mounts & & continue; dd if=/dev/zero of=$d bs=1M oflag=direct & done;
```

The data deletion action takes few hours. On completion of the drive data deletion, you will get the message: No space left on device. Ignore this message.

---

Replacing a Node

Replacing a node uses Expand Cluster to add the replacement node after removing the failed node. Replacing a node can be performed while the HX storage cluster is online or offline, provided the requirements are met. Replacing a converged node in a storage cluster typically requires TAC assistance.
It is highly recommended that you work with TAC when replacing a node in a storage cluster.

### Conditions that require TAC assistance to replace a converged node.

- **3 node cluster**
  
  All 3 node clusters require TAC assistance to replace a node. Replace the node during cluster maintenance.

- **4 node cluster**
  
  - Storage cluster is unhealthy.
  
  - Storage cluster will become unhealthy if a node is removed.
  
  - 2 or more nodes have failed.
  
  - Disks on the replaced node will be reused.

  When a node is added to a storage cluster, the HX Data Platform associates each disk UUID with the node UUID. This is a fixed relationship for the life of the storage cluster. Disks cannot be reassigned to nodes with different UUIDs. TAC will work with you to assign the old node's UUID to the new node to ensure the disk UUID to node UUID association.

  - Storage cluster to remain online while replacing a node.

- **5 node cluster**
  
  - Storage cluster is unhealthy.
  
  - Storage cluster will become unhealthy if a node is removed.
  
  - 3 or more nodes have failed.
  
  - Disks on the replaced node will be reused.

  When a node is added to a storage cluster, the HX Data Platform associates each disk UUID with the node UUID. This is a fixed relationship for the life of the storage cluster. Disks cannot be reassigned to nodes with different UUIDs. TAC will work with you to assign the old node's UUID to the new node to ensure the disk UUID to node UUID association.

  - Storage cluster to remain online while replacing 2 nodes.
  
  - Storage cluster to remain online and the cluster was initially 3 or 4 nodes.

  If your storage cluster was initially configured with either 3 or 4 nodes, adding nodes to make a total of 5 keeps your cluster as a 3+2 or 4+1 cluster. To keep the cluster online while replacing a node requires TAC assistance.

### Workflows for Replacing a Node

The affecting context is based on the number of converged nodes. The number of compute nodes does not affect the replacing a node workflow.

<table>
<thead>
<tr>
<th>Cluster Size</th>
<th>Nodes Replaced</th>
<th>Workflow</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 node cluster</td>
<td>1 or more</td>
<td>Workflow requires TAC assistance.</td>
</tr>
<tr>
<td>Cluster Size</td>
<td>Nodes Replaced</td>
<td>Workflow</td>
</tr>
<tr>
<td>-------------------</td>
<td>----------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>4 node cluster</td>
<td>1</td>
<td>1. Cluster is healthy.</td>
</tr>
<tr>
<td></td>
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<td>2. Affected node in Cisco HX Maintenance mode.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Shutdown the cluster (take cluster offline).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use the <code>stcli cluster shutdown</code> command.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Remove the node.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use the <code>stcli node remove</code> command.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Restart the cluster.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use the <code>stcli cluster start</code> command.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Wait until cluster is online and healthy.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7. Use <strong>HX Installer &gt; Expand Cluster</strong> to add replacement node.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Note</strong> Do not reuse the removed node or its disks in this or another cluster.</td>
</tr>
<tr>
<td>5 node cluster</td>
<td>1</td>
<td>1. Cluster is healthy.</td>
</tr>
<tr>
<td>4 node cluster</td>
<td>2 or more</td>
<td>Workflow requires TAC assistance.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Affected node in Cisco HX Maintenance mode.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Cluster remains online.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Remove the node.</td>
</tr>
<tr>
<td></td>
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<td>Use the <code>stcli node remove</code> command.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Restart the cluster.</td>
</tr>
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<td></td>
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<td>Use the <code>stcli cluster start</code> command.</td>
</tr>
<tr>
<td></td>
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<td>6. Wait until cluster is online and healthy.</td>
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<tr>
<td></td>
<td></td>
<td>7. Use <strong>HX Installer &gt; Expand Cluster</strong> to add replacement node.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Note</strong> Do not reuse the removed node or its disks in this or another cluster.</td>
</tr>
</tbody>
</table>
### Replacing a Node and discarding the failed node's disks.

<table>
<thead>
<tr>
<th>Cluster Size</th>
<th>Nodes Replaced</th>
<th>Workflow</th>
</tr>
</thead>
</table>
| 5 node cluster | 2 | 1. Cluster is healthy.  
3. Shutdown the cluster (take cluster offline).  
   Use the `stcli cluster shutdown` command.  
4. Remove the nodes.  
   Use the `stcli node remove` command.  
   Specify both nodes.  
5. Restart the cluster.  
   Use the `stcli cluster start` command.  
6. Wait until cluster is online and healthy.  
7. Use `HX Installer > Expand Cluster` to add replacement node.  
   **Note** Do not reuse the removed node or its disks in this or another cluster. |
| 5 node cluster | 3 or more | Workflow requires TAC assistance. |

#### Step 1
Remove the old node. Follow the steps in the appropriate topic:

- **Removing a Node from an Online Storage Cluster**
  
  Use this method only if the HX cluster was initially configured with at least 5 nodes and currently still has at least 5 nodes.

- **Removing a Node from an Offline Storage Cluster**
  
  Use this method for all other non-TAC assisted node removal.

**Note** Even though you remove a node and its associated disks, the HX Data Platform remembers the disk UUIDs. When logs and reports are generated, messages indicate that the disks exist but cannot be found. Ignore these messages.

#### Step 2
Add the new node using the Expand option in the HX Data Platform Installer. See the *Cisco HyperFlex Systems Getting Started Guide*. 
Expand Cisco HyperFlex System Clusters

- Cluster Expansion Guidelines, on page 125
- Prerequisites When Creating a Mixed M4/M5 Cluster, on page 126
- Mixed Cluster Expansion Guidelines, on page 127
- Steps During Mixed Cluster Expansion, on page 128
- Prerequisites for Adding a Converged (HX220c/HX240c) Node, on page 128
- Preparing a Converged Node, on page 129
- Adding a Converged Node to an Existing Cluster, on page 129
- Prerequisites for Adding a Compute-Only Node, on page 137
- Preparing a Compute-Only Node, on page 138
- Adding a Compute-Only Node to an Existing Cluster, on page 140
- Resolving Failure of Cluster Expansion, on page 146
- Enabling Logical Availability Zones, on page 147

Cluster Expansion Guidelines

- If you have replication configured, put replication in pause mode before performing upgrade, expansion or cluster maintenance. After the upgrade, expansion or cluster maintenance is completed, then resume replication. Perform the pause and resume on any cluster that has replication configured to or from this local cluster.

- If you are using RESTful APIs to perform cluster expansion, sometimes the task may take longer than expected.

- ESXi installation is supported on SD cards for M4 converged nodes and M.2 SATA SSD for M5 converged nodes. For compute-only nodes, ESXi installation is supported for SD Cards, SAN boot, or front SSD/HDD. Installing ESXi on USB Flash is not supported for compute-only nodes

  **Note**  
  HW RAID M.2 (UCS-M2-HWRAID and HX-M2-HWRAID) is not supported on Compute-only nodes.

- You must click on the discovered cluster to proceed with expanding a standard ESX cluster in a 3.5.x or earlier release. Not doing so results in errors.
ESXi Installation Guidelines

1. Modify boot policy for compute node.
   - To modify the template and boot policy for HyperFlex Stretched Cluster compute only node on M5 server:
     a. Clone the template.
     b. Uncheck the Flex flash from local boot policy, if the compute M5 node does not have flash cards.
     c. Add the SAN boot with proper WWPN to the boot order.

2. Start the DPI expansion workflow.

3. When prompted, install ESXi using an ISO image.

4. Return to the DPI expansion workflow and complete the ESXi installation workflow.

For Edge compute node, do the following:

1. In the Workflow screen, select the I know what I am doing link to use the customized version of the installation workflow, as the installation of Edge compute node have options to add only unassociated nodes.

2. Check the Hypervisor Configuration, HX Storage Software, and Expand Cluster check boxes.

3. Complete the workflow for ESXi installation.

---

**Note**

If the Hypervisor configuration fails with the SOL logging failure message, access the installer CLI through SSH with root and default password and configure the ESXi hypervisor. Then, run the advanced installer and check the HX Storage Software and Expand Cluster check boxes to proceed with the ESXi installation process.

---

Prerequisites When Creating a Mixed M4/M5 Cluster

The following tasks should be performed prior to beginning cluster expansion in a mixed cluster:

- Upgrade UCS Manager to 3.2(1d) or later.
- Upgrade the existing HX cluster fully to 2.6(1a) or later.
- Download and deploy the matching 2.6(1a) or later HX Data Platform Installer to run the expansion workflow.
- Upgrade existing M4 server firmware to the latest 3.2(1) patch release.
- Upgrade vCenter to 6.5 or later. Without vCenter 6.5, Broadwell EVC mode cannot be enabled. Only vCenter upgrade is required. ESXi can remain on an older version subject to the VMware software interoperability matrix. Proceeding with EVC mode off is not supported and will cause operational issues in the future.
Mixed Cluster Expansion Guidelines

- Expanding existing M4 cluster with M5 converged nodes is supported.
- Expanding existing M5 cluster with M4 converged nodes is not supported.
- Expanding existing mixed M4/M5 cluster with M4 or M5 converged nodes is supported.
- Adding any supported compute-only nodes is permitted with all M4, M5, and mixed M4/M5 clusters using the HX Data Platform 2.6 or later Installer. Some example combinations are listed here, many other combinations are possible.

Example combinations:

Expand mixed M4/M5 cluster with compute-only B200, C220, C240 M4/M5
Expand M4 cluster with compute-only B200 M5, C220 M5, C240M5

- Only expansion workflow is supported to create a mixed cluster. Initial cluster creation with mixed M4/M5 servers is not supported.
- All M5 servers must match the form factor (220/240), type (Hybrid/AF), security capability (Non-SED only) & disk configuration (QTY, capacity, and non-SED) of the existing M4 servers.
  - HX220-M5 will use a maximum of 6 capacity disks (2 disk slots to remain empty) when mixed with HX220-M4.

- HX Edge, SED, LFF, Hyper-V, and Stretched Clusters do not support mixed M4 and M5 clusters.

Mixed Cluster Expansion Guidelines for Release 3.5

A mixed cluster is defined by having both M4 and M5 HX converged nodes within the same storage cluster. When configuring a mixed cluster, the following guidelines apply:

- Expanding existing M4 cluster with M5 converged nodes is supported.
- Expanding existing M5 cluster with M4 converged nodes is not supported.
- Expanding existing mixed M4/M5 cluster with M4 or M5 converged nodes is supported.
- Adding any supported compute-only nodes is permitted with all M4, M5, and mixed M4/M5 clusters using the HX Data Platform 2.6 or later Installer. Some example combinations are listed here, many other combinations are possible.

Example combinations:

Expand mixed M4/M5 cluster with compute-only B200, C220, C240 M4/M5
Expand M4 cluster with compute-only B200 M5, C220 M5, C240M5

- Only expansion workflow is supported to create a mixed cluster. Initial cluster creation with mixed M4/M5 servers is not supported.
- All M5 servers must match the form factor (220/240), type (Hybrid/AF), security capability (Non-SED only) & disk configuration (QTY, capacity, and non-SED) of the existing M4 servers.
  - HX220-M5 will use a maximum of 6 capacity disks (2 disk slots to remain empty) when mixed with HX220-M4.

- HyperFlex Edge does not support mixed clusters.
Steps During Mixed Cluster Expansion

- During the validation steps, before expansion begins, an EVC check is performed. Follow the displayed guidance to manually enable EVC mode on the existing cluster at this time.

  **Caution**

  Failure to enable EVC at the time of the warning will require a complete shutdown of the storage cluster and all associated VMs at a later point in time. Do not skip this warning.

- Perform the EVC mode configuration in vCenter and then retry the validation.
- Cluster expansion will then validate a second time and then continue with the expansion.

Prerequisites for Adding a Converged (HX220c/HX240c) Node

A converged node can be added to a HyperFlex cluster after cluster creation. The storage on a converged node is automatically added to the cluster's storage capacity.

Before you start adding a converged node to an existing storage cluster, make sure that the following prerequisites are met.

- Ensure that the storage cluster state is healthy.
- Ensure that the new node meets the system requirements listed under Installation Prerequisites, including network and disk requirements.
- Ensure that the new node uses the same configuration as the other nodes in the storage cluster. This includes VLAN IDs and switch types (whether vSwitches), VLAN tagging with External Switch VLAN Tagging (EST), VLAN tagging with Virtual Switch Tagging (VST), or Virtual Distributed Switch.

  **Note**

  If the storage cluster is in an out of space condition, when you add a new node, the system automatically rebalances the storage cluster. This is in addition to the rebalancing that is performed every 24 hours.

- Ensure that the node you add is of the same model (HX220 or HX240) type (Hybrid or All Flash), and disk configuration (SED or non-SED). In addition, ensure that the number of capacity disks matches the existing cluster nodes.
- To add a node that has a different CPU family from what is already in use in the HyperFlex cluster, enable EVC. For more details, see the Setting up Clusters with Mixed CPUs section in the Cisco HyperFlex Systems Installation Guide for VMware ESXi.
- Ensure that the software version on the node matches the Cisco HX Data Platform version, the ESXi version, and the vCenter version. To identify the software version, go to the Storage Cluster Summary tab in vCenter and check the HX Data Platform version in the top section. Upgrade if necessary.
Preparing a Converged Node

**Step 1** Connect the converged node to the hardware and the network of the existing storage cluster. For more details refer to Installation Prerequisites.

**Step 2** Ensure that the HX node is a node prepared at factory.

**Note** If the node is not prepared at factory, for manually preparing the HX servers, refer the Cisco HyperFlex Systems Customized Installation Method section in the Cisco HyperFlex Systems Installation Guide for VMware ESXi.

Adding a Converged Node to an Existing Cluster

**Note** If you are using RESTful APIs to perform cluster expansion, sometimes the task may take longer than expected.

**Step 1** Launch the Cisco HX Data Platform Installer.

a) In your web browser, enter the IP address or the node name for the HX Data Platform Installer VM. Click Accept or Continue to bypass any SSL certificate errors. The Cisco HX Data Platform Installer login page appears. Verify the HX Data Platform Installer Build ID in the lower right corner of the login screen.

b) In the login page, enter the following credentials:

   **Username:** root

   **Password** (Default): Cisco123

   **Note** Systems ship with a default password of Cisco123 that must be changed during installation. You cannot continue installation unless you specify a new user supplied password.

c) Read the EULA, check the I accept the terms and conditions checkbox, and click Login.

**Step 2** On the Workflow page, select Cluster Expansion.

**Step 3** On the Credentials page, complete the following fields.
To perform cluster creation, you can import a JSON configuration file with the required configuration data. The following two steps are optional if importing a JSON file, otherwise you can input data into the required fields manually.

**Note** For a first-time installation, contact your Cisco representative to procure the factory preinstallation JSON file.

a. Click **Select a file** and choose your JSON file to load the configuration. Select **Use Configuration**.

b. An **Overwrite Imported Values** dialog box displays if your imported values for Cisco UCS Manager are different. Select **Use Discovered Values**.

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UCS Manager Credentials</strong></td>
<td></td>
</tr>
<tr>
<td>UCS Manager Host Name</td>
<td>UCS Manager FQDN or IP address.</td>
</tr>
<tr>
<td></td>
<td>For example, 10.193.211.120.</td>
</tr>
<tr>
<td>User Name</td>
<td>&lt;admin&gt; username.</td>
</tr>
<tr>
<td>Password</td>
<td>&lt;admin&gt; password.</td>
</tr>
<tr>
<td><strong>vCenter Credentials</strong></td>
<td></td>
</tr>
<tr>
<td>vCenter Server</td>
<td>vCenter server FQDN or IP address.</td>
</tr>
<tr>
<td></td>
<td>For example, 10.193.211.120.</td>
</tr>
<tr>
<td>Note</td>
<td>• A vCenter server is required before the cluster can be made operational.</td>
</tr>
<tr>
<td></td>
<td>• The vCenter address and credentials must have root level administrator permissions to the vCenter.</td>
</tr>
<tr>
<td></td>
<td>• vCenter server input is optional if you are building a nested vCenter. See the Nested vCenter TechNote for more details.</td>
</tr>
<tr>
<td>User Name</td>
<td>&lt;admin&gt; username.</td>
</tr>
<tr>
<td></td>
<td>For example, <a href="mailto:administrator@vsphere.local">administrator@vsphere.local</a>.</td>
</tr>
<tr>
<td>Admin Password</td>
<td>&lt;root&gt; password.</td>
</tr>
<tr>
<td><strong>Hypervisor Credentials</strong></td>
<td></td>
</tr>
<tr>
<td>Admin User Name</td>
<td>&lt;admin&gt; username.</td>
</tr>
<tr>
<td></td>
<td>This is <em>root</em> for factory nodes.</td>
</tr>
</tbody>
</table>
Expand Cisco HyperFlex System Clusters

Adding a Converged Node to an Existing Cluster

Field | Description
--- | ---
Admin Password | `<root>` password. Default password is `Cisco123` for factory nodes. **Note** Systems ship with a default password of `Cisco123` that must be changed during installation. You cannot continue installation unless you specify a new user supplied password.

**Step 4**

Click **Continue**. A **Cluster Expand Configuration** page is displayed. Select the **HX Cluster** that you want to expand. If the HX cluster to be expanded is not found, or if loading the cluster takes time, enter the IP of the Cluster Management Address in the **Management IP Address field**.

**Step 5**

The **Server Selection** page displays a list of unassociated HX servers under the **Unassociated** tab, and the list of discovered servers under the **Associated** tab. Select the servers under the **Unassociated** tab to include in the HyperFlex cluster.

If HX servers do not appear in this list, check Cisco UCS Manager and ensure that they have been discovered. For each server you can use the **Actions** drop-down list to set the following:

- **Launch KVM Console**—Choose this option to launch the KVM Console directly from the HX Data Platform Installer.
- **Disassociate Server**—Choose this option to remove a service profile from that server.

**Note** If there are no unassociated servers, the following error message is displayed:

