



System upgrade procedures

NetApp HCI

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System upgrade procedures

Update management services

You can update your management services to the latest bundle version after you have installed management node 11.3 or later.

Beginning with the Element 11.3 management node release, the management node design has been changed based on a new modular architecture that provides individual services. These modular services provide central and extended management functionality for NetApp HCI systems. Management services include system telemetry, logging, and update services, the QoSIOC service for Element Plug-in for vCenter Server, NetApp Hybrid Cloud Control, and more.

About this task

- You must upgrade to the latest management services bundle before upgrading your Element software.



The management services 2.27 bundle includes Element Plug-in for vCenter Server 5.5, which is only compatible with management node 12.8. When you update to management services 2.27, you must change the upgrade sequence and update the management services bundle *after* upgrading to Element 12.8 to have compatibility between the management node and management services.



- Management services 2.22.7 includes Element Plug-in for vCenter Server 5.0 which contains the remote plug-in. If you use the Element plug-in, you should upgrade to management services 2.22.7 or later to comply with the VMware directive that removes support for local plug-ins. [Learn more](#).
- For the latest management services release notes describing major services, new features, bug fixes, and workarounds for each service bundle, see [the management services release notes](#)

What you'll need

Beginning with management services 2.20.69, you must accept and save the End User License Agreement (EULA) before using the NetApp Hybrid Cloud Control UI or API to upgrade management services:

1. Open the IP address of the management node in a web browser:

```
https://<ManagementNodeIP>
```

2. Log in to NetApp Hybrid Cloud Control by providing the storage cluster administrator credentials.
3. Select **Upgrade** near the top right of the interface.
4. The EULA pops up. Scroll down, select **I accept for current and all future updates**, and select **Save**.

Update options

You can update management services using the NetApp Hybrid Cloud Control UI or the management node REST API:

- [Update management services using Hybrid Cloud Control \(Recommended method\)](#)

- [Update management services using the management node API](#)

Update management services using Hybrid Cloud Control

You can update your NetApp management services using NetApp Hybrid Cloud Control.

Management service bundles provide enhanced functionality and fixes to your installation outside of major releases.

Before you begin

- You are running management node 11.3 or later.
- If you are updating management services to version 2.16 or later and you are running a management node 11.3 to 11.8, you will need to increase your management node VM's RAM prior to updating management services:
 - a. Power off the management node VM.
 - b. Change the RAM of the management node VM from 12GB to 24GB RAM.
 - c. Power on the management node VM.
- Your cluster version is running NetApp Element software 11.3 or later.
- You have upgraded your management services to at least version 2.1.326. NetApp Hybrid Cloud Control upgrades are not available in earlier service bundles.



For a list of available services for each service bundle version, see the [Management Services Release Notes](#).

Steps

1. Open the IP address of the management node in a web browser:

```
https://<ManagementNodeIP>
```

2. Log in to NetApp Hybrid Cloud Control by providing the storage cluster administrator credentials.
3. Select **Upgrade** near the top right of the interface.
4. On the Upgrades page, select the **Management Services** tab.
5. Follow the instructions on the page to download and save a management services upgrade package to your computer.
6. Select **Browse** to locate the package you saved and upload it.

After you upload the package, the upgrade starts automatically.

After the upgrade begins, you can see the upgrade status on this page. During the upgrade, you might lose connection with NetApp Hybrid Cloud Control and have to log back in to see the results of the upgrade.

Update management services using the management node API

Users should ideally perform management services updates from NetApp Hybrid Cloud Control. You can however manually upload, extract, and deploy a service bundle update for management services to the management node using the REST API. You can run each command from the REST API UI for the

management node.

Before you begin

- You have deployed a NetApp Element software management node 11.3 or later.
- If you are updating management services to version 2.16 or later and you are running a management node 11.3 to 11.8, you will need to increase your management node VM's RAM prior to updating management services:
 - a. Power off the management node VM.
 - b. Change the RAM of the management node VM from 12GB to 24GB RAM.
 - c. Power on the management node VM.
- Your cluster version is running NetApp Element software 11.3 or later.
- You have upgraded your management services to at least version 2.1.326. NetApp Hybrid Cloud Control upgrades are not available in earlier service bundles.



For a list of available services for each service bundle version, see the [Management Services Release Notes](#).

Steps

1. Open the REST API UI on the management node:

`https://<ManagementNodeIP>/mnode`

2. Select **Authorize** and complete the following:

- a. Enter the cluster user name and password.
- b. Enter the client ID as `mnode-client` if the value is not already populated.
- c. Select **Authorize** to begin a session.
- d. Close the window.

3. Upload and extract the service bundle on the management node using this command: `PUT /services/upload`

4. Deploy the management services on the management node: `PUT /services/deploy`

5. Monitor the status of the update: `GET /services/update/status`

A successful update returns a result similar to the following example:

```
{  
  "current_version": "2.10.29",  
  "details": "Updated to version 2.17.52",  
  "status": "success"  
}
```

Find more information

[NetApp Element Plug-in for vCenter Server](#)

Run Element storage health checks prior to upgrading storage

You must run health checks prior to upgrading Element storage to ensure all storage nodes in your cluster are ready for the next Element storage upgrade.

What you'll need

- **Management services:** You have updated to the latest management services bundle (2.10.27 or later).



You must upgrade to the latest management services bundle before upgrading your Element software.