```
No unassociated servers found. Please login to UCS Manager and ensure server ports are enabled.
```

The **Configure Server Ports** button allows you to discover any new HX nodes. Typically, the server ports are configured in Cisco UCS Manager before you start the configuration.

**Step 6**

Click **Continue**. The **UCSM Configuration** page appears.

**Note** If you imported a JSON file at the beginning, the **Credentials** page should be populated with the required configuration data from the preexisting HX cluster. This information must match your existing cluster configuration.

**Step 7**

In the **UCSM Configuration** page, complete the following fields for each network.

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VLAN Configuration</td>
<td>Use separate subnet and VLANs for each of the following networks.</td>
</tr>
<tr>
<td>VLAN Name</td>
<td>Name: hx-inband-mgmt</td>
</tr>
<tr>
<td>VLAN ID</td>
<td>Default VLAN ID: 3091</td>
</tr>
</tbody>
</table>

Cisco HyperFlex Data Platform Administration Guide, Release 3.5
### VLAN for HyperFlex storage traffic

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VLAN Name</td>
<td>Name: hx-storage-data</td>
</tr>
<tr>
<td>VLAN ID</td>
<td>Default VLAN ID: 3092</td>
</tr>
</tbody>
</table>

### VLAN for VM vMotion

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VLAN Name</td>
<td>Name: hx-vmotion</td>
</tr>
<tr>
<td>VLAN ID</td>
<td>Default VLAN ID: 3093</td>
</tr>
</tbody>
</table>

### VLAN for VM Network

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VLAN Name</td>
<td>Name: vm-network</td>
</tr>
<tr>
<td>VLAN ID(s)</td>
<td>Default VLAN ID: 3094</td>
</tr>
<tr>
<td></td>
<td>A comma-separated list of guest VLANs.</td>
</tr>
</tbody>
</table>

### MAC Pool

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAC Pool Prefix</td>
<td>Configure MAC Pool prefix by adding in two more hex characters (0-F). For example, 00:25:B5:A0.</td>
</tr>
</tbody>
</table>

### 'hx-ext-mgmt' IP Pool for Out-of-Band CIMC

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP Blocks</td>
<td>The range of IP addresses designated for the HyperFlex nodes. This can be a comma-separated list of values for the guest VLANs. For example, 10.193.211.124-127, 10.193.211.158-163</td>
</tr>
<tr>
<td>Subnet Mask</td>
<td>Set the subnet to the appropriate level to limit and control IP addresses. For example, 255.255.0.0.</td>
</tr>
<tr>
<td>Gateway</td>
<td>IP address. For example, 10.193.0.1.</td>
</tr>
</tbody>
</table>

### iSCSI Storage

**Note** This must be configured upfront if you want to use external storage at any point in the future.

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enable iSCSI Storage checkbox</td>
<td>Check to configure iSCSI storage.</td>
</tr>
<tr>
<td>VLAN A Name</td>
<td>Name of the VLAN associated with the iSCSI vNIC, on the primary fabric interconnect (FI-A).</td>
</tr>
<tr>
<td>VLAN A ID</td>
<td>ID of the VLAN associated with the iSCSI vNIC, on the primary fabric interconnect (FI-A).</td>
</tr>
<tr>
<td>Field</td>
<td>Description</td>
</tr>
<tr>
<td>----------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>VLAN B Name</td>
<td>Name of the VLAN associated with the iSCSI vNIC, on the subordinate fabric interconnect (FI-B).</td>
</tr>
<tr>
<td>VLAN B ID</td>
<td>ID of the VLAN associated with the iSCSI vNIC, on the subordinate fabric interconnect (FI-A).</td>
</tr>
<tr>
<td>FC Storage</td>
<td></td>
</tr>
<tr>
<td>Note</td>
<td>This must be configured upfront if you want to use external storage at any point in the future.</td>
</tr>
<tr>
<td>Enable FC Storage</td>
<td>Check to enable FC Storage.</td>
</tr>
<tr>
<td>WWxN Pool</td>
<td>A WWN pool that contains both WW node names and WW port names. For each fabric interconnect, a WWxN pool is created for WWPN and WWNN.</td>
</tr>
<tr>
<td>VSAN A Name</td>
<td>The name of the VSAN for the primary fabric interconnect (FI-A). By default, this is set to hx-ext-storage-fc-a.</td>
</tr>
<tr>
<td>VSAN A ID</td>
<td>The unique identifier assigned to the network for the primary fabric interconnect (FI-A).</td>
</tr>
<tr>
<td>Caution</td>
<td>Do not enter VSAN IDs that are currently used on the UCS or HyperFlex system. If you enter an existing VSAN ID in the installer which utilizes UCS zoning, zoning will be disabled in your existing environment for that VSAN ID.</td>
</tr>
<tr>
<td>VSAN B Name</td>
<td>The name of the VSAN for the subordinate fabric interconnect (FI-B). By default, this is set to hx-ext-storage-fc-b.</td>
</tr>
<tr>
<td>VSAN B ID</td>
<td>The unique identifier assigned to the network for the subordinate fabric interconnect (FI-B).</td>
</tr>
<tr>
<td>Caution</td>
<td>Do not enter VSAN IDs that are currently used on the UCS or HyperFlex system. If you enter an existing VSAN ID in the installer which utilizes UCS zoning, zoning will be disabled in your existing environment for that VSAN ID.</td>
</tr>
<tr>
<td>Advanced</td>
<td></td>
</tr>
<tr>
<td>UCS Firmware Version</td>
<td>Select the UCS firmware version to associate with the HX servers from the drop-down list. The UCS firmware version must match the UCSM version. See the latest Cisco HX Data Platform Release Notes for more details. For example, 3.2(1d).</td>
</tr>
</tbody>
</table>

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The name applied to a group of HX Servers in a given cluster. This is a user-defined name. The HyperFlex cluster name adds a label to service profiles for easier identification.

Org Name
Displays a unique Org Name of the cluster, that ensures isolation of the HyperFlex environment from the rest of the UCS domain.

Note
Review the VLAN, MAC pool, and IP address pool information in the Configuration pane. These VLAN IDs might be changed by your environment. By default, the Installer sets the VLANs as non-native. You must configure the upstream switches to accommodate the non-native VLANs by appropriately applying a trunk configuration.

Step 8
Click Continue. The Hypervisor Configuration page appears. Complete the following fields:

Attention  You can skip the completion of the fields described in this step in case of a reinstall, and if ESXi networking has been completed.

Configure Common Hypervisor Settings

Field | Description
--- | ---
Subnet Mask | Set the subnet mask to the appropriate level to limit and control IP addresses.
| For example, 255.255.0.0.
Gateway | IP address of gateway.
| For example, 10.193.0.1.
DNS Server(s) | IP address for the DNS Server.
| If you do not have a DNS server, do not enter a hostname in any of the fields on the Cluster Configuration page of the HX Data Platform installer. Use only static IP addresses and hostnames for all ESXi hosts.
| If you are providing more than one DNS server, check carefully to ensure that both DNS servers are correctly entered, separated by a comma.

Hypervisor Settings
Ensure to select Make IP Addresses and Hostnames Sequential, to make the IP addresses sequential.

Note  You can rearrange the servers using drag and drop.

Field | Description
--- | ---
Name | Server name.
Serial | Serial number of the server.
Static IP Address | Input static IP addresses and hostnames for all ESXi hosts.
Click **Continue**. The **IP Addresses** page appears. You can add more compute or converged servers, by clicking **Add Compute Server** or **Add Converged Server**.

Ensure to select **Make IP Addresses Sequential**, to make the IP addresses sequential. For the IP addresses, specify if the network should belong to Data Network or Management Network.

For each HX node, complete the following fields for Hypervisor Management and Data IP addresses.

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Management Hypervisor</strong></td>
<td>Enter the static IP address that handles the Hypervisor management network connection between the ESXi host and the storage cluster.</td>
</tr>
<tr>
<td><strong>Management Storage Controller</strong></td>
<td>Enter the static IP address that handles the HX Data Platform storage controller VM management network connection between the storage controller VM and the storage cluster.</td>
</tr>
<tr>
<td><strong>Data Hypervisor</strong></td>
<td>Enter the static IP address that handles the Hypervisor data network connection between the ESXi host and the storage cluster.</td>
</tr>
<tr>
<td><strong>Data Storage Controller</strong></td>
<td>Enter the static IP address that handles the HX Data Platform storage controller VM data network connection between the storage controller VM and the storage cluster.</td>
</tr>
</tbody>
</table>

When you enter IP addresses in the first row for Hypervisor (Management), Storage Controller VM (Management), Hypervisor (Data), and Storage Controller VM (Data) columns, the HX Data Platform Installer applies an incremental auto-fill to the node information for the rest of the nodes. The minimum number of nodes in the storage cluster is three. If you have more nodes, use the **Add** button to provide the address information.

**Note**  Compute-only nodes can be added only after the storage cluster is created.
<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controller VM Password</td>
<td>A default administrator username and password is applied to the controller VMs. The VMs are installed on all converged and compute-only nodes.</td>
</tr>
</tbody>
</table>
|                              | **Important**  
|                              | • You cannot change the name of the controller VM or the controller VM’s datastore.                                                                                                                                  |
|                              | • Use the same password for all controller VMs. The use of different passwords is not supported.                                                                                                                                                                           |
|                              | • Provide a complex password that includes 1 uppercase character, 1 digit, 1 special character, and a minimum of 10 characters in total.                                                                                                         |
|                              | • You can provide a user-defined password for the controller VMs and for the HX cluster to be created. For password character and format limitations, see the section on Guidelines for HX Data Platform Special Characters in the *Cisco HX Data Platform Management Guide*. |

**Advanced Configuration**

**Jumbo frames**

**Enable Jumbo Frames** checkbox

Check to set the MTU size for the storage data network on the host vSwitches and vNICs, and each storage controller VM.

The default value is 9000.

**Note** To set your MTU size to a value other than 9000, contact Cisco TAC.

**Disk Partitions**

**Clean up Disk Partitions** checkbox

Check to remove all existing data and partitions from all nodes added to the storage cluster. You must backup any data that should be retained.

**Important** Do not select this option for factory prepared systems. The disk partitions on factory prepared systems are properly configured. For manually prepared servers, select this option to delete existing data and partitions.

---

**Step 10** Click **Start**. A **Progress** page displays the progress of various configuration tasks.
If the vCenter cluster has EVC enabled, the deploy process fails with a message: The host needs to be manually added to vCenter. To successfully perform the deploy action, do the following:

- Log in to the ESXi host to be added in vSphere Client.
- Power off the controller VM.
- Add the host to the vCenter cluster in vSphere Web Client.
- In the HX Data Platform Installer, click Retry Deploy.

**Step 11**

When cluster expansion is complete, start managing your storage cluster by clicking **Launch HyperFlex Connect**.

**Note**

When you add a node to an existing storage cluster, the cluster continues to have the same HA resiliency as the original storage cluster until auto-rebalancing takes place at the scheduled time.

Rebalancing is typically scheduled during a 24-hour period, either 2 hours after a node fails or if the storage cluster is out of space.

If you need to rebalance the storage cluster before the scheduled time, initiate rebalance storage cluster command manually as shown below.

From a storage cluster controller VM command line, run the following commands:

a. 
   ```
   # stcli rebalance start --force
   ```
   b. To monitor rebalance status
   ```
   # stcli rebalance status
   ```

**Step 12**

After the new nodes are added to the storage cluster, HA services are reset so that HA is able to recognize the added nodes.

a) Log in to vSphere.

b) In the vSphere Web Client, navigate to Home > vCenter > Inventory Lists > Hosts and Clusters > vCenter > Server > Datacenter > Cluster > Host.

c) Select the new node.

d) Right-click and select **Reconfigure** for vSphere HA.

---

**Prerequisites for Adding a Compute-Only Node**

A compute-only node can be added to a HyperFlex cluster, after cluster creation. It is added to provide extra compute resources. The Cisco UCS server does not need to have any caching or persistent drives as they do not contribute any storage capacity to the cluster.

Before you start adding a compute-only node, make sure that the following prerequisites are met.

- Ensure that the storage cluster state is healthy.

- Ensure that the new node meets the compute-only system requirements listed in *Installation Prerequisites*, including network and disk requirements.

- Install ESXi hypervisor after service profile association.
• Ensure that the new node uses the same configuration as the other nodes in the storage cluster. This includes VLAN IDs and switch types (whether vSwitches), VLAN tagging with External Switch VLAN Tagging (EST), VLAN tagging with Virtual Switch Tagging (VST), or Virtual Distributed Switch.

**Note**

If the storage cluster is in an out of space condition, when you add a new node, the system automatically rebalances the storage cluster. This is in addition to the rebalancing that is performed every 24 hours.

• Enable EVC if the new node to be added has a different CPU family than what is already used in the HX cluster. For more details, see the *Setting up Clusters with Mixed CPUs* section in the *Cisco HyperFlex Systems Installation Guide for VMware ESXi*.

• Ensure that the software version on the node matches the Cisco HX Data Platform version, the ESXi version, and the vCenter version. To identify the software version, go to the *Storage Cluster Summary* tab in vCenter and check the *HX Data Platform version* in the top section. Upgrade if necessary.

• Ensure that the new node has at least one valid DNS and NTP server configured.

• If you are using SSO or Auto Support, ensure that the node is configured for SSO and SMTP services.

• ESXi installation is supported on SD cards for M4 converged nodes and M.2 SATA SSD for M5 converged nodes. For compute-only nodes, ESXi installation is supported for SD Cards, SAN boot, or front SSD/HDD. Installing ESXi on USB Flash is not supported for compute-only nodes.

**Note**

HW RAID M.2 (UCS-M2-HWRAID and HX-M2-HWRAID) is not supported on Compute-only nodes.

**Preparing a Compute-Only Node**

**Step 1**

Ensure that the server is a supported HX server and meets the requirements. For more details, see the *Host Requirements* section in the *Cisco HyperFlex Systems Installation Guide for VMware ESXi*.

**Step 2**

Log in to Cisco UCS Manager.

a) Open a browser and enter the Cisco UCS Manager address for the fabric interconnect of the storage cluster network.
b) Click the *Launch UCS Manager* button.
c) If prompted, download, install, and accept Java.
d) Log in with administrator credentials.

**Username:** admin

**Password:** <admin password>

**Step 3**

Locate the server to ensure that the server has been added to the same FI domain as the storage cluster and is an approved compute-only model. Check the latest *Release Notes for Cisco HX Data Platform* for a full list of compatible Compute-only nodes.
Verify the HX Data Platform Installer

**Step 1** Verify that the HX Data Platform installer is installed on a node that can communicate with all the nodes in the storage cluster and compute nodes that are being added to the storage cluster.

**Step 2** If the HX Data Platform installer is not installed, see Deploy the HX Data Platform Installer.

Apply an HX Profile on a Compute-only Node Using UCS Manager

In Cisco UCS Manager the network policies are grouped into an HX profile. The HX installer handles automatic service profile association for compute-only nodes. Manual association is not required.

Once install beings, you should monitor compute-only node service profile association in UCS Manager. Wait until the server is fully associated before continuing on to install ESXi.

Install VMware ESXi on Compute Nodes

**Important**

Install VMware ESXi on each compute-only node.

Install a Cisco HX Data Platform supported version of ESXi. See the Cisco HyperFlex Data Platform Release Notes for a list of supported ESXi versions.

If the compute only node already has ESXi installed, it must be re-imaged with the Cisco HX Custom image.

**Before you begin**

Ensure the required hardware and network settings are met. For more details, see the Installation Prerequisites section in the Cisco HyperFlex Systems Installation Guide for VMware ESXi. Ensure the service profiles in the previous step have finished associating.

**Step 1** Download the HX Custom Image for ESXi from the Cisco.com download site for Cisco HyperFlex. See Download Software.

Select a networked location that can be accessed through Cisco UCS Manager.

**Step 2** Log in to Cisco UCS Manager.

**Step 3** Log in to the KVM console of the server through Cisco UCS Manager.

a) In the Navigation Pane, click Servers > Service Profiles > Sub-Ogranizations > hx-cluster.

b) Right click the hx-cluster and choose KVM Console.

**Step 4** Copy the HX-Vmware.iso image to the KVM path for the compute server.

**Example:**
Step 5  From the KVM console session, select Virtual Media > Map CD/DVD and mount the HX Custom Image for ESXi image. If you do not see the Map CD/DVD option, first activate virtual devices.
   a) Select Virtual Media > Activate Virtual Devices.
      This opens in a pop-up window.
   b) Click Accept the session > Apply.

Step 6  From the Map CD/DVD option, map to the location of the HX-Vmware.iso file.
   a) Select the HX-Vmware.iso file.
   b) Select Map Device.
      There is a check mark indicating that the file is on a mapped location, once the process is complete. The mapped file's full name includes the ESXi build ID.

Step 7  Reset the compute server.
   a) Click the Reset button on the KVM console. Click OK to confirm.
   b) Select Power Cycle. Click OK.

Step 8  Change the boot path to point to the HX-Vmware.iso file.
   a) Press F6.
   b) From the Enter boot selection menu, use the arrow keys to highlight the Cisco vKVM-Mapped vDVD1.22 option.
   c) Press Enter to select.
      This launches the ESXi installer bootloader. Select one of the three compute-only node options based on desired boot type: SD Card, Local Disk, or Remote Disk. Type in yes (all lowercase) to confirm selection. The rest of the installation is automated. ESXi will reboot several times. It is normal to see warnings that automatically dismiss after a short wait period. Wait for the ESXi DCUI to fully appear, signaling the end of installation.

Step 9  Repeat steps 3 to 8 for each Cisco HyperFlex server.

Step 10  Once ESXi is fully installed, click continue. Then click Retry Hypervisor Configuration to complete the rest of the cluster expansion.

---

Adding a Compute-Only Node to an Existing Cluster

To add a HyperFlex compute-only node to an existing HyperFlex system cluster, complete the following steps.

---

**Note**  If you are using RESTful APIs to perform cluster expansion, sometimes the task may take longer than expected.

---

**Note**  After you add a compute-only node to an existing cluster, you must manually configure the vmk2 interface for vmotion.
**Step 1** Launch the Cisco HX Data Platform Installer.

a) In your web browser, enter the IP address or the node name for the HX Data Platform Installer VM. Click **Accept** or **Continue** to bypass any SSL certificate errors. The Cisco HX Data Platform Installer login page appears. Verify the HX Data Platform Installer **Build ID** in the lower right corner of the login screen.

b) In the login page, enter the following credentials:

   - **Username**: root
   - **Password** (Default): Cisco123

   **Note** Systems ship with a default password of Cisco123 that must be changed during installation. You cannot continue installation unless you specify a new user supplied password.

c) Read the EULA, check the **I accept the terms and conditions** checkbox, and click **Login**.

**Step 2** On the **Workflow** page, select **Cluster Expansion**.

**Step 3** On the **Credentials** page, complete the following fields.

To perform cluster creation, you can import a **JSON configuration** file with the required configuration data. The following two steps are optional if importing a JSON file, otherwise you can input data into the required fields manually.

**Note** For a first-time installation, contact your Cisco representative to procure the factory preinstallation JSON file.

a. Click **Select a file** and choose your **JSON file** to load the configuration. Select **Use Configuration**.

b. An **Overwrite Imported Values** dialog box displays if your imported values for Cisco UCS Manager are different. Select **Use Discovered Values**.

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UCS Manager Credentials</strong></td>
<td></td>
</tr>
<tr>
<td>UCS Manager Host Name</td>
<td>UCS Manager FQDN or IP address.</td>
</tr>
<tr>
<td></td>
<td>For example, 10.193.211.120.</td>
</tr>
<tr>
<td>User Name</td>
<td>&lt;admin&gt; username.</td>
</tr>
<tr>
<td>Password</td>
<td>&lt;admin&gt; password.</td>
</tr>
<tr>
<td><strong>vCenter Credentials</strong></td>
<td></td>
</tr>
</tbody>
</table>
## Adding a Compute-Only Node to an Existing Cluster

### Field

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>vCenter Server</td>
<td>vCenter server FQDN or IP address.</td>
</tr>
<tr>
<td></td>
<td>For example, 10.193.211.120.</td>
</tr>
<tr>
<td><strong>Note</strong></td>
<td>• A vCenter server is required before the</td>
</tr>
<tr>
<td></td>
<td>cluster can be made operational.</td>
</tr>
<tr>
<td></td>
<td>• The vCenter address and credentials must</td>
</tr>
<tr>
<td></td>
<td>have root level administrator permissions to</td>
</tr>
<tr>
<td></td>
<td>the vCenter.</td>
</tr>
<tr>
<td></td>
<td>• vCenter server input is optional if you are</td>
</tr>
<tr>
<td></td>
<td>building a nested vCenter. See the Nested</td>
</tr>
<tr>
<td></td>
<td>vCenter TechNote for more details.</td>
</tr>
</tbody>
</table>

| User Name              | <admin> username.                                 |
|                        | For example, administrator@vsphere.local.         |

| Admin Password         | <root> password.                                  |

### Hypervisor Credentials

| Admin User Name        | <admin> username.                                  |
|                        | This is root for factory nodes.                   |

| Admin Password         | <root> password.                                  |

- Default password is Cisco123 for factory nodes.

**Note** Systems ship with a default password of Cisco123 that must be changed during installation. You cannot continue installation unless you specify a new user supplied password.

### Step 4

Click Continue. A Cluster Expand Configuration page is displayed. Select the HX Cluster that you want to expand.

If the HX cluster to be expanded is not found, or if loading the cluster takes time, enter the IP of the Cluster Management Address in the Management IP Address field.

### Step 5

Click Continue. A Server Selection page is displayed. On the Server Selection page, the Associated tab lists all the HX servers that are already connected. Do not select them. On the Unassociated tab, select the servers you wish to add to the cluster.

### Step 6

Click Continue. A UCS Manager Configuration page is displayed.

**Note**

- If you imported a JSON file at the beginning, the fields should be populated with the required configuration data from the pre-existing HX cluster. If the server to add into the cluster is not associated, select them and click Continue.

- This information must match your existing cluster configuration. Ensure that you use the proper settings on this page.
Enter the following information for each network:

<table>
<thead>
<tr>
<th>Field</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VLAN for ESXi and HyperFlex management</strong></td>
<td></td>
</tr>
<tr>
<td>VLAN Name</td>
<td>Name: hx-inband-mgmt</td>
</tr>
<tr>
<td>VLAN ID</td>
<td>Default VLAN ID: 3091</td>
</tr>
<tr>
<td><strong>VLAN for HyperFlex Storage traffic</strong></td>
<td></td>
</tr>
<tr>
<td>VLAN Name</td>
<td>Name: hx-storage-data</td>
</tr>
<tr>
<td>VLAN ID</td>
<td>Default VLAN ID: 3092</td>
</tr>
<tr>
<td><strong>VLAN for VM vMotion</strong></td>
<td></td>
</tr>
<tr>
<td>VLAN Name</td>
<td>Name: hx-vmotion</td>
</tr>
<tr>
<td>VLAN ID</td>
<td>Default VLAN ID: 3093</td>
</tr>
<tr>
<td><strong>VLAN for VM Network</strong></td>
<td></td>
</tr>
<tr>
<td>VLAN Name</td>
<td>Name: hx-vm-network</td>
</tr>
<tr>
<td>VLAN ID</td>
<td>Default VLAN ID: 3094</td>
</tr>
<tr>
<td><strong>MAC Pool</strong></td>
<td></td>
</tr>
<tr>
<td>MAC Pool Prefix</td>
<td>For example, 00:25:B5:99 (99 is default and can be set as per the user environment).</td>
</tr>
<tr>
<td><strong>hx-ext-mgmt IP Pool for Out-of-Band CIMC</strong></td>
<td></td>
</tr>
<tr>
<td>IP Blocks</td>
<td>The range of IP addresses designated for the HyperFlex nodes. This can be a comma-separated list of values for the guest VLANs. For example, 10.193.211.124-127, 10.193.211.158-163, 255.255.255.0. Enter IP address of gateway. For example, 10.193.0.1.</td>
</tr>
<tr>
<td>Subnet</td>
<td>Set the subnet to the appropriate level to limit and control IP addresses. For example, 255.255.0.0.</td>
</tr>
<tr>
<td>Default gateway</td>
<td>IP address.</td>
</tr>
<tr>
<td></td>
<td>For example, 10.193.0.1.</td>
</tr>
<tr>
<td>Advanced</td>
<td></td>
</tr>
</tbody>
</table>
InformationField

Select the UCS firmware version to associate with the HX servers from the drop-down list. The UCS firmware version must match the UCSM version. See the latest Cisco HX Data Platform Release Notes for more details.

For example, 3.2(1d).

HyperFlex Cluster Name

The name applied to a group of HX Servers in a given cluster. This is a user-defined name. The HyperFlex cluster name adds a label to service profiles for easier identification.

Note

Review the VLAN, MAC pool, and IP address pool information in the Configuration pane. These VLAN IDs might be changed by your environment. By default, the Installer sets the VLANs as non-native. You must configure the upstream switches to accommodate the non-native VLANs by appropriately applying a trunk configuration.

Step 7

Click Continue. The Hypervisor Configuration page appears. Complete the following fields:

Attention

You can skip the completion of the fields described in this step in case of a reinstall, and if ESXi networking has been completed.

Field

Configure Common Hypervisor Settings

Subnet Mask

Set the subnet mask to the appropriate level to limit and control IP addresses.

For example, 255.255.0.0.

Gateway

IP address of gateway.

For example, 10.193.0.1.

DNS Server(s)

IP address for the DNS Server.

If you do not have a DNS server, do not enter a hostname in any of the fields on the Cluster Configuration page of the HX Data Platform installer. Use only static IP addresses and hostnames for all ESXi hosts.

Note

If you are providing more than one DNS server, check carefully to ensure that both DNS servers are correctly entered, separated by a comma.

Hypervisor Settings

Ensure to select Make IP Addresses and Hostnames Sequential, to make the IP addresses sequential.

Note

You can rearrange the servers using drag and drop.

Name

Server name.
<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial</td>
<td>Serial number of the server.</td>
</tr>
<tr>
<td>Static IP Address</td>
<td>Input static IP addresses and hostnames for all ESXi hosts.</td>
</tr>
<tr>
<td>Hostname</td>
<td>Do not leave the hostname fields empty.</td>
</tr>
</tbody>
</table>

**Step 8**

Click **Continue**. An **IP Addresses** page is displayed. Click **Add Compute-only Node** to add a new node. If you are adding more than one compute-only node, select **Make IP Addresses Sequential**.

<table>
<thead>
<tr>
<th>Field</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management Hypervisor</td>
<td>Enter the static IP address that handles the Hypervisor management network connection between the ESXi host and storage cluster.</td>
</tr>
<tr>
<td>Management Storage Controller</td>
<td>None.</td>
</tr>
<tr>
<td>Data Hypervisor</td>
<td>Enter the static IP address that handles the Hypervisor data network connection between the ESXi host and the storage cluster.</td>
</tr>
<tr>
<td>Data Storage Controller</td>
<td>None.</td>
</tr>
</tbody>
</table>
| Controller VM                | Enter the default Admin username and password that were applied to controller VMs when they were installed on the existing HX Cluster.  
**Note** The name of the controller VM cannot be changed. Use the existing cluster password. |

**Step 9**

Click **Start**. A **Progress** page displays the progress of various configuration tasks.

**Note** By default no user intervention is required if you are booting from FlexFlash (SD Card). However, if you are setting up your compute-only node to boot from a local disk, complete the following steps in Cisco UCS Manager:

- a. Click the service profile created by the HX Data Platform Installer. For example, `blade-1(HX_Cluster_Name).
- b. On the **General** tab, click **Unbind from the Template**.
- c. In the working pane, click the **Storage** tab. Click the **Local Disk Configuration Policy** sub tab.
- d. In the Actions area, select **Change Local Disk Configuration Policy > Create Local Disk Configuration Policy**.
- e. Under **Create Local Disk Configuration Policy**, enter a name for the policy, and keep the rest as default. Click **Ok**.
- f. In the **Change Local Disk Configuration Policy** Actions area, select the newly created local disk configuration policy from the drop-down list. Click **Ok**.
g. Now, go back to the HX Data Platform Installer UI and click **Continue**, and then click **Retry UCSM**.

Compute Node Expansion - ESXi Installation Required

ESXi must be installed on all nodes being added at this point using the HX ESXi ISO on cisco.com.

Using an existing installation of ESXi will cause installation to fail. Other ESXi ISOs other than the one posted on Cisco are not supported.

Once ESXi is installed, select **Continue** and then **Retry** to continue installation.

Full instructions can be found below.

If ESXi is already installed using the HX ESXi ISO wait for it to boot and then select **Continue** and **Retry** to continue installation.

- Instructions
- Launch UCS Manager

**Configuration.**

**Note** If the vCenter cluster has EVC enabled, the deploy process fails. The host needs to be manually added to vCenter. To successfully perform the deploy action, do the following:

a) Log in to the ESXi host to be added in vSphere Client.
b) Power off the controller VM.
c) Add the host to the vCenter cluster in vSphere Web Client.
d) In the HX installer, click **Retry Deploy**.

**Step 10** When installation is complete, start managing your storage cluster by clicking **Launch HyperFlex Connect**.

**Step 11** After the new nodes are added to the storage cluster, HA services are reset so that HA is able to recognize the added nodes.

a) Log on to VMware vSphere Client.
b) Select Home > Hosts and Clusters > Datacenter > Cluster > Host.
c) Select the new node.
d) Right-click and select **Reconfigure for vSphere HA**.

**Step 12** After adding compute-only nodes to an existing cluster, you must manually configure the vmk2 interface for vmotion.

---

**Resolving Failure of Cluster Expansion**

If you receive an error dialog box and the storage cluster expansion doesn't complete, proceed with the resolution options listed below:

**Step 1** **Edit Configuration** - Returns you to the Cluster Configuration page. You fix the issues listed in the validation page.
### Step 2
**Start Over** - Allows you to reverse the settings you applied by clearing progress table entries and you are returned to the Cluster Configuration page to restart a new deployment. See Technical Assistance Center (TAC).

### Step 3
**Continue** - Adds the node to the storage cluster in spite of the failure generating errors. See Technical Assistance Center (TAC).

**Note**
Select the Continue button only if you understand the failures and are willing to accept the possibility of unpredictable behavior.

For more information about cleaning up a node for the purposes of redeploying HyperFlex, see the HyperFlex Customer Cleanup Guides for FI and Edge.

---

### Enabling Logical Availability Zones

Once you have successfully configured your HyperFlex cluster, refer to the commands below to enable or disable Logical Availability Zones (LAZ).

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>stcli cluster get-zone</td>
<td>Checks if zones are enabled.</td>
</tr>
<tr>
<td>stcli cluster set-zone --zone 0</td>
<td>Disables zones.</td>
</tr>
<tr>
<td>stcli cluster set-zone --zone 1</td>
<td><em>(Recommended)</em> Enables and creates zones (default number of zones)*</td>
</tr>
<tr>
<td>stcli rebalance start</td>
<td></td>
</tr>
</tbody>
</table>

**Important**

- Please be advised to wait for at least 10 seconds between successive invocations of LAZ disable and, LAZ enable operations in that order.
- In case of fresh cluster installation, for best results, it is recommended that LAZ is enabled during cluster creation.

**Important**

- A cluster created without zoning enabled, will become zone compliant only after enabling zoning and successful completion of rebalance.
- You must execute the `rebalance start` command after you enable and create zones.
- Triggering rebalance activity may involve large scale data movements across several nodes in the cluster which may decrease the IO performance in the cluster.
### Command

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>stcli cluster set-zone</td>
<td>Enables zones and creates a specific number of zones.</td>
</tr>
<tr>
<td>--zone 1 --numzones</td>
<td>Important You must execute the rebalance start command after you enable and create zones.</td>
</tr>
<tr>
<td>integer-value</td>
<td></td>
</tr>
<tr>
<td>stcli rebalance start</td>
<td></td>
</tr>
</tbody>
</table>

### Requirements and Limitations for Logical Availability Zones

Logical Availability Zones (LAZ) are subject to the following requirements and limitations:

- Only HyperFlex clusters with 8 nodes or more can be configured with Logical Availability Zones during the installation process.

- Logical Availability Zones can be enabled during the HyperFlex cluster installation, or it can be enabled using the command line interface at a later time. It is recommended to enable this feature during installation, in order to avoid a large migration and reorganization of data across the cluster, which would be necessary to comply with the data distribution rules if LAZ is turned on in a cluster already containing data.

- The number of zones can be manually specified as 3, 4, 5, or you can allow the installer to automatically choose, which is the recommended setting. When you let the installer decide the number of zones, the number of zones is decided based on the number of nodes in the cluster.

Here is a mapping table of number of nodes and resultant number of zones, with the assumption of RF as 3:

<table>
<thead>
<tr>
<th>No. of Hyperconverged Nodes in the cluster</th>
<th>No. of Zones in the cluster</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>13</td>
<td>3</td>
</tr>
<tr>
<td>14</td>
<td>7</td>
</tr>
<tr>
<td>15</td>
<td>3</td>
</tr>
<tr>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td>17</td>
<td>3</td>
</tr>
<tr>
<td>18</td>
<td>3</td>
</tr>
<tr>
<td>19</td>
<td>3</td>
</tr>
<tr>
<td>20</td>
<td>4</td>
</tr>
</tbody>
</table>
You can view the LAZ status and check which node is in which zone, by accessing **HyperFlex Connect > System information** and **HyperFlex Connect > Dashboard** respectively.

Also, you can view the LAZ details through CLI by running the following command:

```
stcli cluster get-zone
```

```
zones:
  ------------------------------
pNodes:
  ------------------------------
  state: ready
  name: 10.10.18.61
  state: ready
  name: 10.10.18.59
  zoneId: 0000000057eebaab:000000000000000003
  numNodes: 2
  ------------------------------
pNodes:
  state: ready
  name: 10.10.18.60
  state: ready
  name: 10.10.18.65
  zoneId: 0000000057eebaab:000000000000000001
  numNodes: 2
  ------------------------------
pNodes:
  state: ready
  name: 10.10.18.60
  ```

---

<table>
<thead>
<tr>
<th>No. of Hyperconverged Nodes in the cluster</th>
<th>No. of Zones in the cluster</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>3</td>
</tr>
<tr>
<td>22</td>
<td>11</td>
</tr>
<tr>
<td>23</td>
<td>3</td>
</tr>
<tr>
<td>24</td>
<td>3</td>
</tr>
<tr>
<td>25</td>
<td>5</td>
</tr>
<tr>
<td>26</td>
<td>13</td>
</tr>
<tr>
<td>27</td>
<td>3</td>
</tr>
<tr>
<td>28</td>
<td>4</td>
</tr>
<tr>
<td>29</td>
<td>3</td>
</tr>
<tr>
<td>30</td>
<td>3</td>
</tr>
<tr>
<td>31</td>
<td>3</td>
</tr>
<tr>
<td>32</td>
<td>4</td>
</tr>
</tbody>
</table>
Expanding Cluster with Nodes Lesser than Zones

There are several requirements and guidelines to configuring Logical Availability Zones (LAZ) in a cluster. See Requirements and Limitations for Logical Availability Zones, on page 148. If you choose to ignore these requirements, you can expand the cluster with the following procedure.

**Step 1**
Disable LAZ.

```
stcli cluster --set-zone 0
```

You must wait for a few minutes, roughly around 5 minutes for LAZ to be disabled.

**Step 2**
Add nodes to the cluster.

**Step 3**
After the nodes are added to the cluster, enable LAZ.

```
stcli cluster set-zone --zone 1
```

If the number of zones are not set explicitly, by default 4 zones are created.
Step 4  Initiate rebalancing in the cluster.

```
estcli rebalance start
```

**Note**
- Rebalancing of nodes may decrease the performance of the cluster by about 30% to 40%.
- The time taken to rebalance the nodes in the cluster depends on the cluster size and the data within the cluster. You can use the `stcli rebalance status` command to review the progress of the rebalancing activity.

Step 5  Review the cluster configuration and determine if the cluster is zone compliant.

```
estcli cluster --get-zone
```
Managing HX Controller VMs

Managing Storage Controller VMs

Storage controller VMs provide critical functionality for the Cisco HX Distributed Data Platform. A storage controller VM is installed on every converged node in the storage cluster. The storage controller VMs provide a command line interface for running stcli commands on the storage cluster.

Powering On or Off Storage Controller VMs

You can power on or off VMs through the vSphere Web Client or through the ESX command line. This also applies to storage controller VMs, though generally the storage cluster operations handle powering on or off the storage controller VMs.

Step 1 Using the vSphere Web Client to power on or off a VM.
   a) Login to the vSphere Web Client.
   b) Locate the VM.
      From the Navigator select, Global Inventory Lists > Virtual Machines > vm.
      Storage controller VMs, have the prefix, stCtlVM.
   c) From the right-click or Actions menu select, Power > Power On or Power > Power Off.

Step 2 Using the ESX command line to power on or off a VM.
   a) Login to the command line for the ESX host for a VM.
   b) Locate the VM vmid.
      This is specific to the ESX host. Run the command.
      # vim-cmd vmsvc/getallvms
      Sample response
Storage controller VMs, have the prefix, stCtlVM.

c) To power on a VM. Run the command specifying the VM to power on.

```
# vim-cmd vmsvc/power.on 1
```

d) To power off a VM. Run the command specifying the VM to power off.