- **Management node:** You are running management node 11.3 or later.
- **Element software:** Your cluster version is running NetApp Element software 11.3 or later.
- **End User License Agreement (EULA):** Beginning with management services 2.20.69, you must accept and save the EULA before using the NetApp Hybrid Cloud Control UI or API to run Element storage health checks:
 1. Open the IP address of the management node in a web browser:

```
https://<ManagementNodeIP>
```

2. Log in to NetApp Hybrid Cloud Control by providing the storage cluster administrator credentials.
3. Select **Upgrade** near the top right of the interface.
4. The EULA pops up. Scroll down, select **I accept for current and all future updates**, and select **Save**.

Health check options

You can run health checks using the NetApp Hybrid Cloud Control UI or the NetApp Hybrid Cloud Control API:

- [Use NetApp Hybrid Cloud Control to run Element storage health checks prior to upgrading storage](#) (Preferred method)
- [Use API to run Element storage health checks prior to upgrading storage](#)

You can also find out more about storage health checks that are run by the service:

- [Storage health checks made by the service](#)

Use NetApp Hybrid Cloud Control to run Element storage health checks prior to upgrading storage

Using NetApp Hybrid Cloud Control (HCC), you can verify that a storage cluster is ready to be upgraded.

Steps

1. Open the IP address of the management node in a web browser:

```
https://<ManagementNodeIP>
```

2. Log in to NetApp Hybrid Cloud Control by providing the storage cluster administrator credentials.
3. Select **Upgrade** near the top right of the interface.
4. On the **Upgrades** page, select the **Storage** tab.
5.  Select the health check  for the cluster you want to check for upgrade readiness.
6. On the **Storage Health Check** page, select **Run Health Check**.
7. If there are issues, do the following:
 - a. Go to the specific KB article listed for each issue or perform the specified remedy.
 - b. If a KB is specified, complete the process described in the relevant KB article.
 - c. After you have resolved cluster issues, select **Re-Run Health Check**.

After the health check completes without errors, the storage cluster is ready to upgrade. See storage node upgrade [instructions](#) to proceed.

Use API to run Element storage health checks prior to upgrading storage

You can use REST API to verify that a storage cluster is ready to be upgraded. The health check verifies that there are no obstacles to upgrading, such as pending nodes, disk space issues, and cluster faults.

Steps

1. Locate the storage cluster ID:
 - a. Open the management node REST API UI on the management node:

```
https://<ManagementNodeIP>/mnode
```
 - b. Select **Authorize** and complete the following:
 - i. Enter the cluster user name and password.
 - ii. Enter the client ID as `mnode-client` if the value is not already populated.
 - iii. Select **Authorize** to begin a session.
 - iv. Close the authorization window.
 - c. From the REST API UI, select `GET /assets`.
 - d. Select **Try it out**.
 - e. Select **Execute**.
 - f. From the response, copy the "`id`" from the "storage" section of the cluster you intend to check for upgrade readiness.



Do not use the "parent" value in this section because this is the management node's ID, not the storage cluster's ID.

```
"config": {},  
"credentialId": "12bbb2b2-f1be-123b-1234-12c3d4bc123e",  
"host_name": "SF_DEMO",  
"id": "12cc3a45-e6e7-8d91-a2bb-0bdb3456b789",  
"ip": "10.123.12.12",  
"parent": "d123ec42-456e-8912-ad3e-4bd56f4a789a",  
"sshcredentialId": null,  
"ssl_certificate": null
```

2. Run health checks on the storage cluster:

- Open the storage REST API UI on the management node:

```
https://<ManagementNodeIP>/storage/1/
```

- Select **Authorize** and complete the following:

- Enter the cluster user name and password.
- Enter the client ID as `mnnode-client` if the value is not already populated.
- Select **Authorize** to begin a session.
- Close the authorization window.

- Select **POST /health-checks**.

- Select **Try it out**.

- In the parameter field, enter the storage cluster ID obtained in Step 1.

```
{  
  "config": {},  
  "storageId": "123a45b6-1a2b-12a3-1234-1a2b34c567d8"  
}
```

- Select **Execute** to run a health check on the specified storage cluster.

The response should indicate state as `initializing`:

```

{
  "_links": {
    "collection": "https://10.117.149.231/storage/1/health-checks",
    "log": "https://10.117.149.231/storage/1/health-checks/358f073f-896e-4751-ab7b-ccbb5f61f9fc/log",
    "self": "https://10.117.149.231/storage/1/health-checks/358f073f-896e-4751-ab7b-ccbb5f61f9fc"
  },
  "config": {},
  "dateCompleted": null,
  "dateCreated": "2020-02-21T22:11:15.476937+00:00",
  "healthCheckId": "358f073f-896e-4751-ab7b-ccbb5f61f9fc",
  "state": "initializing",
  "status": null,
  "storageId": "c6d124b2-396a-4417-8a47-df10d647f4ab",
  "taskId": "73f4df64-bda5-42c1-9074-b4e7843dbb77"
}

```

g. Copy the healthCheckID that is part of response.

3. Verify the results of the health checks:

- Select **GET /health-checks/{healthCheckId}**.
- Select **Try it out**.
- Enter the health check ID in the parameter field.
- Select **Execute**.
- Scroll to the bottom of the response body.

If all health checks are successful, the return is similar to the following example:

```

"message": "All checks completed successfully.",
"percent": 100,
"timestamp": "2020-03-06T00:03:16.321621Z"

```

4. If the message return indicates that there were problems regarding cluster health, do the following:

- Select **GET /health-checks/{healthCheckId}/log**
- Select **Try it out**.
- Enter the health check ID in the parameter field.
- Select **Execute**.
- Review any specific errors and obtain their associated KB article links.
- Go to the specific KB article listed for each issue or perform the specified remedy.
- If a KB is specified, complete the process described in the relevant KB article.
- After you have resolved cluster issues, run **GET /health-checks/{healthCheckId}/log** again.

Storage health checks made by the service

Storage health checks make the following checks per cluster.

Check Name	Node/Cluster	Description
check_async_results	Cluster	Verifies that the number of asynchronous results in the database is below a threshold number.
check_cluster_faults	Cluster	Verifies that there are no upgrade blocking cluster faults (as defined in Element source).
check_upload_speed	Node	Measures the upload speed between the storage node and the management node.
connection_speed_check	Node	Verifies that nodes have connectivity to the management node serving upgrade packages and estimates connection speed.
check_cores	Node	Checks for kernel crash dump and core files on the node. The check fails for any crashes in a recent time period (threshold 7 days).
check_root_disk_space	Node	Verifies the root file system has sufficient free space to perform an upgrade.
check_var_log_disk_space	Node	Verifies that /var/log free space meets some percentage free threshold. If it does not, the check will rotate and purge older logs in order to fall under threshold. The check fails if it is unsuccessful at creating sufficient free space.
check_pending_nodes	Cluster	Verifies that there are no pending nodes on the cluster.

Find more information

[NetApp Element Plug-in for vCenter Server](#)

Upgrade Element software

To upgrade NetApp Element software, you can use the NetApp Hybrid Cloud Control UI or REST API. Certain operations are suppressed during an Element software upgrade, such as adding and removing nodes, adding and removing drives, and commands associated with initiators, volume access groups, and virtual networks, among others.

CAUTION:

The management services 2.27 bundle includes Element Plug-in for vCenter Server 5.5, which is only compatible with management node 12.8. When you update to management services 2.27, you must change the upgrade sequence and update the management services bundle after upgrading to Element 12.8 to ensure compatibility between the management node and management services.

If you're updating to management services 2.21.61 through 2.26.40, you must update the management services bundle before upgrading to Element 12.8.

Before you begin

- **Admin privileges:** You have storage cluster administrator permissions to perform the upgrade.
- **Valid upgrade path:** You have checked upgrade path information for the Element version you are upgrading to and verified that the upgrade path is valid. See [NetApp KB: Upgrade matrix for storage clusters running NetApp Element Software](#)

Beginning with Element 12.5, NetApp HealthTools is no longer supported for Element software upgrades. If you are running Element 11.0 or 11.1, you must first [upgrade to Element 12.3 using HealthTools](#) and then upgrade to Element 12.5 or later using NetApp Hybrid Cloud Control.

- **System time sync:** You have ensured that the system time on all nodes is synced and that NTP is correctly configured for the storage cluster and nodes. Each node must be configured with a DNS nameserver in the per-node web UI ([https://\[IP address\]:442](https://[IP address]:442)) with no unresolved cluster faults related to time skew.
- **System ports:** If you are using NetApp Hybrid Cloud Control for upgrades, you have ensured that the necessary ports are open. See [Network ports](#) for more information.
- **Management node:** For NetApp Hybrid Cloud Control UI and API, the management node in your environment is running version 11.3.
- **Cluster health:** You have verified that the cluster is ready to be upgraded. See [Run Element storage health checks prior to upgrading storage](#).
- **Updated baseboard management controller (BMC) for H610S nodes:** You have upgraded the BMC version for your H610S nodes. See the [release notes and upgrade instructions](#).
- **Upgrade process time:** You have scheduled sufficient time to perform your upgrade. When you upgrade to Element software 12.5 or later, the upgrade process time varies depending on your current Element software version and firmware updates.

Storage Node	Current Element software version	Approximate software and firmware install time per node ¹	Approximate data synchronization time per node ²	Approximate total upgrade time per node
All SolidFire and NetApp H-series nodes with up-to-date firmware	12.x	15 minutes	10 to 15 minutes	20 to 30 minutes
H610S and H410S	12.x and 11.8	60 minutes	30 to 60 minutes	90 to 120 minutes

Storage Node	Current Element software version	Approximate software and firmware install time per node ¹	Approximate data synchronization time per node ²	Approximate total upgrade time per node
H610S	11.7 and earlier	90 minutes	40 to 70 minutes	130 to 160 minutes You must also perform a complete node shutdown and power disconnect for each H610S node.

¹For a complete matrix of firmware and driver firmware for your hardware, see [supported firmware and ESXi driver versions for NetApp HCI](#) and [firmware versions for NetApp HCI storage nodes](#).

²If you combine a cluster with a heavy write IOPS load with a longer firmware update time, the data synchronization time will increase.

- **End User License Agreement (EULA):** Beginning with management services 2.20.69, you must accept and save the EULA before using the NetApp Hybrid Cloud Control UI or API to upgrade Element software:

1. Open the IP address of the management node in a web browser:

```
https://<ManagementNodeIP>
```

2. Log in to NetApp Hybrid Cloud Control by providing the storage cluster administrator credentials.
3. Select **Upgrade** near the top right of the interface.
4. The EULA pops up. Scroll down, select **I accept for current and all future updates**, and select **Save**.