```
# vim-cmd vmsvc/power.off 1
```

---

**Disabling HA VM Monitoring in HX Controller VMs**

To avoid All Paths Down (APD) state in an HX cluster, use the vSphere Web Client to disable HA VM Monitoring for all the HX Controller VMs.

**Step 1**
Login to the vSphere Web Client.

**Step 2**
Select the HX cluster that you want to modify.

**Step 3**
Select **Configure > VM Overrides** from the menu.

**Step 4**
Click **Add**.

*Add VM Override Sandbox* window is displayed along with the list of VMs in vCenter.

**Step 5**
Select all the available HX Controller VMs in the window.

*Note* The HX Controller VM names begin with stCtlVM-

**Step 6**
Click **Next**.

*Add VM Override* dialog box is displayed.

**Step 7**
Locate the **vSphere HA - VM Monitoring** option and select the following:

- **Override** checkbox
- **Disabled** from the drop-down list

**Step 8**
Click **Finish** to apply the configuration changes.

HA VM Monitoring is disabled for all the HX controller VMs.
Managing Ready Clones

- HX Data Platform Ready Clones Overview, on page 155
- Benefits of HX Data Platform Ready Clones, on page 155
- Supported Base VMs, on page 156
- Ready Clone Requirements, on page 156
- Ready Clone Best Practices, on page 157
- Creating Ready Clones Using HX Connect, on page 157
- Creating Ready Clones Using the HX Data Platform Plug-In, on page 158
- Prepare to Customize HX Data Platform Ready Clones, on page 160
- Configuring Ready Clones Using Customized Specifications, on page 161
- Managing Virtual Machine Networking, on page 162

HX Data Platform Ready Clones Overview

HX Data Platform Ready Clones is a pioneer storage technology that enables you to rapidly create and customize multiple cloned VMs from a host VM. It enables you to create multiple copies of VMs that can then be used as standalone VMs.

A Ready Clone, similar to a standard clone, is a copy of an existing VM. The existing VM is called the host VM. When the cloning operation is complete, the Ready Clone is a separate guest VM.

Changes made to a Ready Clone do not affect the host VM. A Ready Clone's MAC address and UUID are different from that of the host VM.

Installing a guest operating system and applications can be time consuming. With Ready Clone, you can make many copies of a VM from a single installation and configuration process.

Clones are useful when you deploy many identical VMs to a group.

Benefits of HX Data Platform Ready Clones

HX Data Platform Ready Clones provide the following benefits:

- **Create multiple clones of a VM at a time** - Simply right-click a VM and create multiple clones of the VM using the Ready Clones feature.
• **Rapid cloning** - HX Data Platform Ready Clones are extremely fast and more efficient than legacy cloning operations because they support VMware vSphere® Storage APIs – Array Integration (VAAI) data offloads. VAAI also called hardware acceleration or hardware offload APIs, are a set of APIs to enable communication between VMware vSphere ESXi hosts and storage devices. Use HX Data Platform Ready Clones to clone VMs in seconds instead of minutes.

• **Batch customization of guest VMs** - Use the HX Data Platform Customization Specification to instantly configure parameters such as IP address, host name, VM name for multiple guest VMs cloned from a host VM.

• **Automation of several steps to a one-click process** - The HX Data Platform Ready Clones feature automates the task to create each guest VM.

• **VDI deployment support** - Ready Clones are supported for desktop VMs on VDI deployments which are using VMware native technology.

• **Datastore access** - Ready Clone work on partially mounted/accessible datastores as long as the VM being cloned is on an accessible mountpoint.

### Supported Base VMs

HX Data Platform supports:

- Base VMs stored on a HX Data Platform datastore
- Base VMs with HX Data Platform Snapshots
- Maximum 2048 Ready Clones from one base VM
- Maximum 256 Ready Clones created in one batch at a time.

HX Data Platform does not support:

- Powered on base VMs with Win2008 and Win2012 server guest
- Powered on base VMs with > 30 snapshots
- Powered on base VMs with Redo log snapshots

### Ready Clone Requirements

- VMs must be within the HX Data Platform storage cluster. Non-HX Data Platform VMs are not supported.
- VMs must reside on a HX Data Platform datastore, VM folder, and resource pool.

  Ready Clones fail for any VM that is not on a HX Data Platform datastore. This applies to Ready Clones on a VM level, VM folder level, or resource pool level.

- VMs can have only native snapshots. Ready Clones cannot be created from VMs with snapshots that have redo logs, (non-native snapshots).
- SSH must be enabled in ESX on all the nodes in the storage cluster.
- Use only the single vNIC customization template for Ready Clones.
Ready Clone Best Practices

- Use the customization specification as a profile or a template.
- Ensure that properties that apply to the entire batch are in the customization specification.
- Obtain user-defined parameters from the HX Data Platform Ready Clone batch cloning work flow.
- Use patterns to derive per-clone identity settings such as the VM guest name.
- Ensure that the network administrator assigns static IP addresses for guest names and verify these addresses before cloning.
- You can create a batch of 1 through 256 at a given time. The HX Data Platform plug-in enables you to verify this.
- Do not create multiple batches of clones simultaneously on the same VM (when it is powered on or powered off) because it causes failures or displays incorrect information on the master task updates in the HX Data Platform plug-in.

Creating Ready Clones Using HX Connect

Use HX Data Platform Ready Clones feature to populate your cluster by creating multiple clones of a VM, each with different static IP addresses.

If you click Ready Clones to clone a VM when the OVA deployment of that VM is in progress, you will get an error message. You can clone a VM only after the successful VM deployment.

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Log into HX Connect as an administrator.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 2</td>
<td>From Virtual Machines page, select a virtual machine, then click Ready Clones.</td>
</tr>
<tr>
<td>Step 3</td>
<td>Complete the Ready Clone dialog fields.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of clones</td>
<td>Enter the number of Ready Clones that you want to create. You can create a batch of 1 through 256 clones at a given time.</td>
</tr>
<tr>
<td>Customization Specification</td>
<td>Optional field. Click the drop-down list and select a Customization Specification for the clone from the drop-down list (which includes the customization specifications available in vCenter). The system filters the customization specifications for the selected host virtual machine. For example, if the selected host virtual machine uses Windows OS for guest virtual machines, the drop-down list displays Windows OS customization specifications.</td>
</tr>
</tbody>
</table>
Creating Ready Clones Using the HX Data Platform Plug-In

If you use the VMware cloning operation, you can create only a single clone from a VM. This operation is manual and slower than batch processing multiple clones from a VM. For example, to create 20 clones of a VM, you must manually perform the clone operation over and over again.

Note
Use HX Data Platform Ready Clones to create multiple clones of a VM in one click!
For example, you can create ten different clones with different static IP addresses from a Windows VM.

### Step 1
From the vSphere Web Client Navigator, select **Global Inventory Lists > Virtual Machines**. This displays the list of VMs in vCenter.

### Step 2
Select the VM to clone, and open the **Actions** menu. Either right-click the VM or click the **Actions** menu in the VM information portlet.

If needed, view the list of clusters and associated VMs to verify the VM is a storage cluster VM.

### Step 3
Select **Cisco HX Data Platform > Ready Clones** to display the Ready Clones dialog box.

### Step 4
Specify the following information in the Ready Clones dialog box:

<table>
<thead>
<tr>
<th>Control</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of clones</td>
<td>Type the number of clones that you want to create. You can create a batch of 1 through 256 clones at a given time.</td>
</tr>
<tr>
<td>Customization Specification</td>
<td>Click the drop-down list and select a Customization Specification for the clone from the drop-down list (which includes the customization specifications available in vCenter). The system filters the customization specifications for the selected host VM. For example, if the selected host VM uses Windows OS for guest VMs, the drop-down list displays Windows OS customization specifications.</td>
</tr>
<tr>
<td>VM name prefix</td>
<td>Type a prefix for the guest VM name.</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong> The VM Name Prefix which is used to name a Ready Clone, must contain only letters, numbers, and the hyphen (-) character. The name must start with a letter and cannot contain only digits or hyphen.</td>
</tr>
<tr>
<td>Starting clone number</td>
<td>Type a clone number for the starting clone.</td>
</tr>
<tr>
<td>Use same name for 'Guest Name'</td>
<td>Select this check box to use the vCenter VM inventory name as the guest host VM name. If you uncheck this box, a text box is displayed. Enter the name you want to use for the guest host VM name. The system displays the guest VM names in the Guest Name column in the dialog box. There is a similar option in the Customization Specification option itself. This HX Data Platform Ready Clone batch customization process overrides the option that you specify in the Customization Specification option.</td>
</tr>
<tr>
<td>Increment clone number by</td>
<td>Type a value using which the clone number in the guest VM name must be increased, or leave the default value 1 as is. The system appends a number to the names of the VM clones (such as clone1, clone2, and clone3). By default, the number starts from 1. You can change this value to any number.</td>
</tr>
</tbody>
</table>
### Prepare to Customize HX Data Platform Ready Clones

- Create a customization specification per the VMware documentation.

  Apply the customization settings described in the following topics specific to either Linux or Windows VMs.

  - Obtain the IP addresses from the administrator. For example, ten IP addresses 10.64.1.0 through 10.64.1.9.
  - Gather information specific to your network such as the subnet mask for these IP addresses.
  - Ensure that the base VM is valid (not disconnected, undergoing snapshots, or vMotion).
  - Ensure that Guest Tools is installed on the base VM. Update it if necessary.
  - Go to the VM Summary tab and verify that Guest Tools is working.

### Creating a Customization Specification for Linux in the vSphere Web Client

Use the vSphere Web Client Guest Customization wizard to save guest operating system settings in a specification that you can apply when cloning virtual machines or deploying from templates.

Complete the wizard with the following considerations.

- You can use the HX Data Platform Ready Clones feature to overwrite the guest name that you specify in when you create the customization specification.
- HX Data Platform Ready Clones enable you to use patterns in the VM name or guest name.
- HX Data Platform supports only one NIC.
- Editing the NIC of a Customized Linux VM
  - You can use a fake IP address because the HX Data Platform Ready Clone customization process overwrites this address.

<table>
<thead>
<tr>
<th>Control</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power on VMs after cloning</td>
<td>Select this check box to turn the guest VMs on after the cloning process completes.</td>
</tr>
</tbody>
</table>
- HX Data Platform Ready Clones resolve VM guest names to static IP addresses and sets them for the cloned VMs.

The customization specification you created is listed in the Customization Specification Manager. You can use it to customize virtual machine guest operating systems.

**Create a Customization Specification for Windows in the vSphere Web Client**

Use the vSphere Web Client Guest Customization wizard to save Windows guest operating system settings in a specification that you can apply when cloning virtual machines or deploying from templates.

**Note**

The default administrator password is not preserved for Windows Server 2008 after customization. During customization, the Windows Sysprep utility deletes and recreates the administrator account on Windows Server 2008. You must reset the administrator password when the virtual machine boots the first time after customization.

Complete the wizard with the following considerations:

- The operating system uses this name to identify itself on the network. On Linux systems, it is called the host name.

- HX Data Platform supports only one NIC.

- Editing the NIC of a Customized Windows VM

  You can use a fake IP address because the HX Data Platform Ready Clone customization process overwrites it.

The customization specification you created is listed in the Customization Specification Manager. You can use it to customize virtual machine guest operating systems.

**Configuring Ready Clones Using Customized Specifications**

Use a customized specification to ensure IP addresses are applied correctly to the new VMs if you use static IP addresses.

For example, if you create a Windows server VM clone and you use DHCP, the guest VMs are automatically assigned new IP addresses. But, if you use static IP addresses, the IP address is not automatically replicated in the guest VM. To resolve this, configure HX Data Platform Ready Clones using a Customization Specification.

**Step 1**

Obtain the valid DNS names and ensure that they resolve to valid IP addresses.

For example, to provision a batch of 100 Windows VMs where the guest name is userwinvm1 to userwinvm100, check that userwinvm1 through userwinvm100 are valid IP addresses.

**Step 2**

Install Guest VM tools on the source VM.

**Step 3**

Clone the source VM using the Ready Clones feature. The cloned guest VMs obtain the identity of the source VM.
Step 4 Use the Customization Specification to change the identity of all cloned VMs. You can configure parameters such as IP address, host name, and VM name.

Managing Virtual Machine Networking

After you have made changes to your storage cluster, you can ensure that the networking for the virtual machines on the nodes in the clusters is configured correctly. See the UCS Manager documentation for complete virtual machine networking information.

Step 1 Verify the VLANs are configured correctly.

Step 2 Verify the vNICs are configured correctly.

Step 3 Verify the Virtual Port Groups are configured correctly.
Managing Native Snapshots

• HX Data Platform Native Snapshots Overview, on page 163
• Benefits of HX Data Platform Native Snapshots, on page 163
• Native Snapshot Considerations, on page 164
• Native Snapshot Best Practices, on page 167
• Understanding SENTINEL Snapshots, on page 167
• Native Snapshot Timezones, on page 168
• Creating Snapshots, on page 169
• Scheduling Snapshots Overview, on page 169
• Scheduling Snapshots, on page 170
• Setting the Frequency of Scheduled Snapshots, on page 171
• Deleting Snapshot Schedules, on page 171
• Reverting to a Snapshot, on page 172
• Deleting Snapshots, on page 172

HX Data Platform Native Snapshots Overview

HX Data Platform Native Snapshots is a backup feature that saves versions (states) of working VMs. VMs can be reverted back to native snapshots.

Use the HX Data Platform Plug-in to take native snapshots of your VMs. HX Data Platform native snapshot options include: create a native snapshot, revert to any native snapshot, and delete a native snapshot. Timing options include: Hourly, Daily, and Weekly, all in 15 minute increments.

A native snapshot is a reproduction of a VM that includes the state of the data on all VM disks and the VM power state (on, off, or suspended) at the time the native snapshot is taken. Take a native snapshot to save the current state of the VM, so that you can revert to the saved state.

For additional information about VMware snapshots, see the VMware KB, Understanding virtual machine snapshots in VMware ESXi and ESX (1015180) at, http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=1015180

Benefits of HX Data Platform Native Snapshots

HX Data Platform native snapshots use native technology. Native snapshots provide the following benefits:
Native Snapshot Considerations

Snapshots parameters

- **Reverting registered VMs** - If a VM is registered, whether powered-on or powered-off, native snapshots, same as VM snapshots, can be used to revert to an earlier point in time at which the snapshot was created.

- **High performance** - The HX Data Platform native snapshot process is fast because it does not incur I/O overhead.

- **VM performance** - HX Data Platform native snapshots do not degrade VM performance.

- **Crash-consistent** - HX Data Platform native snapshots are crash-consistent by default. I/O crash consistency is defined as maintaining the correct order of write operations to enable an application to restart properly from a crash.

- **Application-consistent** - You can select the `quiesce` option of the `stcli vm snapshot` command through the HX Data Platform CLI to enable HX Data Platform native snapshots to be application-consistent. The applications in the guest VM run transparently exactly like they do in the host VM. For details, see the [Cisco HyperFlex Data Platform CLI Guide](http://kb.vmware.com/selfservice/search.do?cmd=displayKC&docType=kc&docTypeID=DT_KB_1_1&externalId=1007696).

  Quiescing a file system is a process of bringing the on-disk data of a physical or virtual computer into a state suitable for backups. This process might include operations such as flushing dirty buffers from the operating system's in-memory cache to disk, or other higher-level application-specific tasks.

  If your system displays quiesce errors, see the following VMware KB article *Troubleshooting Volume Shadow Copy (VSS) quiesce related issues (1007696)*, at:

  [http://kb.vmware.com/selfservice/search.do?cmd=displayKC&docType=kc&docTypeID=DT_KB_1_1&externalId=1007696](http://kb.vmware.com/selfservice/search.do?cmd=displayKC&docType=kc&docTypeID=DT_KB_1_1&externalId=1007696)

- **Scheduled snapshots tolerant to node failures** - Scheduled snapshots are tolerant to administrative operations that require a node shutdown, such as HX maintenance mode and HX online upgrade. Scheduled Snapshots are tolerant to failures in other HX clusters in multi cluster environments.

- **Unified interface** - You can manage native snapshots created through the HX Data Platform plug-in using VMware snapshot manager™.

- **Individual or grouped** - You can take native snapshots on a VM level, VM folder level, or resource pool level.

- **Granular progress and error reporting** - These monitoring tasks performed at Task level for Resource Pool, Folder and VM level snapshot.

- **Instantaneous snapshot delete** - Deletion of a snapshot and consolidation is always instantaneous.

- **Parallel batch snapshots** - Support for up to 255 VMs in a Resource Pool or Folder for parallel batched snapshots.

- **VDI deployment support** - HX scheduled snapshots are supported for desktop VMs on VDI deployments which are using VMware native technology.

- **Recoverable VM** - The VM is always recoverable when there are snapshot failures.

- **Datastore access** - Snapshots work on partially mounted/accessible datastores as long as the VM being snapshotted is on an accessible mountpoint.
**Managing Native Snapshots**

**Native Snapshot Considerations**

- **Native snapshots** - After you create the first native snapshot using the HX Data Platform plug-in, if you create more snapshots in the vSphere Web Client, these are considered to be native as well. However, if you create the first snapshot using the vSphere Web Client and not the HX Data Platform plug-in, then the vSphere Web Client snapshots are considered to be non-native.

- **Maximum number of stored snapshots** - Currently VMware has a limitation of 31 snapshots per VM. This maximum total includes VMware created snapshots, HX Data Platform SENTINEL snapshot, and HX Data Platform native snapshots.

  For details, see VMware KB, *Committing snapshots in vSphere when more than 32 levels of snapshots are present fails with the error: Too many levels of redo logs (1004545)*, at: [https://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=1004545](https://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=1004545)

- **Scheduled snapshots** - Do not have overlapping snapshots scheduled on VMs and their resource pools.

**Upgrade**

- HX native snapshots are not supported while upgrade of HX, ESXi, or UCS is in progress.

**VMs**

---

**Note**

Ensure that Virtual Machine is not attached to Graphic Processing Unit (GPU).

---

**Note**

For 3.5.2(a) and previous releases, all powered on VMs use synchronous consolidation (asynConsolidate = false) when taking HX snapshots.

For 3.5.2(b) and later releases, all powered on VMs use asynchronous consolidation (asyncConsolidate = true) when taking HX snapshots. If the VM is powered off, the settings remain unchanged.

- **Deleted VMs** - The life cycle of native snapshots, similar to VM snapshots, is tied to the virtual machine. If the VM is deleted, accidentally or intentionally, all associated snapshots are also deleted. Snapshots do not provide a mechanism to recover from a deleted VM. Use a backup solution to protect against VM deletion.

- **HX Data Platform storage controller VMs** - You cannot schedule snapshots for storage controller VMs.

- **Non-HX Data Platform VMs** - Snapshots fail for any VM that is not on a HX Data Platform datastore. This applies to snapshots on a VM level, VM folder level, or resource pool level. To make a snapshot, the VM must reside on a HX Data Platform datastore in a HX Data Platform storage cluster.

- **Suspended VMs** - Creating the first native snapshot, the SENTINEL snapshot, from VMs in suspended state is not supported.

- **VM Size** - The maximum size of the Virtual Machine Disk (VMDK) that an HyperFlex snapshot is 3TB. The time taken to snapshot vary depending on the cluster model, cluster load, and I/O workload on the VM.

- **VM Name** - The VM name must be unique per vCenter for taking a snapshot.

**vCenter**
• **Ready storage cluster** - To allow a native snapshot: The storage cluster must be healthy, including sufficient space and online. The datastores must be accessible. The VMs must be valid and not in a transient state, such as vMotioning.

• **vMotion** - vMotion is supported on VMs with native snapshots.

• **Storage vMotion** - Storage vMotion is not supported on VMs with native snapshots. If the VM needs to be moved to a different datastore, delete the snapshots before running storage vMotion.

**Naming**

• **Duplicate names** - Do not have VMs or Resource Pools with duplicate names within the HX Data Platform vCenter or snapshots fail. This includes parents and children within nested resource pools and resource pools within different vCenter clusters.

• **Characters in names** - Do not use the special characters, dot (.), dollar sign ($), or accent grave (´) in any guest/user VM name for which you want to enable snapshots.

**Disks and datastores**

• **VM datastores** - Ensure that all the VM (VMDK) disks are on the same datastore prior to creating native snapshots. This applies to HX Snapshot now and HX Scheduled Snapshots.

• **Thick disks** - If the source disk is thick, then the snapshot of the VM's disk will also be thick. Increase the datastore size to accommodate the snapshot.

• **Virtual disk types** - VMware supports a variety of virtual disk backing types. The most common is the FlatVer2 format. Native snapshots are supported for this format.

  There are other virtual disk formats like Raw Device Mapping (RDM), SeSparse, VmfsSparse (Redlog format). VMs containing virtual disks of these formats are not supported for native snapshots.

**Login access**

• **SSH** - Ensure that SSH is enabled in ESX on all the nodes in the storage cluster.

**Limitations**

<table>
<thead>
<tr>
<th>Object</th>
<th>Maximum Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snapshots</td>
<td>30 per storage cluster</td>
</tr>
<tr>
<td></td>
<td>VMware limit is 31. One snapshot is consumed by SENTINEL.</td>
</tr>
<tr>
<td>Datastores</td>
<td>8 per storage cluster</td>
</tr>
<tr>
<td>VMs</td>
<td>1024 per host</td>
</tr>
<tr>
<td>Powered on VMs</td>
<td>100 per host</td>
</tr>
<tr>
<td>vDisks per VM</td>
<td>60 per VM</td>
</tr>
</tbody>
</table>
## Native Snapshot Best Practices

<table>
<thead>
<tr>
<th>Important</th>
<th>Always use the HX Data Platform Snapshot feature to create your first snapshot of a VM. This ensures that all subsequent snapshots are in native format.</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Do not use the VMware Snapshot feature to create your first snapshot.</td>
<td>VMware snapshots use redo log technology that result in degraded performance of the original VM. This performance degrades further with each additional snapshot.</td>
</tr>
<tr>
<td>• Native format snapshots do not impact VM performance after the initial native snapshot is created.</td>
<td>If you have any redo log snapshots, on the ESXi hosts where the redo log snapshots reside, edit the <code>/etc/vmware/config</code> file and set <code>snapshot.asyncConsolidate=&quot;TRUE&quot;</code>.</td>
</tr>
<tr>
<td>• Add all the VMDKs to the VM prior to creating the first snapshot.</td>
<td>When VMDKs are added to the VM, additional SENTINEL snapshots are taken. Each additional SENTINEL consumes a space for additional snapshots.</td>
</tr>
<tr>
<td>• When creating large numbers of snapshots consider the following:</td>
<td>For example, if you have an existing VM and you add 2 new VMDKs, at the next scheduled snapshot, 1 new SENTINEL is created. Check the snapshot schedule retention number to be sure you have sufficient snapshot slots available; one for the new SENTINEL, one for the snapshot.</td>
</tr>
<tr>
<td>• Schedule the snapshots at a time when you expect data traffic might be low.</td>
<td>• Use multiple resource pools or VM folders to group VMs rather than a single resource pool or VM folder. Then stagger the snapshot schedule by group.</td>
</tr>
<tr>
<td>• Use multiple resource pools or VM folders to group VMs rather than a single resource pool or VM folder. Then stagger the snapshot schedule by group.</td>
<td>For example resourcePool1, schedule snapshots at :00, resourcePool2, schedule snapshots at :15, resourcePool3, schedule snapshots at :30.</td>
</tr>
<tr>
<td>• If you have your vCenter running on a VM in the storage cluster, do not take a native snapshot of the vCenter VM. This is related to VMware KB, VMware VirtualCenter Server service fails due to a quiesced snapshot operation on the vCenter Server database virtual machine (2003674), at <a href="https://kb.vmware.com/selfservice/microsites/search.do?language=en_US&amp;cmd=displayKC&amp;externalId=2003674">https://kb.vmware.com/selfservice/microsites/search.do?language=en_US&amp;cmd=displayKC&amp;externalId=2003674</a></td>
<td></td>
</tr>
</tbody>
</table>

### Understanding SENTINEL Snapshots

When you create the first snapshot of a VM, through either Snapshot Now or a Scheduled Snapshot, the HX Data Platform plug-in creates a base snapshot called a SENTINEL snapshot. The SENTINEL snapshot ensures follow-on snapshots are all native snapshots.

SENTINEL snapshots prevent reverted VMs from having VMware redo log-based virtual disks. Redo log-based virtual disks occur when an original snapshot is deleted and the VM is reverted to the second oldest snapshot.

SENTINEL snapshots are in addition to the revertible native snapshot. The SENTINEL snapshot consumes one snapshot of the total 31 available per VMware limitation.
Using SENTINEL snapshots

- Do not delete the SENTINEL snapshot.
- Do not revert your VM to the SENTINEL snapshot.

Native Snapshot Timezones

There are three objects that display and affect the timestamp and schedule of snapshots:

- vSphere and vCenter use UTC time.
- vSphere Web client uses the browser timezone.
- HX Data Platform plug-in, storage cluster, and storage controller VM use the same timezone. This is enforced across the storage cluster. The timezone used by these is configurable. The default is UTC.

The storage controller VM time is used to set the schedule. The vSphere UTC time is used to create the snapshots. The logs and timestamps vary depending upon the method used to view them.

When a schedule is created using the HX Data Platform plug-in, the scheduled times are converted to UTC from the storage controller VM timezone. When you view the schedule through the Web Client Schedule Tasks it displays the tasks in browser time zone.

When converted to the same timezone, they translate to the same time. For example: 5:30pm PST, 8:30PM EST, 1:30AM UTC are all the same time.

To have vSphere Scheduled Tasks tab display the same time for a Scheduled Snapshot that you create in the HX Data Platform plug-in, set the storage controller VM to UTC.

To have Scheduled Snapshots run based on local time zone settings, set that timezone for the storage cluster. By default, the storage controller VM uses the UTC time zone set during HX Data Platform installation.

If the vSphere and the storage controller VM are not using the same timezone, the vSphere Scheduled tasks tab might display a different time than the scheduled in the HX Data Platform Schedule Snapshot dialog.

When you configure an hourly snapshot, the snapshot schedule runs between a specific start time and end time. The vSphere Task window might display a status that a scheduled snapshot was completed outside the hourly end time based on the timezone.

Identify and set the timezone used by the storage controller VM

1. From the storage controller VM command line, view the set timezone.

   $ stcli services timezone show

2. Change the storage cluster timezone.

   $ stcli services timezone set --timezone timezone_code

See a timezone reference for timezone codes, such as

Creating Snapshots

**Before you begin**

If you have any redo log snapshots for VMs in the HX storage cluster, edit the ESXi host configuration where the redo log snapshots reside. If this step is not completed, VMs might be stunned during snapshot consolidation.

Redo log snapshots are snapshots that are created through the VMware Snapshot feature and not through the HX Data Platform Snapshot feature.

1. Login to the ESXi host command line
2. Locate and open for editing the file, /etc/vmware/config
3. Set the `snapshot.asyncConsolidate parameter` to TRUE.
   ```
   snapshot.asyncConsolidate="TRUE"
   ```

**Step 1**

From the vSphere Web Client Navigator, select the VM level, VM folder level, or resource pool level. For example, `vCenter Inventory Lists > Virtual Machines` to display the list of VMs in vCenter.

**Step 2**

Select a storage cluster VM and open the Actions menu. Either right-click the VM or click the Actions menu in the VM information portlet.

**Note**

Ensure there are no non-HX Data Platform datastores on the storage cluster resource pool or the snapshot will fail.

**Step 3**

Select `Cisco HX Data Platform > Snapshot Now` to display the Snapshot dialog box.

**Step 4**

Type a name for the snapshot in the snapshot dialog box.

**Step 5**

Type a description of the snapshot.

**Step 6**

Click OK to accept your configuration.

The Recent Tasks tab displays the status message:

*Create virtual machine native snapshot.*

The first snapshot

---

**Scheduling Snapshots Overview**

You apply snapshot schedules to storage cluster objects: VMs or resource pools.

**Note**

If you re-register the vCenter cluster, your HX Data Platform snapshot schedule is lost. If this happens, reconfigure your snapshot schedule.
You can schedule a snapshot to adjust your backup requirements. For example, you can retain more frequent snapshots of critical data. If there is a disaster, you can restore recent snapshots or create a custom real-time snapshot. For less critical data, you do not need to create frequent snapshots or retain backup copies.

Snapshot scheduling enables you to control the costs of using backup. For each VM in your storage cluster, you can schedule hourly, daily, or weekly snapshots. The maximum frequency for any specific VM is once per hour. Hourly setting is in 15 minute increments.

For example, snapshots are taken each day, given the following settings.

- VM 1 hourly snapshots to run at hour:15 minutes, between 10 PM and 1 AM.
- VM 2 hourly snapshots to run at hour:30 minutes, between 8 PM and 12 AM.
- VM 3 and 4 hourly snapshots to run at hour:45, between 6 AM and 8 AM.
- VM 5 daily snapshot to run at 6:00 AM

Each day these snapshots are taken.

- 6:00 AM — VM 5
- 6:45 AM — VM 3, VM 4
- 7:45 AM — VM 3, VM 4
- 8:30 PM — VM2
- 9:30 PM — VM2
- 10:15 PM — VM1
- 10:30 PM — VM2
- 11:15 PM — VM1
- 11:30 PM — VM2
- 12:15 AM — VM1

Notice that the last snapshot is before the ending hour:00.

To schedule a snapshot every hour over 24 hours, set the start time, then set the end time one hour before. For example, hour:15, start 4 PM, end 3 PM. This takes a snapshot at 4:15 PM, 5:15 PM, ... 12:15 AM, 1:15 AM ... 2:15 PM, 3:15 PM. Then restarts the 24 hour cycle. Note: The maximum number of snapshots per VM is 32. So, you could only take an hourly snapshot up to 32 hours.

The schedule snapshot displays the set time for the snapshot based on the current time zone setting for the storage controller VM. So, if a snapshot was set at 7 pm PST and the storage controller VM time zone is changed to EST. The next time you open the scheduler window, it automatically updates to 10 pm EST.

### Scheduling Snapshots

**Step 1**  From the vSphere Web Client Navigator Home page, select the VM or resource pool list. For example, vCenter Inventory Lists > Virtual Machines to display the list of VMs in vCenter.

**Step 2**  Select a storage cluster VM or resource pool and open the Actions menu. Either right-click the object or click the Actions menu.

**Step 3**  From the Actions menu, select Cisco HX Data Platform > Schedule Snapshot to display the Schedule Snapshot dialog box.

**Step 4**  Select the snapshot frequency.
Click the boxes for hourly, daily, and/or weekly frequency and set the starting days, times, and duration.

**Step 5**
Set the number of snapshots to retain.
When the maximum number is reached, older snapshots are removed as newer snapshots are created.

**Step 6**
Unselect existing scheduled items, as needed.
If a previous schedule existed, unselecting items deletes those items from the future schedule.

**Step 7**
Click **OK** to accept the schedule and close the dialog.

---

### Setting the Frequency of Scheduled Snapshots

Create a snapshot every hour at specific times, daily at a specific time, or weekly on selected days and times.

**Before you begin**
Open the **Schedule Snapshot** dialog box for a VM or resource pool.

**Step 1**
From the Schedule Snapshot dialog box, select the **Enable Hourly Snapshot**, **Enable Daily Snapshot**, or **Enable Weekly Snapshot** check box.

**Step 2**
Click the **Start at** drop-down list to select a start time. Select hour, minutes in 15 minute increments, and AM or PM.

**Step 3**
For an hourly snapshot schedule, click the **Until** drop-down list to select an end time. Select hour, minutes in 15 minute increments, and AM or PM. Set the minute to the same value as the Start at time.

The HX Data Platform plug-in creates a snapshot of the VM every hour between the start and end times.

**Step 4**
Select the corresponding check box to specify **Days** of the week on which you want to take the snapshots.

**Step 5**
Under **Retention**, either type a number or use the arrow button to specify the maximum number of copies to retain for each schedule.