Upgrade options

Choose one of the following Element software upgrade options:

- [Use NetApp Hybrid Cloud Control UI to upgrade Element storage](#)
- [Use NetApp Hybrid Cloud Control API to upgrade Element storage](#)

 If you are upgrading an H610S series node to Element 12.5 or later and the node is running a version of Element software earlier than 11.8, you will need to perform the additional upgrade steps in this [KB article](#) for each storage node. If you are running Element 11.8 or later, the additional upgrade steps are not required.

Use NetApp Hybrid Cloud Control UI to upgrade Element storage

Using the NetApp Hybrid Cloud Control UI, you can upgrade a storage cluster.

 For potential issues while upgrading storage clusters using NetApp Hybrid Cloud Control and their workarounds, see this [KB article](#).

Steps

1. Open the IP address of the management node in a web browser:

```
https://<ManagementNodeIP>
```

2. Log in to NetApp Hybrid Cloud Control by providing the storage cluster administrator credentials.
3. Select **Upgrade** near the top right of the interface.
4. On the **Upgrades** page, select **Storage**.

The **Storage** tab lists the storage clusters that are part of your installation. If a cluster is inaccessible by NetApp Hybrid Cloud Control, it will not be displayed on the **Upgrades** page.

5. Choose from the following options and perform the set of steps that are applicable to your cluster:

Option	Steps
All clusters running Element 11.8 and later	<ol style="list-style-type: none"> 1. Select Browse to upload the upgrade package that you downloaded. 2. Wait for the upload to complete. A progress bar shows the status of the upload. <p> The file upload will be lost if you navigate away from the browser window.</p> <p>An on-screen message is displayed after the file is successfully uploaded and validated. Validation might take several minutes. If you navigate away from the browser window at this stage, the file upload is preserved.</p> <ol style="list-style-type: none"> 3. Select Begin Upgrade. <p> The Upgrade Status changes during the upgrade to reflect the status of the process. It also changes in response to actions you take, such as pausing the upgrade, or if the upgrade returns an error. See Upgrade status changes.</p> <p> While the upgrade is in progress, you can leave the page and come back to it later to continue monitoring the progress. The page does not dynamically update status and current version if the cluster row is collapsed. The cluster row must be expanded to update the table or you can refresh the page.</p> <p>You can download logs after the upgrade is complete.</p>

Option	Steps
You are upgrading an H610S cluster running Element version earlier than 11.8.	<ol style="list-style-type: none"> 1. Select the drop-down arrow next to the cluster you are upgrading, and select from the upgrade versions available. 2. Select Begin Upgrade. After the upgrade is complete, the UI prompts you to perform additional upgrade steps. 3. Complete the additional steps required in the KB article, and acknowledge in the UI that you have completed them. <p>You can download logs after the upgrade is complete. For information about the various upgrade status changes, see Upgrade status changes.</p>

Upgrade status changes

Here are the different states that the **Upgrade Status** column in the UI shows before, during, and after the upgrade process:

Upgrade state	Description
Up to Date	The cluster was upgraded to the latest Element version available.
Versions Available	Newer versions of Element and/or storage firmware are available for upgrade.
In Progress	The upgrade is in progress. A progress bar shows the upgrade status. On-screen messages also show node-level faults and display the node ID of each node in the cluster as the upgrade progresses. You can monitor the status of each node using the Element UI or the NetApp Element plug-in for vCenter Server UI.
Upgrade Pausing	You can choose to pause the upgrade. Depending on the state of the upgrade process, the pause operation can succeed or fail. You will see a UI prompt asking you to confirm the pause operation. To ensure that the cluster is in a safe spot before pausing an upgrade, it can take up to two hours for the upgrade operation to be completely paused. To resume the upgrade, select Resume .
Paused	You paused the upgrade. Select Resume to resume the process.

Upgrade state	Description
Error	An error has occurred during the upgrade. You can download the error log and send it to NetApp Support. After you resolve the error, you can return to the page, and select Resume . When you resume the upgrade, the progress bar goes backwards for a few minutes while the system runs the health check and checks the current state of the upgrade.
Complete with Follow-up	Only for H610S nodes upgrading from Element version earlier than 11.8. After phase 1 of the upgrade process is complete, this state prompts you to perform additional upgrade steps (see the KB article). After you complete these additional steps and acknowledge that you have completed it, the status changes to Up to Date .

Use NetApp Hybrid Cloud Control API to upgrade Element storage

You can use APIs to upgrade storage nodes in a cluster to the latest Element software version. You can use an automation tool of your choice to run the APIs. The API workflow documented here uses the REST API UI available on the management node as an example.

Steps

1. Download the storage upgrade package to a device that is accessible to the management node; go to the NetApp HCI software [downloads page](#) and download the latest storage node image.
2. Upload the storage upgrade package to the management node:
 - a. Open the management node REST API UI on the management node:

`https://<ManagementNodeIP>/package-repository/1/`
 - b. Select **Authorize** and complete the following:
 - i. Enter the cluster user name and password.
 - ii. Enter the client ID as `mnode-client`.
 - iii. Select **Authorize** to begin a session.
 - iv. Close the authorization window.
 - c. From the REST API UI, select **POST /packages**.
 - d. Select **Try it out**.
 - e. Select **Browse** and select the upgrade package.
 - f. Select **Execute** to initiate the upload.
 - g. From the response, copy and save the package ID ("`id`") for use in a later step.
3. Verify the status of the upload.
 - a. From the REST API UI, select **GET /packages/{id}/status**.
 - b. Select **Try it out**.

- c. Enter the package ID you copied in the previous step in **id**.
- d. Select **Execute** to initiate the status request.

The response indicates state as SUCCESS when complete.

4. Locate the storage cluster ID:
 - a. Open the management node REST API UI on the management node:

```
https://<ManagementNodeIP>/inventory/1/
```

- b. Select **Authorize** and complete the following:
 - i. Enter the cluster user name and password.
 - ii. Enter the client ID as `mnode-client`.
 - iii. Select **Authorize** to begin a session.
 - iv. Close the authorization window.
 - c. From the REST API UI, select **GET /installations**.
 - d. Select **Try it out**.
 - e. Select **Execute**.
 - f. From the response, copy the installation asset ID ("id").
 - g. From the REST API UI, select **GET /installations/{id}**.
 - h. Select **Try it out**.
 - i. Paste the installation asset ID into the **id** field.
 - j. Select **Execute**.
 - k. From the response, copy and save the storage cluster ID ("id") of the cluster you intend to upgrade for use in a later step.

5. Run the storage upgrade:
 - a. Open the storage REST API UI on the management node:

```
https://<ManagementNodeIP>/storage/1/
```

- b. Select **Authorize** and complete the following:
 - i. Enter the cluster user name and password.
 - ii. Enter the client ID as `mnode-client`.
 - iii. Select **Authorize** to begin a session.
 - iv. Close the authorization window.
 - c. Select **POST /upgrades**.
 - d. Select **Try it out**.
 - e. Enter the upgrade package ID in the parameter field.

f. Enter the storage cluster ID in the parameter field.

The payload should look similar to the following example:

```
{  
  "config": { },  
  "packageId": "884f14a4-5a2a-11e9-9088-6c0b84e211c4",  
  "storageId": "884f14a4-5a2a-11e9-9088-6c0b84e211c4"  
}
```

g. Select **Execute** to initiate the upgrade.

The response should indicate the state as initializing:

```
{
  "_links": {
    "collection": "https://localhost:442/storage/upgrades",
    "self": "https://localhost:442/storage/upgrades/3fa85f64-1111-4562-b3fc-2c963f66abc1",
    "log": "https://localhost:442/storage/upgrades/3fa85f64-1111-4562-b3fc-2c963f66abc1/log
  },
  "storageId": "114f14a4-1ala-11e9-9088-6c0b84e200b4",
  "upgradeId": "334f14a4-1ala-11e9-1055`-6c0b84e2001b4",
  "packageId": "774f14a4-1ala-11e9-8888-6c0b84e200b4",
  "config": {},
  "state": "initializing",
  "status": {
    "availableActions": [
      "string"
    ],
    "message": "string",
    "nodeDetails": [
      {
        "message": "string",
        "step": "NodePreStart",
        "nodeID": 0,
        "numAttempt": 0
      }
    ],
    "percent": 0,
    "step": "ClusterPreStart",
    "timestamp": "2020-04-21T22:10:57.057Z",
    "failedHealthChecks": [
      {
        "id": "3fa85f64-1111-4562-b3fc-2c963f66abc1"
      }
    ]
  }
}
```

```

    "checkID": 0,
    "name": "string",
    "displayName": "string",
    "passed": true,
    "kb": "string",
    "description": "string",
    "remedy": "string",
    "severity": "string",
    "data": {},
    "nodeID": 0
  }
]
},
"taskId": "123f14a4-1a1a-11e9-7777-6c0b84e123b2",
"dateCompleted": "2020-04-21T22:10:57.057Z",
"dateCreated": "2020-04-21T22:10:57.057Z"
}

```

- h. Copy the upgrade ID ("upgradeId") that is part of the response.

6. Verify the upgrade progress and results:
 - a. Select **GET /upgrades/{upgradeld}**.
 - b. Select **Try it out**.
 - c. Enter the upgrade ID from the previous step in **upgradeld**.
 - d. Select **Execute**.
 - e. Do one of the following if there are problems or special requirements during the upgrade:

Option	Steps
<p>You need to correct cluster health issues due to <code>failedHealthChecks</code> message in the response body.</p>	<ol style="list-style-type: none"> 1. Go to the specific KB article listed for each issue or perform the specified remedy. 2. If a KB is specified, complete the process described in the relevant KB article. 3. After you have resolved cluster issues, reauthenticate if needed and select PUT /upgrades/{upgradeld}. 4. Select Try it out. 5. Enter the upgrade ID from the previous step in upgradeld. 6. Enter "action": "resume" in the request body. <div style="border: 1px solid #ccc; padding: 10px; width: fit-content; margin: auto;"> <pre>{ "action": "resume" }</pre> </div> <ol style="list-style-type: none"> 7. Select Execute.
<p>You need to pause the upgrade because the maintenance window is closing or for another reason.</p>	<ol style="list-style-type: none"> 1. Reauthenticate if needed and select PUT /upgrades/{upgradeld}. 2. Select Try it out. 3. Enter the upgrade ID from the previous step in upgradeld. 4. Enter "action": "pause" in the request body. <div style="border: 1px solid #ccc; padding: 10px; width: fit-content; margin: auto;"> <pre>{ "action": "pause" }</pre> </div> <ol style="list-style-type: none"> 5. Select Execute.