---

### Deleting Snapshot Schedules

**Step 1**
From the vSphere Web Client Navigator Home page, select the VM or resource pool list.
For example, **vCenter Inventory Lists > Virtual Machines** to display the list of VMs in vCenter.

**Step 2**
Select a storage cluster VM or resource pool and open the **Actions** menu.
Either right-click the object or click the Actions menu.

**Step 3**
From the Actions menu, select **Cisco HX Data Platform > Schedule Snapshot** to display the Schedule Snapshot dialog box.

**Step 4**
Unclick the scheduled options you no longer want.

**Step 5**
Click **OK** to accept the changes, this includes deleting previously configured schedules, and exit the dialog.
Reverting to a Snapshot

Reverting a snapshot is returning a VM to a state stored in a snapshot. Reverting to a snapshot is performed on one VM at a time. This is not performed at the resource pool or VM folder level. Reverting snapshots is performed through the vCenter Snapshot Manager and not through the HX Data Platform plug-in.

Before you begin
Snapshots of the VM must exist.

Step 1 From the vSphere Web Client Navigator Home page, select the VM level, VM folder level, or resource pool level. For example, vCenter Inventory Lists > Virtual Machines to display the list of VMs in vCenter.

Step 2 Select a storage cluster VM and open the Actions menu. Either right-click the VM or click the Actions menu in the VM information portlet.

Step 3 Select Snapshots > Manage Snapshots to open the vSphere Snapshot Manager.

Step 4 Select a snapshot to revert to from the hierarchy of snapshots for the selected VM.

Step 5 Click Revert to > Yes > Close.

The reverted VM is included in the list of VMs and powered off. In selected cases, a VM reverted from a VM snapshot is already powered on. See the following table for more details.

<table>
<thead>
<tr>
<th>VM State When HX VM Snapshot is Taken</th>
<th>VM State After Restoration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Powered on (includes memory)</td>
<td>Reverts to the HX VM snapshot, and the VM is powered on and running.</td>
</tr>
<tr>
<td>Powered on (does not include memory)</td>
<td>Reverts to the HX VM snapshot, and the VM is powered off.</td>
</tr>
<tr>
<td>Powered off (does not include memory)</td>
<td>Reverts to the HX VM snapshot, and the VM is powered off.</td>
</tr>
</tbody>
</table>

Step 6 If the reverted VM is powered off, then select the VM and power it on.

Deleting Snapshots

Deleting snapshots is managed through the vSphere interface and not through the HX Data Platform plug-in.
<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>From the vSphere Web Client Navigator, select VMs and Templates &gt; vcenter_server &gt; Snapshots &gt; datacenter &gt; vm.</td>
</tr>
<tr>
<td>Step 2</td>
<td>Right-click the vm and select Snapshots &gt; Manage Snapshots.</td>
</tr>
<tr>
<td>Step 3</td>
<td>Select a snapshot and click Delete.</td>
</tr>
</tbody>
</table>

**Note**  
Delete the SENTINEL snapshot by using Delete All option only. Do not delete the SENTINEL snapshot individually.
Deleting Snapshots
Managing Clusters Running on Different HXDP Versions

Scenario—Site A at HXDP 3.0 and Site B at HDXP 2.6

The following terms and abbreviations are used:

- **Site A**—Source cluster
- **Site B**—Target cluster
- **dr_cleanup tool**—Contact Cisco TAC to obtain this tool available in the 3.0 internal support package.

**Prerequisites**

- Before upgrading make sure, there are no VMs or groups in **Recovered** or **Halted** state.
- If the VMs are in **Halted** State, recover and unprotect the VMs or groups.
- If the VMs are in **Recovered** state, then unprotect the VMs or groups.

<table>
<thead>
<tr>
<th>Step</th>
<th>Site A</th>
<th>Site B</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>At HXDP version 2.6 or lower.</td>
<td>At HXDP version 2.6 or lower.</td>
<td>—</td>
</tr>
</tbody>
</table>
### Scenario—Site A at HXDP 3.0 and Site B at HXDP 2.6

<table>
<thead>
<tr>
<th>Step</th>
<th>Site A</th>
<th>Site B</th>
<th>Result</th>
</tr>
</thead>
</table>
| 2.   | Upgrade to HXDP 3.0. | —      | • Ongoing replication continues.  
|      |        |        | • Planned migration for VMs is not supported.  
|      |        |        | • See Functionality Limitations, on page 178 for more details. |
| 3.   | Before upgrading Site B, if a disaster happens on Site A. | 1. Execute the command:  
|      |        |        | `stcli dp peer forget`  
|      |        | 2.    | Recover VMs that are required.  
|      |        | 3.    | Run the `dr_cleanup` tool to delete all the VM information from the disaster recovery database.  
|      |        |        | Workloads are now running on Site B. |
| 4.   | Restore Site A.  
|      | After Site A is restored, do the following:  
|      | 1. Execute the command:  
|      | `stcli dp peer forget`  
|      | 2. Run the `dr_cleanup` tool to delete all the VM information from the disaster recovery database. | —      | Sites are unpaired. |
| 5.   | —      | Upgrade to HXDP 3.0. | —      |
| 6.   | Pair the sites. | —      | Site A and Site B can now be re-paired and workloads can be protected. |
Scenario—Site A at HXDP 2.6 and Site B at HXDP 3.0

The following terms and abbreviations are used:

- **Site A**—Source cluster
- **Site B**—Target cluster
- **dr_cleanup tool**—Contact Cisco TAC to obtain this tool available in the 3.0 internal support package.

**Prerequisites**

- Before upgrading make sure, there are no VMs or groups in **Recovered** or **Halted** state.
- If the VMs are in **Halted** State, recover and unprotect the VMs or groups.
- If the VMs are in **Recovered** state, then unprotect the VMs or groups.

<table>
<thead>
<tr>
<th>Step</th>
<th>Site A</th>
<th>Site B</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>At HXDP version 2.6 or lower.</td>
<td>At HXDP version 2.6 or lower.</td>
<td>—</td>
</tr>
</tbody>
</table>
| 2.   | — | Upgrade to HXDP 3.0. | • Ongoing replication continues.  
• Planned migration for VMs is not supported.  
• See Functionality Limitations, on page 178 for more details. |
| 3.   | Before upgrading Site A, if a disaster happens on Site A. | 1. Execute the command:  
`stcli dp peer forget`  
2. Recover VMs that are required.  
3. Run the **dr_clean up** tool to delete all the VM information from the disaster recovery database. | • Not all recovery options are available.  
• See Functionality Limitations, on page 178 for more details.  
• Workloads are now running on Site B. |
Sites are unpaired.—Restore Site A.

After Site A is restored, do the following:

1. Execute the command:
   
   stcli dp peer forget

2. Run the `dr_cleanup` tool to delete all the VM information from the disaster recovery database.

5. Upgrade Site A to HXDP 3.0.

6. Pair the sites.

Site A and Site B can now be re-paired and workloads can be protected.

**Functionality Limitations**

Newer functionality in release 3.0 is supported ONLY when both the source and target clusters are on the same HXDP version. It can take a while during upgrade for both the source and target to be on the same version. Review the following functionality limitations:

- Planned migration for VMs is not supported when peer sites have mismatched versions, such as when the target cluster is on 2.6, and source cluster is on 3.0.

- When the source is upgraded, all the newer features in release 3.0, such as movein and moveout of group VMs, migration are blocked on the source cluster until the peer is upgraded.

- If only the target cluster is upgraded, in HX Connect UI, Network Mapping options in the Recovery dialog box will not available until the source cluster is upgraded.
CHAPTER 16

Managing Virtual Machine Disaster Recovery

- Data Protection Overview, on page 179
- Protecting Virtual Machines Overview, on page 185
- Disaster Recovery Overview, on page 204
- Replication Maintenance Overview, on page 213

Data Protection Overview

The HX Data Platform disaster recovery feature allows you to protect virtual machines from a disaster by setting up replication of running VMs between a pair of network connected clusters. Protected virtual machines running on one cluster replicate to the other cluster in the pair, and vice versa. The two paired clusters typically are located at a distance from each other, with each cluster serving as the disaster recovery site for virtual machines running on the other cluster.

Once protection has been set up on a VM, HX Data Platform periodically takes a replication snapshot of the running VM on the local cluster and replicates (copies) the snapshot to the paired remote cluster. In the event of a disaster at the local cluster, you may use the most recently replicated snapshot of each protected VM to recover and run the VM at the remote cluster. Each cluster that serves as a disaster recovery site for another cluster, must be sized with adequate spare resources so that upon a disaster, it can run the newly recovered virtual machines in addition to its normal workload.

Note

Only one snapshot retention is supported for backup workflows.

Each virtual machine can be individually protected by assigning it protection attributes, chief among which is the replication interval (schedule). The shorter the replication interval, the fresher the replicated snapshot data is likely to be, when it is time to recover the VM after a disaster. Replication intervals can range between 5 minutes and 24 hours.

Protection group is a group of VMs that have a common replication schedule and snapshot properties.

Setting up replication requires two existing clusters running HX Data Platform version 2.5 or higher. Both clusters must be on the same HX Data Platform version. This setup can be completed online.

First, each cluster is set up for replication networking. Use HX Connect to provide a set of IP addresses to be used by local cluster nodes to replicate to the remote cluster. HX Connect creates VLANs through UCS Manager, for dedicated replication network use.
When this option is chosen in HX Connect, UCSM is configured only when both UCS Manager and fabric interconnect are associated with the HyperFlex cluster. When UCSM and FI are not present, you must enter the VLAN ID, and not select UCSM configuration in HX Connect.

The two clusters, and their corresponding existing relevant datastores must be explicitly paired. The pairing setup can be completed using HX Connect from one of the two clusters. This requires administrative credentials of the other cluster.

Virtual machines can be protected (or have their existing protection attributes modified) by using HX Connect at the cluster where they are currently active.

HX Connect can be used to monitor the status of both incoming and outgoing replications at a cluster.

After a disaster, a protected VM can be recovered and run at the cluster that serves as the disaster recovery site for that VM.

Replication and Recovery Considerations

The following is a list of considerations when configuring virtual machine replication and performing disaster recovery of virtual machines.

- **Administrator**—All replication and recovery tasks, except monitoring, can only be performed with administrator privileges on the local cluster. For tasks involving a remote cluster, both the local and remote user must have administrator privileges and should be configured with the vCenter SSO on their respective clusters.

- **Minimum and Recommended Bandwidth**—Note that the minimum bandwidth supported is 50Mbs for a 4 node cluster (i.e. 12.5Mbps per node). The recommended bandwidth is 1Gbps for a 4 node cluster (i.e. 250Mbps per node).

- **Maximum Latency**—Maximum latency supported is 75ms between two clusters.

  If you are scheduling to run multiple replication jobs at the same time, for example 32 as maximum supported by DR, and your bandwidth (50Mbs) is low and latency (75ms) high, it is possible that some jobs will error out until bandwidth becomes available. If this situation occurs, increase bandwidth or reduce the concurrency by staggering the replications.

  During this situation, unprotect operations can take longer than expected.

- **Network Loss**—When there is a packet loss in data transmission across two sites, protection and recovery operations will have unexpected results. The transmission should be reliable for these features to work as expected.

- **Storage Space**—Ensure that you have sufficient space on the remote cluster to support your replication schedule. The protected virtual machines are replicated (copied) to the remote cluster at every scheduled interval. Though storage capacity methods are applied (deduplication and compression), each replicated virtual machine will consume some storage space.

  Not having sufficient storage space on the remote cluster can cause the remote cluster to reach capacity usage maximums. If you see **Out of Space** errors, see *Handling Out of Space Errors, on page 69.* Pause all replication schedules until you have appropriately adjusted the space available on the HX Cluster. Always ensure that your cluster capacity consumption is below the space utilization warning threshold.

- **Supported Clusters**—Replication is supported between the following HyperFlex clusters:
• 1:1 replication between HX clusters running under fabric interconnects.

• 1:1 replication between All Flash and Hybrid HX cluster running under fabric interconnects.

• 1:1 replication between 3-Node and 4-Node HX Edge and another 3-Node and 4-Node HX Edge cluster.

• 1:1 replication between All Flash 3-Node and 4-Node Edge and Hybrid 3-Node and 4-Node HX Edge clusters.

• 1:1 replication between 3-Node and 4-Node HX Edge and an HX cluster running under fabric interconnects.

---

**Note**

1:1 replication with 2-Node HX Edge is not supported.

• **Rebootsing Nodes**—Do not reboot any nodes in the HX Cluster during any restore, replication, or recovery operation.

• **Thin Provision**—Protected virtual machines are recovered with thin provisioned disks irrespective of how disks were specified in the originally protected virtual machine.

• **Protection Group Limitations**
  
  • The maximum number of VMs allowed in a protection group is 32.
  
  • Do not add VMs with ISOs or floppies to protection groups.

• **Non-HX Datastores**—If you have protected a VM with storage on a non-HX datastore, periodical replication will fail on this. You can either unprotect this VM or remove its non-HX storage.

  Do not move protected VMs from HX datastores to non-HX datastores. If a VM is moved to a non-HX datastore through storage vMotion, unprotect the VM, then reapply the protection.

• **Templates**—Templates are not supported for Disaster Recovery.

• **Protection and Recovery of Virtual Machines with Snapshots**
  
  • A VM with no Snapshots—When replication is enabled the entire content of the VM is replicated.
  
  • A VM with VMware Redolog snapshots—When replication is enabled the entire content including the snapshot data is replicated. When a VM with redolog snapshots is recovered, all previous snapshots are preserved.
  
  • A VM with Hyperflex Snapshots—When replication is enabled only the latest data is replicated, and the snapshot data is not replicated. When the VM is recovered, previous snapshots are not preserved.

• **Data Protection and Disaster Recovery (DR) snapshots** are stored on the same datastore as the protected VMs. Deleting these snapshots manually by an Admin, is not supported. Deleting the snapshot directories would compromise HX data protection and disaster recovery.
Replication Network and Pairing Considerations

A replication network must be established between clusters that are expected to use replication for Data Protection. This Replication network is created to isolate inter-cluster replication traffic from other traffic within each cluster and site.

The following is a list of pre-validation checks necessary for pairing:

- Verify and ensure that peer credentials are working.
- Check the health of both clusters and proceed with pairing only when both the clusters are healthy.
- Verify and ensure that vCenter version is at least same or higher than ESXi version at each cluster.

The following is a list of considerations when configuring replication network and pairing:

- To support efficient replication, all M nodes of cluster A have to communicate with all N nodes of cluster B, as illustrated in the $M \times N$ connectivity between clusters figure.
- To enable replication traffic between clusters to cross the site-boundary and traverse the internet, each node on Cluster A should be able to communicate with each node on Cluster B across the site boundary and the internet.
- The replication traffic must be isolated from other traffic within the cluster and the data center.
- To create this isolated replication network for inter-cluster traffic, complete these steps:
  - Create a replication network on each cluster.
  - Pair clusters to associate the clusters and establish $M \times N$ connectivity between the clusters.
- IP addresses, Subnet, VLAN, and Gateway are associated with each replication network of each cluster. You must configure the corporate firewall and routers on both sites, to allow communication between the clusters and the sites on TCP ports 9338, 3049, 9098, 4049, 4059.

$M \times N$ Connectivity Between Clusters
Data Protection Terms

**Interval**—Part of the replication schedule configuration, used to enforce how often the protected VMs replication snapshot must be taken and copied to the target cluster.

**Local cluster**—The cluster you are currently logged into through HX Connect, in a VM replication cluster pair. From the local cluster, you can configure replication protection for locally resident VMs. The VMs are then replicated to the paired remote cluster.

**Migration**—A routine system maintenance and management task where a recent replication snapshot copy of the VM becomes the working VM. The replication pair of source and target cluster do not change.

**Primary cluster**—An alternative name for the source cluster in VM disaster recovery.

**Protected virtual machine**—A VM that has replication configured. The protected VMs Reside on a datastore in the local cluster of a replication pair. They have a replication schedule configured either individually or through a protection group.

**Protection group**—A means to apply the same replication configuration on a group of VMs.

**Recovery process**—The manual process to recover protected VMs in the event the source cluster fails or a disaster occurs.

**Recovery test**—A maintenance task that ensures the recovery process is successful in the event of a disaster.

**Remote cluster**—One of a VM replication cluster pair. The remote cluster receives the replication snapshots from the Protected VMs in the local cluster.

**Replication pair**—Two clusters that together provide a remote cluster location for storing the replication snapshots of local cluster VMs.

Clusters in a replication pair can be both a remote or local cluster. Both clusters in a replication pair can have resident VMs. Each cluster is local to its resident VMs. Each cluster is remote to the VMs that reside on the paired local cluster.
Replication snapshot—Part of the replication protection mechanism. A type of snapshot taken of the protected VM, which is copied from the local cluster to the remote cluster.

Secondary cluster—An alternative name for the target cluster in VM disaster recovery.

Source cluster—one of a VM replication cluster pair. The source cluster is where the protected VMs reside.

Target cluster—one of a VM replication cluster pair. The target cluster receives the replication snapshots from the VMs of the source cluster. The target cluster is used to recover the VMs in the event of a disaster on the source cluster.

Best Practices for Data Protection and Disaster Recovery

As an administrator, you will need to design and deploy an effective data protection and disaster recovery strategy in your environment. The solution that you design and subsequently deploy must meet or exceed business requirements for both, Recovery Point Objectives (RPO) and Recovery Time Objectives (RTO) of the production VMs. Following are some of the points that you must consider while designing this strategy:

• The number of Service Level Agreements (SLA) necessary to comply with various categories of production workloads that may include mission critical, business critical, and important VMs.

• Detailed constructs of each SLA that may include RPO, RTO, the number or recovery points retained, requirements for offsite copies of data, and any requirements for storing backup copies on different media types. There may be additional requirements that include the ability to recover to a different environment such as a different location, different hypervisor or different private/public cloud.

• An ongoing testing strategy for each SLA which serves to prove that the solution meets the business requirements it was designed for.

Note that backups and backup copies must be stored external to the HyperFlex cluster being protected. For example, backups performed to protect VMs on a Hyperflex cluster should not be saved to a backup repository or a disk library that is hosted on the same HyperFlex cluster.

The built-in HyperFlex data protection capabilities are generalized into the following categories:

• Data Replication Factor—Refers to the number of redundant copies of data within a HyperFlex cluster. A data replication factor of 2 or 3 can be configured during data platform installation and cannot be changed. The data replication factor benefit is that it contributes to the number of cluster tolerated failures. See the section titled, HX Data Platform Cluster Tolerated Failures, on page 9 for additional information about the data replication factor.

Note

Data Replication Factor alone may not fulfill requirements for recovery in the highly unlikely event of a cluster failure, or an extended site outage. Also, the data replication factor does not facilitate point-in-time recovery, retention of multiple recovery points, or creation of point-in-time copies of data external to the cluster.

• Data Platform Snapshots—Operates on an individual VM basis and enables saving versions of a VM over time. A maximum of 31 snapshots can be retained.
Data Platform Snapshots alone may not fulfill requirements for recovery in the highly unlikely event of a cluster failure, or an extended site outage. Also, it does not facilitate the ability to create point-in-time copies of data external to the cluster. More importantly, unintentional deletion of a VM will also delete any data platform snapshots associated with the deleted VM.

Note

Asynchronous Replication—Also known as The HX Data Platform disaster recovery feature, it enables protection of virtual machines by replicating virtual machine snapshots between a pair of network connected HyperFlex clusters. Protected virtual machines running on one cluster replicate to the other cluster in the pair, and vice versa. The two paired clusters typically are located at a distance from each other, with each cluster serving as the disaster recovery site for virtual machines running on the other cluster.

Asynchronous Replication alone may not fulfill requirements for recovery when multiple point-in-time copies need to be retained on the remote cluster. Only the most recent snapshot replica for a given VM is retained on the remote cluster. Also, asynchronous replication does not facilitate the ability to create point-in-time copies of data external to either cluster.

We recommend that you first understand the unique business requirements of your environment and then deploy a comprehensive data protection and disaster recovery solution to meet those requirements.

Protecting Virtual Machines Overview

To protect a virtual machine, specify the following protection attributes:

- Replication interval, which is the frequency of replication.
- A start time (within the next 24 hours), which specifies the first-time replication is attempted for that virtual machine.
- Specify if the replication snapshot should be taken with the virtual machine quiesced or not.

Protection attributes can be created and assigned to protection groups. To assign the protection attributes to virtual machines, they can be added to a protection group.

For example, say you have three classes of protection: gold, silver, and bronze. Set up a protection group for each class, with replication intervals such as 5 or 15 minutes for gold, 4 hours for silver, and 24 hours for bronze. Most of your VMs could be protected by merely adding them to one of the three already created protection groups.

To protect virtual machines, you can choose from the following methods:

Note

When you select multiple virtual machines, you must add them to a protection group.
• **Independently**—Select one virtual machine and configure. Set the replication schedule and the VMware quiesce option for the specific virtual machine. Changes to the replication settings will only affect the independently protected virtual machine. The virtual machine is not included in a protection group.

• **Existing protection group**—Select one or more virtual machines and add them to an existing protection group. The schedule and VMware quiesce option settings are applied to all the virtual machines in the protection group. When the protection group settings are changed, the changes are applied to all the virtual machines in the protection group.

• **New protection group**—Select two or more virtual machines and choose to create a new protection group. Define the protection group name, schedule, and VMware quiesce option settings. These settings are applied to all the virtual machines in the protection group. When the protection group settings are changed, the changes are applied to all the virtual machines in the protection group.

### Data Protection Workflow

To protect VMs and their data using replication, perform the following steps:

- Configure two clusters and pair them to each other, to support the replication network activity.

- Assign replication schedule for the VMs to set the frequency (interval) for creating replication snapshots on the source cluster and copy them to the target cluster. Set replication schedule on individual VMs and on protection groups.

### Replication Workflow

1. Install HX Data Platform, create two clusters.

2. Create at least one datastore on each cluster.

3. Log in to HX Connect.

4. Before creating the replication network, verify the IP addresses, subnet mask, VLAN, gateway, and IP range to be used for the replication network. After the replication network is created, validate connectivity within the cluster over this new replication network.

5. The default value of MTU is 1500. If your HyperFlex cluster uses OTV or other tunneling mechanisms, ensure that you choose an MTU which will work for inter-site or inter-cluster connectivity.

6. Configure cluster replication network on each cluster. The replication network information is unique to each cluster.

   Specify the subnet, gateway, range of IP addresses, bandwidth limit for dedicated use by the replication network. HX Data Platform configures a VLAN through UCS Manager for both clusters.

7. An intra-cluster network test is performed to validate connectivity between the nodes in the cluster, after the replication network is configured. If the intra-cluster network test fails, the replication network configuration is rolled back. Reconfigure the replication network after fixing the issue.

8. Before creating the replication pair, ensure that you have updated the corporate network to support this pairing.

9. Create a replication pair from one cluster to the other, connecting the two clusters. After the replication pair is created, a test of the inter-cluster pair network is performed to validate bidirectional connectivity between the clusters. Set the datastore mapping from both clusters.
10. Optionally, you can create protection groups.
   • Set the schedule. Each protection group must have one schedule.
   • Create multiple protection groups if you want to have various replication intervals (schedules) for
different virtual machines. A virtual machine can only belong to one protection group.

11. Select virtual machines to protect, as individual virtual machines or virtual machines assigned to
protection groups.

12. Set protection, do the following:
   a. Select one or more virtual machines. Click Protect.
   b. From the Protect Virtual Machine wizard, the options are:
      • Protect a single virtual machine through an existing protection group.
      • Protect a single virtual machine independently.
      • Protect multiple virtual machines through an existing protection group.
      • Protect multiple virtual machines through a new protection group.
      Create new protection group and set schedule.

Configuring the Replication Network in HX Connect

Before a replication pair can be configured, the replication network has to be configured on both the local and
remote cluster. Complete the configuration on the local cluster, then log in to the remote cluster and complete
the configuration there.

Before you begin

Ensure that the following prerequisites are met, before configuring the replication network:

• A minimum of N + 1 IP addresses is required, where N is the number of converged nodes. An IP subnet
spanning these new IP addresses, the gateway, and VLAN associated with this subnet is also required.

• To accommodate future cluster expansion, ensure that there are sufficient IP addresses in the subnet
provided, for later use. Any new converged nodes in the expanded cluster would also need to be assigned
IP addresses for replication. The subnet provided in the previous step should span the potentially new
IP range as well.

• Additional IP-pool ranges can be added to the network later, however IP-pools already configured in the
replication network cannot be modified.

• Make sure that the IP addresses to be used for the replication network are not already in use by other
systems.

• Before creating the replication network, verify IP addresses, Subnet, VLAN, and Gateway to be used
for the replication network.
Step 1 Log in to HX Connect as administrator.

Step 2 Select Replication > Replication Configuration > Configure Network.

Note You can only configure the replication network once. Once configured, you can edit the available IP addresses and the networking bandwidth.

Step 3 In the Configure Replication Network dialog box, under the Configure Replication Network VLAN Configuration tab, enter the network information.

### UI Element | Essential Information
--- | ---
Select an existing VLAN radio button | Click this radio button to add an existing VLAN.
If you manually configured a VLAN for use by the replication network through Cisco UCS Manager, enter that VLAN ID.

Create a new VLAN radio button | Click this radio button to create a new VLAN.

### VLAN ID field
- Click the up or down arrows to select a number for the VLAN ID or type a number in the field.
- This is separate from the HX Data Platform Management traffic network and Data traffic network.

**Important** Be sure to use a different VLAN ID number for each HX Storage Cluster in the replication pair.
- Replication is between two HX Storage Clusters. Each HX Storage Cluster requires a VLAN dedicated to the replication network.
- For example, 3.
- When a value is added, the default VLAN Name is updated to include the additional identifier. The VLAN ID value does not affect a manually entered VLAN name.

### VLAN Name field
- This field is automatically populated with a default VLAN name when the Create a new VLAN radio button is selected. The VLAN ID is concatenated to the name.

For Stretched Cluster, provide Cisco UCS Manager credentials for primary and secondary FIs (site A and site B). For normal cluster, provide Cisco UCS Manager credential for single FI.

### UCS Manager host IP or FQDN field
- Enter Cisco UCS Manager FQDN or IP address.
- For example, 10.193.211.120.

### Username field
- Enter administrative username for Cisco UCS Manager.

### Password field
- Enter administrative password for Cisco UCS Manager.

Step 4 Click Next.

Step 5 In the IP & Bandwidth Configuration tab, set the network parameters and the replication bandwidth.
<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subnet field</strong></td>
<td>Enter the subnet for use by the replication network in network prefix notation. The subnet is separate from the HX Data Platform Management traffic network and Data traffic network.</td>
</tr>
<tr>
<td></td>
<td><strong>Format example:</strong> x.x.x.x/&lt;number of bits&gt;</td>
</tr>
<tr>
<td></td>
<td>1.1.1.1/20</td>
</tr>
<tr>
<td><strong>Gateway field</strong></td>
<td>Enter the gateway IP address for use by the replication network. The gateway is separate from the HX Data Platform Management traffic network and Data traffic network.</td>
</tr>
<tr>
<td></td>
<td>For example, 1.2.3.4.</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong> The gateway IP address must be accessible even if the disaster recovery is being setup for a flat network.</td>
</tr>
<tr>
<td><strong>IP Range field</strong></td>
<td>Enter a range of IP addresses for use by the replication network.</td>
</tr>
<tr>
<td></td>
<td>• The minimum number of IP addresses required is the number of nodes in your HX Storage Cluster plus one more.</td>
</tr>
<tr>
<td></td>
<td>For example, if you have a 4 node HX Storage Cluster, enter a range of at least 5 IP addresses.</td>
</tr>
<tr>
<td></td>
<td>• The from value must be lower than the to value.</td>
</tr>
<tr>
<td></td>
<td>For example, From 10.10.10.20 To 10.10.10.30.</td>
</tr>
<tr>
<td></td>
<td>• If you plan to add nodes to your cluster, include sufficient number of IP addresses to cover any additional nodes. You can add IP addresses at any time.</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong> The IP address range excludes compute-only nodes.</td>
</tr>
<tr>
<td><strong>Add IP Range button</strong></td>
<td>Click to add the range of IP addresses entered in IP Range From and To fields.</td>
</tr>
<tr>
<td><strong>Set Replication Bandwidth Limit check box</strong></td>
<td>Enter the maximum network bandwidth that the replication network is allowed to consume for inbound and outbound traffic. Acceptable value is 33,000 Mbits/sec.</td>
</tr>
<tr>
<td></td>
<td>The default value is unlimited, which sets the maximum network bandwidth to the total available to the network.</td>
</tr>
<tr>
<td></td>
<td>The replication bandwidth is used to copy replication snapshots from this local HX Storage Cluster to the paired remote HX Storage Cluster.</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong> At lower bandwidth (typically, lesser than 50 Mbits/sec), the replications of multiple VMs may exit without executing the replication process due to high data transfer rate. To overcome this issue, either increase the bandwidth or stagger VM replication schedule so that VMs do not replicate in the same window.</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong> The bandwidth setting must be close to the link speed. The bandwidth setting for the clusters in the pair must be same.</td>
</tr>
<tr>
<td>UI Element</td>
<td>Essential Information</td>
</tr>
<tr>
<td>---------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| **Set non-default MTU check box** | Default MTU value is 1500. Select the check box to set a custom MTU size for the replication network. MTU can be set in the range 1024 to 1500. Note: • Ensure to use the same MTU value on both sides of the cluster. • After configuring the cluster, if the MTU value needs to be changed, you must reconfigure the cluster. To reconfigure the replication network with a new MTU value, do the following:  
  a. Delete the replication pair if it is already configured.  
  b. In the Web CLI of HX Connect, execute the following command:  
     ```sh
stcli drnetwork cleanup
```
  c. After completion of the `drnetwork cleanup` task, configure the replication network. |