Option	Steps
<p>If you are upgrading an H610S cluster running an Element version earlier than 11.8, you see the state <code>finishedNeedsAck</code> in the response body. You must perform additional upgrade steps for each H610S storage node.</p>	<ol style="list-style-type: none"> 1. Complete the additional upgrade steps in this KB article for each node. 2. Reauthenticate if needed and select PUT /upgrades/{upgradeld}. 3. Select Try it out. 4. Enter the upgrade ID from the previous step in <code>upgradeld</code>. 5. Enter "action": "acknowledge" in the request body. <div style="border: 1px solid #ccc; padding: 10px; width: fit-content; margin: 10px auto;"> <pre>{ "action": "acknowledge" }</pre> </div> <ol style="list-style-type: none"> 6. Select Execute.

f. Run the **GET /upgrades/{upgradeld}** API multiple times, as needed, until the process is complete.

During the upgrade, the `status` indicates `running` if no errors are encountered. As each node is upgraded, the `step` value changes to `NodeFinished`.

The upgrade has finished successfully when the `percent` value is 100 and the `state` indicates `finished`.

What happens if an upgrade fails using NetApp Hybrid Cloud Control

If a drive or node fails during an upgrade, the Element UI will show cluster faults. The upgrade process does not proceed to the next node, and waits for the cluster faults to resolve. The progress bar in the UI shows that the upgrade is waiting for the cluster faults to resolve. At this stage, selecting **Pause** in the UI will not work, because the upgrade waits for the cluster to be healthy. You will need to engage NetApp Support to assist with the failure investigation.

NetApp Hybrid Cloud Control has a pre-set three-hour waiting period, during which one of the following scenarios can happen:

- The cluster faults get resolved within the three-hour window, and upgrade resumes. You do not need to take any action in this scenario.
- The problem persists after three hours, and the upgrade status shows **Error** with a red banner. You can resume the upgrade by selecting **Resume** after the problem is resolved.
- NetApp Support has determined that the upgrade needs to be temporarily aborted to take corrective action before the three-hour window. Support will use the API to abort the upgrade.



Aborting the cluster upgrade while a node is being updated might result in the drives being ungracefully removed from the node. If the drives are ungracefully removed, adding the drives back during an upgrade will require manual intervention by NetApp Support. The node might be taking longer to do firmware updates or post update syncing activities. If the upgrade progress seems stalled, contact NetApp Support for assistance.

Find more information

[NetApp Element Plug-in for vCenter Server](#)

Upgrade storage firmware

Starting with Element 12.0 and management services version 2.14, you can perform firmware-only upgrades on your storage nodes using the NetApp Hybrid Cloud Control UI and REST API. This procedure does not upgrade Element software and enables you to upgrade storage firmware outside of a major Element release.

What you'll need

- **Admin privileges:** You have storage cluster administrator permissions to perform the upgrade.
- **System time sync:** You have ensured that the system time on all nodes is synced and that NTP is correctly configured for the storage cluster and nodes. Each node must be configured with a DNS nameserver in the per-node web UI ([https://\[IP address\]:442](https://[IP address]:442)) with no unresolved cluster faults related to time skew.
- **System ports:** If you are using NetApp Hybrid Cloud Control for upgrades, you have ensured that the necessary ports are open. See [Network ports](#) for more information.
- **Management node:** For NetApp Hybrid Cloud Control UI and API, the management node in your environment is running version 11.3.
- **Management services:** You have updated your management services bundle to the latest version.



For H610S storage nodes running Element software version 12.0, you should apply D-patch SUST-909 before you upgrade to storage firmware bundle 2.27. Contact NetApp Support to obtain the D-patch before you upgrade. See [Storage Firmware Bundle 2.27 Release Notes](#).



You must upgrade to the latest management services bundle before upgrading the firmware on your storage nodes. If you are updating your Element software to version 12.2 or later, you need management services 2.14.60 or later to proceed.



To update your iDRAC/BIOS firmware, contact NetApp Support. For additional information, see this [KB article](#).

- **Cluster health:** You have run health checks. See [Run Element storage health checks prior to upgrading storage](#).
- **Updated baseboard management controller (BMC) for H610S nodes:** You have upgraded the BMC version for your H610S nodes. See [release notes and upgrade instructions](#).



For a complete matrix of firmware and driver firmware for your hardware, see [supported firmware versions for NetApp HCI storage nodes](#).

- **Upgrade process time:** You have scheduled sufficient time to perform your upgrade. When you upgrade to Element software 12.5 or later, the upgrade process time varies depending on your current Element software version and firmware updates.

Storage Node	Current Element software version	Approximate software and firmware install time per node ¹	Approximate data synchronization time per node ²	Approximate total upgrade time per node
All SolidFire and NetApp H-series nodes with up-to-date firmware	12.x	15 minutes	10 to 15 minutes	20 to 30 minutes
H610S and H410S	12.x and 11.8	60 minutes	30 to 60 minutes	90 to 120 minutes
H610S	11.7 and earlier	90 minutes	40 to 70 minutes	130 to 160 minutes You must also perform a complete node shutdown and power disconnect for each H610S node.

¹For a complete matrix of firmware and driver firmware for your hardware, see [supported firmware and ESXi driver versions for NetApp HCI](#) and [firmware versions for NetApp HCI storage nodes](#).

²If you combine a cluster with a heavy write IOPS load with a longer firmware update time, the data synchronization time will increase.

- **End User License Agreement (EULA):** Beginning with management services 2.20.69, you must accept and save the EULA before using the NetApp Hybrid Cloud Control UI or API to upgrade storage firmware:

1. Open the IP address of the management node in a web browser:

`https://<ManagementNodeIP>`

2. Log in to NetApp Hybrid Cloud Control by providing the storage cluster administrator credentials.
3. Select **Upgrade** near the top right of the interface.
4. The EULA pops up. Scroll down, select **I accept for current and all future updates**, and select **Save**.

Upgrade options

Choose one of the following storage firmware upgrade options:

- [Use NetApp Hybrid Cloud Control UI to upgrade storage firmware](#)
- [Use NetApp Hybrid Cloud Control API to upgrade storage firmware](#)

Use NetApp Hybrid Cloud Control UI to upgrade storage firmware

You can use the NetApp Hybrid Cloud Control UI to upgrade the firmware of the storage nodes in your cluster.

What you'll need

If your management node is not connected to the internet, you have [downloaded the Storage firmware package for NetApp HCI storage clusters](#).



For potential issues while upgrading storage clusters using NetApp Hybrid Cloud Control and their workarounds, see this [KB article](#).



The upgrade process takes approximately 30 minutes per storage node. If you are upgrading an Element storage cluster to storage firmware newer than version 2.76, individual storage nodes will only reboot during the upgrade if new firmware was written to the node.

Steps

1. Open the IP address of the management node in a web browser:

```
https://<ManagementNodeIP>
```

2. Log in to NetApp Hybrid Cloud Control by providing the storage cluster administrator credentials.

3. Select **Upgrade** near the top right of the interface.

4. On the **Upgrades** page, select **Storage**.



The **Storage** tab lists the storage clusters that are part of your installation. If a cluster is inaccessible by NetApp Hybrid Cloud Control, it will not be displayed on the **Upgrades** page. If you have clusters running Element 12.0 or later, you will see the current firmware bundle version listed for these clusters. If the nodes in a single cluster have different firmware versions on them or as the upgrade progresses, you will see **Multiple** in the **Current Firmware Bundle Version** column. You can select **Multiple** to navigate to the **Nodes** page to compare firmware versions. If all your clusters are running Element versions earlier than 12.0, you will not see any information about firmware bundle version numbers. This information is also available on the **Nodes** page. See [View your inventory](#).

If the cluster is up to date and/or no upgrade packages are available, the **Element** and **Firmware Only** tabs are not displayed. These tabs are also not displayed when an upgrade is in progress. If the **Element** tab is displayed, but not the **Firmware Only** tab, no firmware packages are available.

5. Select the drop-down arrow next to the cluster you are upgrading.
6. Select **Browse** to upload the upgrade package that you downloaded.
7. Wait for the upload to complete. A progress bar shows the status of the upload.



The file upload will be lost if you navigate away from the browser window.

An on-screen message is displayed after the file is successfully uploaded and validated. Validation might take several minutes. If you navigate away from the browser window at this stage, the file upload is preserved.

8. Select **Firmware Only**, and select from the upgrade versions available.
9. Select **Begin Upgrade**.



The **Upgrade Status** changes during the upgrade to reflect the status of the process. It also changes in response to actions you take, such as pausing the upgrade, or if the upgrade returns an error. See [Upgrade status changes](#).



While the upgrade is in progress, you can leave the page and come back to it later to continue monitoring the progress. The page does not dynamically update status and current version if the cluster row is collapsed. The cluster row must be expanded to update the table or you can refresh the page.

You can download logs after the upgrade is complete.

Upgrade status changes

Here are the different states that the **Upgrade Status** column in the UI shows before, during, and after the upgrade process:

Upgrade state	Description
Up to Date	The cluster was upgraded to the latest Element version available or the firmware was upgraded to the latest version.
Unable to Detect	This status is displayed when the storage service API returns an upgrade status that is not in the enumerated list of possible upgrade statuses.
Versions Available	Newer versions of Element and/or storage firmware are available for upgrade.
In Progress	The upgrade is in progress. A progress bar shows the upgrade status. On-screen messages also show node-level faults and display the node ID of each node in the cluster as the upgrade progresses. You can monitor the status of each node using the Element UI or the NetApp Element plug-in for vCenter Server UI.
Upgrade Pausing	You can choose to pause the upgrade. Depending on the state of the upgrade process, the pause operation can succeed or fail. You will see a UI prompt asking you to confirm the pause operation. To ensure that the cluster is in a safe spot before pausing an upgrade, it can take up to two hours for the upgrade operation to be completely paused. To resume the upgrade, select Resume .
Paused	You paused the upgrade. Select Resume to resume the process.

Upgrade state	Description
Error	<p>An error has occurred during the upgrade. You can download the error log and send it to NetApp Support. After you resolve the error, you can return to the page, and select Resume. When you resume the upgrade, the progress bar goes backwards for a few minutes while the system runs the health check and checks the current state of the upgrade.</p>

What happens if an upgrade fails using NetApp Hybrid Cloud Control

If a drive or node fails during an upgrade, the Element UI will show cluster faults. The upgrade process does not proceed to the next node, and waits for the cluster faults to resolve. The progress bar in the UI shows that the upgrade is waiting for the cluster faults to resolve. At this stage, selecting **Pause** in the UI will not work, because the upgrade waits for the cluster to be healthy. You will need to engage NetApp Support to assist with the failure investigation.

NetApp Hybrid Cloud Control has a pre-set three-hour waiting period, during which one of the following scenarios can happen:

- The cluster faults get resolved within the three-hour window, and upgrade resumes. You do not need to take any action in this scenario.
- The problem persists after three hours, and the upgrade status shows **Error** with a red banner. You can resume the upgrade by selecting **Resume** after the problem is resolved.
- NetApp Support has determined that the upgrade needs to be temporarily aborted to take corrective action before the three-hour window. Support will use the API to abort the upgrade.