**Note** When you use an existing VLAN for replication network, the replication network configuration fails. You must add the self-created replication VLAN to the management vNIC templates in Cisco UCS Manager.

**Step 6** Click **Next**.

**Step 7** In the **Test Configuration** tab, check the replication network configuration.

**Step 8** Click **Configure**.

**What to do next**

- Be sure to configure the replication network on both HX Storage Clusters for the replication pair.

- After the replication network is created on the cluster, each converged node on the cluster would be configured with an IP address on the eth2 interface.

- Check for duplicate IP assignment using `arp-scan`.

  For example if your replication subnet is 10.89.1.0/24:
  ```sh
  $ sudo arp-scan 192.168.0.0/24 | cut -f1 | sort | uniq -d
  ```

  If there is a duplicate IP assignment, it is necessary to remove the replication network assignments.

To reconfigure the replication network with proper IP assignment, do the following:

1. Delete the replication pair if it is already configured.

2. In the Web CLI of HX Connect, execute the following command:

   ```sh
   stcli drnetwork cleanup
   ```

3. After completion of the `drnetwork cleanup` task, configure the IP address in the replication network.
Test Local Replication Network

To perform an intra-cluster replication network test, do the following:

---

**Step 1** Log in to HX Connect.
   a) Enter the HX Storage Cluster management IP address in a browser. Navigate to
   b) Enter the administrative username and password.
   c) Click **Login**.

**Step 2** In the Navigation pane, click **Replication**.

**Step 3** From the **Actions** drop-down list, select **Test Local Replication Network**.

**Step 4** Click **Run Test**.

**Step 5** On the **Activity** page, you can view the progress of the **Test Replication Network** task.

---

Editing the Replication Network

When you expand a HX Cluster that has replication configured, ensure that you have sufficient IP addresses available for the replication network. The replication network requires dedicated IP addresses, one for every node in the cluster plus one more. For example, in a 3 node cluster, four IP addresses are required. If you are adding one more node to the cluster, five IP addresses are minimum. Edit the replication network to add IP addresses.

---

**Step 1** Log in to HX Connect as administrator.

**Step 2** In the Navigation pane, Select **Replication**.

**Step 3** From the **Actions** drop-down list, select **Edit Replication Network**.

**Step 4** In the **Edit Network Configuration** dialog box, you can edit the range of IPs to use and set the replication bandwidth limit for replication traffic. The replication network subnet and gateway are displayed for reference only and cannot be edited.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subnet field</td>
<td>The subnet that is configured for the replication network in network prefix notation. This value cannot be edited.</td>
</tr>
<tr>
<td>Gateway field</td>
<td>The gateway that is configured for the replication network. This is value cannot be edited.</td>
</tr>
</tbody>
</table>
### Replication Pair Overview

Creating a replication cluster pair is a pre-requisite for setting up VMs for replication. The replication network and at least one datastore must be configured prior to creating the replication pair.

By pairing cluster 1 with cluster 2, you are specifying that all VMs on cluster 1 that are explicitly set up for replication, can replicate to cluster 2, and that all VMs on cluster 2 that are explicitly set up for replication, can replicate to cluster 1.

By pairing a datastore A on cluster 1 with a datastore B on cluster 2, you are specifying that for any VM on cluster 1 that is set up for replication, if it has files in datastore A, those files will be replicated to datastore B on cluster 2. Similarly, for any VM on cluster 2 that is set up for replication, if it has files in datastore B, those files will be replicated to datastore A on cluster 1.

Pairing is strictly 1-to-1. A cluster can be paired with no more than one other cluster. A datastore on a paired cluster, can be paired with no more than one datastore on the other cluster.
Creating a Replication Pair

The replication pair defines the two halves of the protection network. The HX Storage Cluster you are logged into is the local cluster, the first half of the pair. Through this dialog, you identify another HX Storage Cluster, the second half of the pair, the remote cluster. To ensure the storage component, map the replication pair to datastores on each HX Storage Cluster. After the replication pair is configured, you can begin protecting virtual machines. See the Virtual Machines tab.

### Important

When pairing or mapping clusters at different versions, cluster pairing must be initiated on the 3.5 cluster and then the datastore mapping must be initiated from the 3.0 cluster.

- Cluster pairing must be initiated only from a 3.5 cluster to a 3.0 cluster.
- Datastore mapping must be initiated only from a 3.0 cluster to a 3.5 cluster.

### Before you begin

- Create a datastore on both the local and the remote cluster.
- Configure the replication network.

### Step 1

From HX Connect, log in to either the local or remote cluster as a user with administrator privileges. Select Replication > Replication Pairs > Create Replication Pair.

### Step 2

Enter a **Name** for the replication pair and click **Next**.

Enter a name for the replication pairing between two HX Storage Clusters. This name is set for both the local and remote cluster. The name cannot be changed.

### Step 3

Enter the **Remote Connection** identification and click **Pair**.

Once the Test Cluster Pair job is successful, you can proceed to the next step. On the Activity page, you can view the progress of the Test Cluster Pair job.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management IP or FQDN</td>
<td>Enter the IP address or fully qualified domain name (FQDN) for the management network on the remote HX Storage Cluster. For example: 10.10.10.10.</td>
</tr>
<tr>
<td>User Name and Password</td>
<td>Enter vCenter single sign-on or cluster specific administrator credentials for the remote HX Storage Cluster.</td>
</tr>
</tbody>
</table>

HX Data Platform verifies the remote HX Storage Cluster and assigns the replication pair name.

**Note** Virtual machines to be protected must reside on one of the datastores in the replication pair.

### Step 4

Set the **Datastore Mapping** from both clusters and click **Next**.

**Note**

- The virtual machines to be protected must on the datastores you select. Moving virtual machines from the configured datastores for the replication pair, also removes protection from the virtual machines.
- Moving virtual machine to another paired datastore is supported. If the VMs are moved to unpaired datastore, replication schedule fails.
Test Remote Replication Network

To test the pairing between clusters in a remote replication network, do the following:

**Step 1**  
Log in to HX Connect.  
a) Enter the HX Storage Cluster management IP address in a browser. Navigate to https://storage-cluster-management-ip.  
b) Enter the administrative username and password.  
c) Click Login.

**Step 2**  
In the Navigation pane, click Replication.

**Step 3**  
From the Actions drop-down list, select Test Remote Replication Network.

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTU Test Value</td>
<td>Default MTU value is 1500. MTU can be set in the range 1024 to 1500.</td>
</tr>
</tbody>
</table>

**Note**  
- After configuring the cluster, if the MTU value needs to be changed, you must reconfigure the cluster. Please contact Cisco TAC.  
- Ensure to use the same MTU value on both sides of the cluster.

**Step 4**  
Click Run Test.
Step 5 On the Activity page, you can view the progress of the Replication Pair Network Check task.

---

## Editing a Replication Pair

Editing a replication pair is changing the datastores for the replication pair.

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Login to HX Connect as an administrator.</td>
</tr>
<tr>
<td>2</td>
<td>Select Replication &gt; Replication Pairs &gt; Edit.</td>
</tr>
<tr>
<td>3</td>
<td>Select the local or remote datastore and click Finish.</td>
</tr>
</tbody>
</table>

### Essential Information

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Local Datastore</strong> column</td>
<td>List of the configured datastores on this cluster, the local HX Storage Cluster. Map one local datastore to one remote datastore.</td>
</tr>
<tr>
<td><strong>Remote Datastore</strong> column</td>
<td>Pair the datastores between the HX Storage Clusters.</td>
</tr>
<tr>
<td>a.</td>
<td>To change the local datastore selection, remove the mapping to the current local datastore. From the pull-down menu in the Remote Datastore column, select <strong>Do not map this datastore</strong>.</td>
</tr>
<tr>
<td>b.</td>
<td>From the desired Local Datastore row, select a datastore from the Remote Datastore pull-down menu. This selects both the remote and local datastores in a single action.</td>
</tr>
</tbody>
</table>

---

## Deleting a Replication Pair

Delete a replication pair on the local and remote clusters.

Select Replication > Replication Pairs > Delete.

**Before you begin**

On both the local and remote clusters, remove dependencies from the replication pair.

Log in to the local and the remote HX storage cluster and perform the following:

- Unprotect all virtual machines. Remove virtual machines from protection groups.
- Remove protection groups. If the protection group does not have a VM, deleting protection group is not required.

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Log in to HX Connect as an administrator.</td>
</tr>
<tr>
<td>2</td>
<td>Unmap the datastores in the replication pair.</td>
</tr>
<tr>
<td>a)</td>
<td>Select Replication &gt; Replication Pairs &gt; Edit.</td>
</tr>
</tbody>
</table>
After the test cluster pair job is successful, you can proceed to the next step. You can view the progress of the Test Cluster Pair job on the Activity page.

b) From the Edit Replication Pair dialog box, select Do not map this datastore from the Remote Datastore menu.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Datastore</td>
<td>List of the configured datastores on this cluster, the local HX Storage Cluster.</td>
</tr>
<tr>
<td></td>
<td>Map one local datastore to one remote datastore.</td>
</tr>
<tr>
<td>Remote Datastore</td>
<td>Pair the datastores between the HX Storage Clusters.</td>
</tr>
<tr>
<td></td>
<td>1. To change the local datastore selection, remove the mapping to the current local</td>
</tr>
<tr>
<td></td>
<td>datastore.</td>
</tr>
<tr>
<td></td>
<td>From the pull-down menu in the Remote Datastore column, select Do not map this</td>
</tr>
<tr>
<td></td>
<td>datastore.</td>
</tr>
<tr>
<td></td>
<td>2. From the desired Local Datastore row, select a datastore from the Remote Datastore</td>
</tr>
<tr>
<td></td>
<td>pull-down menu. This selects both the remote and local datastores in a single action.</td>
</tr>
</tbody>
</table>

c) Ensure all the possible remote datastores are set to Do not map this datastore.

d) Click Finish.

Step 3 Select Replication > Replication Pairs > Delete.

Step 4 Enter administrator credentials for the remote cluster and click Delete.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Name field</td>
<td>Enter the administrator user name for the remote HX Storage Cluster.</td>
</tr>
<tr>
<td>Password field</td>
<td>Enter the administrator password for the remote HX Storage Cluster.</td>
</tr>
</tbody>
</table>

Creating a Protection Group

A protection group is a group of VMs with the same replication scheme.

Create protection groups on a local cluster. Protection groups provide protection to the VMs where they are created. If protection groups have protected virtual machines that replicate to the remote cluster, these protection groups are listed in HX Connect.

Note

You can only manage a protection group from its local cluster, the cluster where it is created.

Before you begin

Ensure that replication network and replication pair are configured.
Step 1  Log in to HX Connect as an administrator.
Step 2  Select Replication > Protection Groups > Create Protection Group.
Step 3  Enter the information in the dialog fields.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection Group Name field</td>
<td>Enter a name for the new protection group for this local cluster. Protection groups are unique to each cluster. The name is referenced on the remote cluster, but not editable on the remote cluster. You can create multiple protection groups on the cluster.</td>
</tr>
<tr>
<td>Protect virtual machines in this group every field</td>
<td>Select how often the virtual machines are to be replicated to the paired cluster. Default is every 1 hour. The pull-down menu options are: 5 minutes, 15 minutes, 30 minutes, 1 hour, 90 minutes, 2 hours, 4 hours, 8 hours, 12 hours, 24 hours</td>
</tr>
<tr>
<td>Start protecting the virtual machines immediately radio button</td>
<td>Select this radio button if you want the first replication to start immediately after you add the first virtual machine to this protection group.</td>
</tr>
</tbody>
</table>
| Start protecting the virtual machines at radio button | Select this radio button if you want to set a specific time for the first replication to start.  

Before you start replication ensure:

- At least one virtual machine is added to the protection group.
- The scheduled start time is reached.

To specify the protection start time:

a. Check the Start protecting the virtual machines at radio button.

b. Click in the time field and select an hour and minute. Then click out of the field.

Cluster time zone and Current time on cluster are references to help you to choose the appropriate replication start time. Start time is based on the local cluster clock. For example:

10 hours, 3 minutes from now with Current time on cluster, 1:56:15PM, means that the first replication occurs at 11:59:00PM.

The hours, minutes from now states when the first replication will occur. This is updated when you change the time field setting.

| Use VMware Tools to quiesce the virtual machine check box | To have HX Data Platform quiesce the virtual machines before taking the replication snapshot, click this check box.  

This only applies to virtual machines with VMware Tools installed. |

Step 4  Click Create Protection Group.

HX Data Platform adds the new group to the Protection Groups tab. This protection group is available to protect virtual machines on this cluster.
Step 5  Click the Replication > Protection Groups to view or edit the new protection group.

If the number of VMs is zero, add virtual machines to this new protection group to apply the replication schedule set in this protection group.

Editing Protection Groups

Change the replication interval (schedule) for the virtual machines in the protection group.

Step 1  Login to HX Connect as an administrator.
Step 2  Select Replication > Protection Groups > Edit Schedule.
Step 3  Edit the information in the dialog fields.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protect virtual machines in this group every field</td>
<td>Select from the pull-down list how often the virtual machines are to be replicated to the paired cluster. The options are: 5 minutes, 15 minutes, 30 minutes, 1 hour, 90 minutes, 2 hours, 4 hours, 8 hours, 12 hours, 24 hours</td>
</tr>
<tr>
<td>Use VMware Tools to quiesce the virtual machine check box</td>
<td>To have HX Data Platform quiesce the virtual machines before taking the replication snapshot, click this checkbox. This only applies to virtual machines with VMware Tools installed.</td>
</tr>
</tbody>
</table>

Step 4  Click Save Changes.

HX Data Platform updates the interval and start time for the protection group. See the Protection Groups tab to view the new interval frequency.

Deleting Protection Groups

Before you begin
Remove all virtual machines from the protection group.

Step 1  Select Replication > Protection Groups > protection_group_name
Step 2  Click Delete. Click Delete in the verification pop-up.

Protecting Virtual Machines with an Existing Protection Group

This task describes how to protect multiple virtual machines using an existing protection group.

Using an Existing protection group—Select one or more virtual machines and add them to an existing protection group. The schedule and VMware quiesce option settings are applied to all the virtual machines in
the protection group. When the protection group settings are changed, the changes are applied to all the virtual machines in the protection group.

**Before you begin**

Replication network and replication pair configured.

Create protection group prior to adding the virtual machines.

---

**Step 1**

Log in to HX Connect with administrator privileges and select **Virtual Machines**.

This lists the virtual machines on the local cluster.

**Step 2**

Select two or more unprotected virtual machines from the list.

Click in the virtual machine row to select it. As you click a virtual machine row, the corresponding virtual machine check box is selected.

**Step 3**

Click **Protect**.

The **Protect Virtual Machines** wizard, **Protection Group** page is displayed.

**Step 4**

Click the radio button, **Add to an existing protection group**

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Set the protection parameters table</strong></td>
<td>Verify the selected virtual machine <strong>Name</strong>. Use the <strong>Storage Provisioned</strong> and <strong>Storage Used</strong> to check you have sufficient resources available on the remote HX Storage Cluster.</td>
</tr>
<tr>
<td><strong>Add to an existing protection group</strong> radio button</td>
<td>Select an existing protection group from the pull-down list. The interval and schedule settings of the protection group are applied to this virtual machine.</td>
</tr>
<tr>
<td><strong>Create a new protection group</strong> radio button</td>
<td>Enter a name for the new protection group for this local cluster. Protection groups are unique to each cluster. The name is referenced on the remote cluster, but not editable on the remote cluster. You can create multiple protection groups on the cluster.</td>
</tr>
</tbody>
</table>

**Step 5**

Select a protection group from the pull-down list and click **Next**.

Be sure the protection group you choose has the schedule interval desired.

The **Protect Virtual Machines** wizard, **Summary** page is displayed.

**Step 6**

Confirm the information in the **Summary** page and click **Add to Protection Group**.

HX Data Platform adds the virtual machines to replication protection. View the **Replication** or **Virtual Machines** pages to confirm. Notice on the Replication page the Protection Group is listed.
Protecting Virtual Machines with a New Protection Group

This task describes how to protect multiple virtual machines by creating a new protection group.

Using a New protection group—Select two or more virtual machines and choose to create a new protection group. Define the protection group name, schedule, and VMware quiesce option settings. These settings are applied to all the virtual machines in the protection group. When the protection group settings are changed, the changes are applied to all the virtual machines in the protection group.

Before you begin

Replication network and replication pair configured.

---

**Step 1**
Login to HX Connect with administrator privileges and select Virtual Machines.
This lists the virtual machines on the local cluster.

**Step 2**
Select two or more unprotected virtual machine from the list.
Click in the virtual machine row to select it. As you click a virtual machine row, the corresponding virtual machine checkbox is selected.

**Step 3**
Click Protect.
The Protect Virtual Machines wizard, Protection Group page is displayed.

**Step 4**
Click the radio button, Create a new protection group, add a name for the protection group, and click Next.
The Protection Schedule Wizard Page wizard page is displayed.

**Step 5**
Complete the schedule and VMware quiesce option, as needed, and click Next.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protect virtual machines in this group every field</td>
<td>Select how often the virtual machines are to be replicated to the paired cluster. Default is every 1 hour.</td>
</tr>
<tr>
<td>Start protecting the virtual machines immediately radio button</td>
<td>Select this radio button if you want the first replication to start immediately after you add the first virtual machine to this protection group.</td>
</tr>
</tbody>
</table>
Start protecting the virtual machines at radio button

Select this radio button if you want to set a specific time for the first replication to start. To start replication requires:

- At least one virtual machine is added to the protection group.
- The scheduled start time is reached.

To specify the protection start time:

a. Check the Start protecting the virtual machines at radio button.

b. Click in the time field and select an hour and minute. Then click out of the field.

The hours, minutes from now states when the first replication will occur. This is updated when you change the time field setting.

Cluster time zone and Current time on cluster are references to help you to choose the appropriate replication start time. Start time is based on the local cluster clock. For example:

10 hours, 3 minutes from now with Current time on cluster, 1:56:15PM, means that the first replication occurs at 11:59:00PM.

Use VMware Tools to quiesce the virtual machine check box

To have HX Data Platform quiesce the virtual machines before taking the replication snapshot, click this checkbox. This only applies to virtual machines with VMware Tools installed.

Step 6

Confirm the information in the Summary page and click Add to Protection Group.

Review the summary content to confirm the settings to apply to the selected virtual machines.

- Name of the protection group
- Number of virtual machines to protect
- Names of virtual machines
- Storage provisioned for each virtual machine
- Storage used (consumed) by each virtual machine

HX Data Platform adds the virtual machines to replication protection. View the Replication or Virtual Machines pages to confirm. Notice on the Replication page the Protection Group is listed.
Protecting Individual Virtual Machines

This task describes how to protect a virtual machine.

- **Independently**—Select one virtual machine and configure. You set the replication schedule and the VMware quiesce option for the specific virtual machine. Changes to the replication settings only affect the independently protected virtual machine. The virtual machine is not included in a protection group.

- **Existing protection group**—Select one or more virtual machines and add them to an existing protection group. The schedule and VMware quiesce option settings are applied to all the virtual machines in the protection group. When the protection group settings are changed, the changes are applied to all the virtual machines in the protection group.

**Before you begin**

Replication network and replication pair configured.

---

**Step 1**
Log in to HX Connect with administrator privileges and select **Virtual Machines**.

**Step 2**
Select one unprotected virtual machine from the list. Click in the virtual machine row to select it.

Click in the virtual machine row to select it. As you click a virtual machine row, the corresponding virtual machine check box is selected.

**Step 3**
Click **Protect**.

The **Protect Virtual Machine** dialog box is displayed.

**Step 4**
Complete the fields as needed.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Add to an existing protection group</strong></td>
<td>Select an existing protection group from the pull-down list. The interval and schedule settings of the protection group are applied to this virtual machine. No additional configuration is required, click <strong>Protect Virtual Machine</strong>.</td>
</tr>
<tr>
<td>radio button</td>
<td></td>
</tr>
<tr>
<td><strong>Protect this virtual machine independently</strong></td>
<td>Enables the interval, schedule options, and VMware Tools option for defining protection for this virtual machine.</td>
</tr>
<tr>
<td>radio button</td>
<td></td>
</tr>
<tr>
<td><strong>Protect this virtual machine every field</strong></td>
<td>Select from the pull-down list how often the virtual machines are to be replicated to the paired cluster. The options are: 5 minutes, 15 minutes, 30 minutes, 1 hour, 90 minutes, 2 hours, 4 hours, 8 hours, 12 hours, 24 hours</td>
</tr>
<tr>
<td><strong>Start protecting the virtual machines immediately</strong></td>
<td>Select this radio button if you want the first replication to start immediately after you add the first virtual machine to this protection group.</td>
</tr>
</tbody>
</table>
Essential Information

**UI Element**

**Start protecting the virtual machines at radio button**

Select this radio button if you want to set a specific time for the first replication to start. To start replication requires:

- At least one virtual machine is added to the protection group.
- The scheduled start time is reached.

To specify the protection start time:

**a.** Check the **Start protecting the virtual machines at** radio button.

**b.** Click in the time field and select an hour and minute. Then click out of the field.

The **hours, minutes from now** states when the first replication will occur. This is updated when you change the time field setting.

**Cluster time zone** and **Current time on cluster** are references to help you to choose the appropriate replication start time. Start time is based on the local cluster clock. For example:

10 hours, 3 minutes from now with Current time on cluster, 1:56:15PM, means that the first replication occurs at 11:59:00PM.

**VMware Tools to quiesce the virtual machine check box**

To have HX Data Platform quiesce the virtual machines before taking the replication snapshot, click this checkbox. This only applies to virtual machines with VMware Tools installed.

---

### Step 5

Click **Protect Virtual Machine**.

The virtual machine status is updated in the **Virtual Machine** page and the **Replication** page. Notice on the Replication page no Protection Group is listed.

Replication is now enabled on this virtual machine.

---

### Unprotecting Virtual Machines

**Note**

You do not need to unprotect virtual machines to pause replication for cluster activities. See **Pausing Replication**, on page 213.

**Note**

The Unprotect process may take several minutes to complete if the replication bandwidth is at 50 Mbps or lower and/or high latency (75ms and higher).

---

### Step 1

Log in to HX Connect as an administrator.
Step 2 Select **Virtual Machines**.
Step 3 Select a protected virtual machine from the list. Click in the virtual machine row.
You can unprotect one virtual machine at a time.
Step 4 Click **Unprotect** and click to confirm.
The state changes for the virtual machine from **protected** to **unprotected**.

---

**Disaster Recovery Overview**

Disaster recovery is performed when the source site is unreachable and you want to failover the VMs and the protected groups to the target cluster. The process of recovery recovers the VM on the target cluster. Recovering virtual machines is restoring a most recent replication snapshot from the recovery (target) cluster.

**Testing VM recovery**—Testing VM recovery gives you the ability to test recovery without breaking replication. It can bring up your VM workload on the target to verify the contents of the VM.

**Recovering virtual machines**—Recovering virtual machines is restoring a most recent replication snapshot from the target (recovery) cluster. Once you start Recovery, all the scheduled replication will be stopped.

**Planned migration**—Performing planned migration pauses the replication schedule, replicates the most recent copy, recovers on the target, switches the ownership from the source to the target, and resumes replication on the target that is now the new source.

**Disaster Recovery and Protect**—Recovers the VM on the target, switches the ownership from the source to the target, and resumes replication on the target that is now the new source.

**Protecting VMs after disaster**—In the event of a disaster, you may lose the source site altogether. After the recovery is performed, complete this task to protect the recovered VMs to a newer cluster.

---

**Compatibility Matrix for Disaster Recovery Operations**

The following compatibility matrix lists the DR operations that are supported when a cluster at HX Data Platform version 3.5(x) is paired with a cluster at HX Data Platform version 3.5(x) or 3.0(1x).

<table>
<thead>
<tr>
<th>Feature</th>
<th>3.5(x) Paired With 3.5(x)</th>
<th>3.5(x) Paired With 3.0(1x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replication</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Cluster Pairing</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Datastore Mapping</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Protection</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Planned Migration (Single click using HX Connect)</td>
<td>√</td>
<td>X</td>
</tr>
<tr>
<td>Planned Migration (Multi-step using WebCLI and HX Connect for Recovery)</td>
<td>√</td>
<td>√</td>
</tr>
</tbody>
</table>


### Testing Virtual Machine Recovery

Testing VM recovery gives you the ability to test recovery without breaking replication. It can bring up your VM workload on the target to verify the contents of the VM.

- Testing recovery does not disrupt the running clusters. The intent is to verify, in the event of an actual disaster, that the VMs are recoverable.
- Using the HX Connect user interface, to test VM recovery, you can run a maximum of 10 tasks in a sequence without waiting for the previously submitted task to complete.

#### Before you begin

Before you begin the test virtual machine recovery process, ensure the following:

- The target cluster is up and in good health.
- The protected virtual machines completed a recent replication to the target cluster. These replicated virtual machines are stored as snapshots on the target clusters.

#### Important

Only one copy of the test recovered VM can be made at any point. If you need to have another test recovered VM, please delete the previously created VM.

---

<table>
<thead>
<tr>
<th>Feature</th>
<th>3.5(x) Paired With 3.5(x)</th>
<th>3.5(x) Paired With 3.0(1x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Recover using HX Connect</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Recover using HX Connect</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Re-protect using HX Connect</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>Re-protect (Multi-step stcli or WebCLI)</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

---

**Step 1**

Log in to HX Connect on the target cluster as administrator.

**Step 2**

Navigate to Replication > Remote VMs Tab > protected_vm.

**Step 3**

To test the recovery process, click the Test Recovery button.

**Note**

All the fields listed here are optional.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource Pool</td>
<td>Select a location for the test VM to be stored.</td>
</tr>
</tbody>
</table>
Recovering Virtual Machines

Recovering virtual machines is restoring a most recent replication snapshot from the target (recovery) cluster.
Attention

- Recover VM is not supported between different vSphere versions. If the Target is at a lower version vSphere environment and does not support the hardware version of a protected VM on the primary, VM test recovery and recovery may fail. Cisco recommends to test recover each protected VM to validate the support on the target site.

Upgrade the target environment to enable recovery of protected VMs.

- When running recovery on virtual machines, you may specify explicit network mapping when recovering the VMs to avoid unintentional network connections to recovered VMs.

You can skip specifying network mapping in the following cases:

- If the source VMs use vSphere Standard Switches and if all ESXi hosts on the recovery side have standard switch networks with the same name.

- If the source VMs use vSphere Distributed Switch (vDS) port groups and if the recovery site has identically named vDS port groups.

- If you want to specify network mapping, ensure that both the name and the type of the VM network matches between the source and the target.

- When running recovery on virtual machines that are individually protected, or that are in different protection groups, the maximum number of concurrent recovery operations on a cluster is 20.

Before you begin

Ensure the following:

- The target cluster is up and in good health.

- The protected virtual machines completed a recent replication to the target cluster. These replicated virtual machines are stored as snapshots on the target clusters.

On the target cluster, perform the following to do disaster recovery.

**Step 1**
Log in to HX Connect as administrator.

**Step 2**
Select Replication > > Remote VMs tab > > protected_vm and click Recover.

**Step 3**
To recover the VM and build a new VM on the local cluster, click the Recover VM button.

**Note**
All the fields that are listed here are optional.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource Pool</td>
<td>Select a location for the new VM to be stored.</td>
</tr>
<tr>
<td>Folders</td>
<td>Select a location for the new VM to be stored.</td>
</tr>
<tr>
<td>Power On/Off</td>
<td>By default Power ON option is selected. The recovered VM is powered on or left off after it is created as per the selected option.</td>
</tr>
</tbody>
</table>
Recovering Virtual Machines in Protection Groups

Step 1 Select a protected-vm and click Recover.

All VMs will be moved from the protection group and the selected VMs will be recovered. Recovered VMs show protection status as Recovered and the remaining (protection group) VMs show protection status as Recovering. The protection group will go in Recovered state and is not reusable. You can delete it from the primary site.

The recovered VMs are displayed in the Standalone Protected VMs subpane.

Step 2 Recover the remaining virtual machines from the Standalone Protected VMs subpane, which were a part of the protection group. See Recovering Virtual Machines, on page 206 for more details.

Planned Migration

Performing planned migration pauses the replication schedule, replicates the most recent copy, recovers on the target, switches the ownership from the source to the target, and resumes replication on the target that is now the new source.
Attention

- This process cannot be rolled back.
- For a single vCenter deployment, the Migrate workflow performed entirely through the HX Connect UI is not supported. To perform a planned migration:

1. Using the WebCLI, run the following command to prepare for failover on the source:

   ```
   # stcli dp vm prepareFailover -vmid <VMID>
   ```

   Result: The task ID is returned.

2. Log in to vSphere Web Client Navigator of the primary site and remove the VM from the primary site to unregister the VM.

   Right-click on the virtual machine and select All vCenter Actions > Remove from Inventory.

3. Log in to HX Connect of the secondary site. Select Replication > Remote VMs Tab > protected_vm. Click Migrate.

4. After the Migratetask has completed successfully, log in to vSphere Web Client of the secondary site and manually register the VM.


   b. Right-click on the appropriate datastore and click Browse Datastore.

      Navigate to the virtualmachine name.vmx file, right-click on the file and click Add to Inventory.
      Follow the wizard to manually register the VM.

---

**Step 1**  Log in to HX connect of the target cluster. The target cluster is where the replication snapshots were copied to.

**Step 2**  On the target cluster, select Replication > Remote VMs Tab > protected_vm.

**Step 3**  Click Migrate.

**Note**  All the fields that are listed here are optional.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource Pool</td>
<td>Select a location for the new VM to be stored.</td>
</tr>
<tr>
<td>Folders drop-down list</td>
<td>Select a location for the new VM to be stored.</td>
</tr>
<tr>
<td>Power On/Off</td>
<td>By default Power ON option is selected. The recovered VM is powered on or left off after it is created as per the selected option.</td>
</tr>
</tbody>
</table>
## Migrating Virtual Machines in Protection Groups

Using the HX Connect user interface, to migrate VMs, you can run a maximum of 4 tasks in a sequence without waiting for the previously submitted task to complete.

### Step 1
Select a **protected-vm** and click **Migrate**.

All the VMs are now moved out from the protection group and are displayed in the **Standalone Protected VMs** subpane. Only the selected VM is recovered.

### Step 2
Migrate the remaining virtual machines from the **Standalone Protected VMs** subpane, which were a part of the protection group. See **Planned Migration, on page 208** for more details.

## Disaster Recovery and Re-protect

Performing disaster recovery recovers the VM on the target, switches the ownership from the source to the target, and resumes replication on the target that is now the new source. Disaster recovery is typically done when disaster occurs, and when you want to reverse the direction of protection.
Attention

- This process cannot be rolled back.
- For a single vCenter deployment, the Disaster Recovery workflow performed entirely through the HX Connect UI is not supported. To perform Disaster Recovery and Re-protect:

1. Log in to vSphere Web Client Navigator of the primary site and remove the VM from the primary site to unregister the VM.
   
   Right-click on the virtual machine and select **All vCenter Actions > Remove from Inventory**.

2. Log in to HX Connect of the secondary site. Select **Replication > Remote VMs Tab** > protected_vm. Click **Recover**.

3. When the primary site comes back up, log in to HX Connect of the secondary site. Select **Replication > Remote VMs Tab** > protected_vm. Click **Re-protect**.

4. After Re-protect has completed successfully, log in to vSphere Web Client of the secondary site and manually register the VM.
   
   a. Log in to vSphere Web Client Navigator. Select **Configuration > Storage**.
   
   b. Right-click on the appropriate datastore and click **Browse Datastore**.

   Navigate to the **virtualmachine name**.vmx file, right-click on the file and click **Add to Inventory**. Follow the wizard to manually register the VM.

- Using the HX Connect user interface, you can run a maximum of 5 re-protect tasks in a sequence without waiting for the previously submitted task to complete.

---

**Step 1**
Log in to HX connect of the source and the target. The target cluster is where the replication snapshots were copied to. The source cluster is the cluster where the virtual machines reside.

**Step 2**
Select a VM from the remote VM list. Execute Recover VM on this cluster workflow.

**Note**
If both the target and source clusters are on the same vCenter, then unregister the VM on the source cluster. This ensures that vCenter no longer has a record of the VM and it stops managing the VM, but it retains the data for the VM.

**Step 3**
Select **Replication > Remote VMs tab > protected_vm** and click **Recover**.

**Step 4**
To recover on the target VM and build a new VM on the local cluster, click the **Recover VM** button.

Complete the following fields in the **Recover VM on this cluster** dialog box.

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Essential Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Resource Pool</strong> drop-down list</td>
<td>Select a location for the new VM to be stored.</td>
</tr>
<tr>
<td><strong>Folders</strong> drop-down list</td>
<td>Select a location for the new VM to be stored.</td>
</tr>
<tr>
<td><strong>Power On/Off</strong> radio button</td>
<td>By default Power ON option is selected. The recovered VM is powered on or left off after it is created as per the selected option.</td>
</tr>
</tbody>
</table>
Select to create a map between the source and target cluster networks.

- **Source Network**—Network name at the source side on which the VM is connected.
- **Target Network**—Select target network from the drop-down list, where the VM has to be connected.

Network options for example:

- Storage Controller Data Network
- Storage Controller Management Network
- Storage Controller Replication Network
- VM Network

---

**Step 5**
Click **Recover VM**.

**Step 6**
On the target cluster, select **Replication > Remote VMs Tab > protected_vm**.

**Step 7**
Click **Re-protect**.

**Attention**
- If both the target cluster and source cluster are on the same vCenter, manually register the VM on the source cluster.
- When the Re-protect task fails and in the HX Connect UI the **Re-protect** tab is not available, execute `stcli reverseprotect` to complete the Re-protect operation.

Protection status of the VM shows as **Protected**.

**Step 8**
After the original primary comes up, to migrate back to the primary do the following:

a) On the target cluster, select **Replication > Remote VMs Tab > protected_vm**.

b) Click **Migrate** to unregister the target VM and transfer the VM ownership to the original primary.

Protection status of the VM shows as **Protected**.

---

**Protecting Virtual Machines After Disaster**

In the event of a disaster, you may lose the source site altogether. After the recovery is performed, you may want to protect the recovered VMs to a newer cluster.

**Step 1**
Recover the Virtual Machines. Perform standalone recovery (Recovering VMs) or group recovery (Recovering VMs in protection groups). See **Recovering Virtual Machines, on page 206** for more details.

**Step 2**
Forget the pairing, run the following command in the HX Connect WebCLI:

```bash
stcli dp peer forget --all
```

Now the cluster is no longer paired to the original source.

**Step 3**
Unprotect all the local and remote VMs. See **Unprotecting Virtual Machines, on page 203** for more details.
Step 4  Pair to the new cluster. See the Creating a Replication Pair section for more details.
Step 5  Protect the virtual machines.

Replication Maintenance Overview

Replication, when configured, runs in the background as per the defined schedule. Replication maintenance tasks include:

- **Testing recovery**—Testing if the recovery methods are working. See Testing Virtual Machine Recovery, on page 205 for more details.

- **Pausing replication**—When you are preparing to upgrade the HX Storage Cluster and you have replication configured, you must pause the replication activity.

  Use the `stcli dp schedule pause` command.

- **Resuming replication**—After HX Storage Cluster maintenance activities are complete, resume the replication schedule.

  Use the `stcli dp schedule resume` command.

- **Migration**—The option to shift VMs from one source cluster to the replication paired target cluster, making the target cluster the new source cluster for the migrated VMs. See Planned Migration for more details.

Pausing Replication

Before you perform a storfs or platform upgrade, if replication is configured in the network, you must pause the replication activity.

Step 1  Log in to a Storage Controller VM.
Step 2  From the command line, run the `stcli dp schedule pause` command.
Step 3  Perform your upgrade task.
Step 4  Resume the replication schedule.

Resuming Replication

After successfully upgrading the HX Storage Cluster which had replication configured, do the following to resume the replication schedule.

**Before you begin**

Ensure your HX Storage Cluster is paused and you have completed your maintenance or upgrade tasks.

Step 1  Login to a Storage Controller VM.
Step 2  
From the command line, run the `stcli dp schedule resume` command.

The previously configured replication schedule for all the protected virtual machines begins.
Managing Cisco HyperFlex Users Overview

The user types allowed to perform actions on or view content in the HX Data Platform, include:

- **admin**—A predefined user included with Cisco HX Data Platform. The password is set during HX Cluster creation. Same password is applied to root. This user has read and modify permissions.

- **root**—A predefined user included with Cisco HX Data Platform. The password is set during HX Cluster creation. Same password is applied to admin. This user has read and modify permissions.

- **administrator**—A created Cisco HX Data Platform user. This user is created through vCenter and assigned the RBAC role, administrator. This user has read and modify permissions. The password is set during user creation.

- **read-only**—A created Cisco HX Data Platform user. This user is created through vCenter and assigned the RBAC role, read-only. This user only has read permissions. The password is set during user creation.

<table>
<thead>
<tr>
<th>HX Interface</th>
<th>admin</th>
<th>root</th>
<th>hx_admin</th>
<th>hx_readonly</th>
</tr>
</thead>
<tbody>
<tr>
<td>HX Data Platform Installer</td>
<td>Required</td>
<td>Optional</td>
<td>Not valid</td>
<td>Not valid</td>
</tr>
<tr>
<td>HX Connect</td>
<td>Can perform most HX tasks.</td>
<td>Not valid</td>
<td>Can perform most HX tasks.</td>
<td>Can only view monitoring information.</td>
</tr>
<tr>
<td></td>
<td>Example: local/admin</td>
<td></td>
<td></td>
<td>A preferred user.</td>
</tr>
</tbody>
</table>
User Management Terms

- **Authentication**—For login credentials. These processes verify user credentials for a named user, usually based on a username and password. Authentication generally verifies user credentials and associates a session with the authenticated user.

- **Authorization**—For access permissions. These processes allow a user/client application to perform some action, such as create, read, update, or delete a managed entity or execute a program, based on the user's identity. Authorization defines what an authenticated user is allowed to do on the server.

- **Accounting**—For tracking user actions. These processes perform record-keeping and track user activities including login sessions and command executions. The information is stored in logs. These logs are included in the support bundle that can be generated through Cisco HX Connect or other Cisco HX Data Platform interface.

- **Identity**—Individuals are provisioned with identities that are assigned roles with granted permissions.

- **Permission**—Settings given to roles to use the Resource. It is the link between roles, resource and the function exposed by the resource. For example, Datastore is a resource and a modifying role is granted permission to mount the datastore, while a read only role can only view that the datastore exists.
• **Privilege**—The link between Identity and the application. It is used in the context of specific interaction with the application. Examples: Power On a Virtual Machine, Create a Datastore, or Rename a datastore.

• **Resource**—The entire Cisco HX Platform, whose functionality and management controls are exposed over HTTP using GET, POST, PUT, DELETE, HEAD and other HTTP verbs. Datastores, Disks, Controller Nodes, Cluster Attributes, are all resources that are exposed to client applications using REST API.

• **Role**—Defines an authority level. An application function may be performed by one or more roles. Examples: Administrator, Virtual Machine Administrator, or Resource Pool Administrator. Role is assigned to a given Identity.

### Audit Logs for AAA Accounting

To support AAA accounting, Cisco HX Data Platform implements audit logs of user activity. These logs are included in the generated support bundle.

See the *Cisco HyperFlex Systems Troubleshooting Guide* for information on generating the support bundles through HX Data Platform interfaces, including Cisco HX Connect.

- **stMgrAudit.log**—Contains audit record of `stcli` activity.

  Sample entry. Note the keyword, `Audit`.

  2017-03-27-22:10:02.528 [pool-1-thread-1] INFO Audit - 2017-03-27-03.10.02 127.0.0.1 --> 127.0.0.1 POST /stmgr 200 : root 27ms

  This file contains other information as well. To filter for audit events, use a script to filter for the word, `Audit`.

- **audit.log**—Contains audit records for REST API activity.

  Sample entry. Note the user name, `administrator@vsphere.local`

  2017-03-29-01:47:28.779 - 127.0.0.1 -> 127.0.0.1 - GET /rest/clusters 200; administrator@vsphere.local 454ms

### Creating Cisco HX Data Platform RBAC Users

Cisco HX Data Platform supports two users: Administrator and Read Only. New users are created for the HX Data Platform through the VMware vCenter interface.

**Before you begin**

Creating users requires Administrator privileges.

**Step 1**

Login to vSphere Web Client as a vCenter administrator.

**Step 2**

From **Navigator Home**, **Administration** > **Users and Groups** > **Users**.

**Step 3**

Click **Add (+)** icon to add a user. Then complete the **New User** information and click **OK**.

Specify a user name and password for the new user.
For passwords, do not use escape character (\), dollar sign ($), question mark (?), equal sign (=). In user names, the only special characters allowed are underscore (_), dash (-), dot (.). See HX Data Platform Names, Passwords, and Characters, on page 20 for user name and password requirements.

What to do next
Add the user to an RBAC role group. See Assigning Users Privileges, on page 218.

Assigning Users Privileges
Privileges are assigned to users through the RBAC roles in vCenter. To assign privileges, add users to either the Administrator or Read-only group.

Before you begin
Create the user.

Step 1
From the Cisco vSphere Web Client, select Navigator Home > Administration > Global Permissions > Manage.

Step 2
Click Add (+) icon to assign roles.

Step 3
Select an Assigned Role.

In the Global Permission Root - Add Permission dialog box, select from the Assigned Role drop down menu. Choose one:

- Administrator
- Read only

Step 4
In the Users and Groups area, click Add.

Step 5
In the Select Users/Groups dialog box, select the user_name and click Add.

Step 6
Click Check names button, to verify the user name.

Step 7
Then click OK to close out of each dialog box.