 Aborting the cluster upgrade while a node is being updated might result in the drives being ungracefully removed from the node. If the drives are ungracefully removed, adding the drives back during an upgrade will require manual intervention by NetApp Support. The node might be taking longer to do firmware updates or post update syncing activities. If the upgrade progress seems stalled, contact NetApp Support for assistance.

Use NetApp Hybrid Cloud Control API to upgrade storage firmware

You can use APIs to upgrade storage nodes in a cluster to the latest Element software version. You can use an automation tool of your choice to run the APIs. The API workflow documented here uses the REST API UI available on the management node as an example.

Steps

1. Download the latest storage firmware upgrade package to a device that is accessible to the management node; go to the [Element software storage firmware bundle page](#) and download the latest storage firmware image.
2. Upload the storage firmware upgrade package to the management node:
 - a. Open the management node REST API UI on the management node:

```
https://<ManagementNodeIP>/package-repository/1/
```

- b. Select **Authorize** and complete the following:
 - i. Enter the cluster user name and password.
 - ii. Enter the client ID as `mnode-client`.
 - iii. Select **Authorize** to begin a session.
 - iv. Close the authorization window.
- c. From the REST API UI, select **POST /packages**.
- d. Select **Try it out**.
- e. Select **Browse** and select the upgrade package.
- f. Select **Execute** to initiate the upload.
- g. From the response, copy and save the package ID ("id") for use in a later step.

3. Verify the status of the upload.
 - a. From the REST API UI, select **GET /packages/{id}/status**.
 - b. Select **Try it out**.
 - c. Enter the firmware package ID you copied in the previous step in **id**.
 - d. Select **Execute** to initiate the status request.

The response indicates `state` as `SUCCESS` when complete.

4. Locate the installation asset ID:
 - a. Open the management node REST API UI on the management node:

```
https://<ManagementNodeIP>/inventory/1/
```

- b. Select **Authorize** and complete the following:
 - i. Enter the cluster user name and password.
 - ii. Enter the client ID as `mnode-client`.
 - iii. Select **Authorize** to begin a session.
 - iv. Close the authorization window.
- c. From the REST API UI, select **GET /installations**.
- d. Select **Try it out**.
- e. Select **Execute**.
- f. From the response, copy the installation asset ID (`id`).

```
"id": "abcd01e2-xx00-4ccf-11ee-11f111xx9a0b",
"management": {
  "errors": [],
  "inventory": {
    "authoritativeClusterMvip": "10.111.111.111",
    "bundleVersion": "2.14.19",
    "managementIp": "10.111.111.111",
    "version": "1.4.12"
  }
}
```

- g. From the REST API UI, select **GET /installations/{id}**.
- h. Select **Try it out**.
- i. Paste the installation asset ID into the **id** field.
- j. Select **Execute**.
- k. From the response, copy and save the storage cluster ID ("id") of the cluster you intend to upgrade for use in a later step.

```
"storage": {
  "errors": [],
  "inventory": {
    "clusters": [
      {
        "clusterUuid": "a1bd1111-4f1e-46zz-ab6f-0a111b1111x",
        "id": "a1bd1111-4f1e-46zz-ab6f-a1a1a11b012",
        "name": "a1a1a11b012"
      }
    ]
  }
}
```

5. Run the storage firmware upgrade:
 - a. Open the storage REST API UI on the management node:

```
https://<ManagementNodeIP>/storage/1/
```
 - b. Select **Authorize** and complete the following:
 - i. Enter the cluster user name and password.
 - ii. Enter the client ID as `mnode-client`.
 - iii. Select **Authorize** to begin a session.
 - iv. Close the window.
 - c. Select **POST /upgrades**.
 - d. Select **Try it out**.
 - e. Enter the upgrade package ID in the parameter field.
 - f. Enter the storage cluster ID in the parameter field.
 - g. Select **Execute** to initiate the upgrade.

The response should indicate state as initializing:

```
{
  "_links": {
    "collection": "https://localhost:442/storage/upgrades",
    "self": "https://localhost:442/storage/upgrades/3fa85f64-1111-4562-b3fc-2c963f66abc1",
    "log": "https://localhost:442/storage/upgrades/3fa85f64-1111-4562-b3fc-2c963f66abc1/log"
  },
  "storageId": "114f14a4-1a1a-11e9-9088-6c0b84e200b4",
  "upgradeId": "334f14a4-1a1a-11e9-1055-6c0b84e2001b4",
  "packageId": "774f14a4-1a1a-11e9-8888-6c0b84e200b4",
  "config": {},
  "state": "initializing",
  "status": {
    "availableActions": [
      "string"
    ],
    "message": "string",
    "nodeDetails": [
      {
        "message": "string",
        "step": "NodePreStart",
        "nodeID": 0,
        "numAttempt": 0
      }
    ],
    "percent": 0,
    "step": "ClusterPreStart",
    "timestamp": "2020-04-21T22:10:57.057Z",
    "failedHealthChecks": [
      {
        "checkID": 0,
        "name": "string",
        "displayName": "string",
        "passed": true,
        "kb": "string",
        "description": "string",
        "remedy": "string",
        "severity": "string",
        "data": {},
        "nodeID": 0
      }
    ]
  }
},
```

```

    "taskId": "123f14a4-1a1a-11e9-7777-6c0b84e123b2",
    "dateCompleted": "2020-04-21T22:10:57.057Z",
    "dateCreated": "2020-04-21T22:10:57.057Z"
}

```

h. Copy the upgrade ID ("upgradeId") that is part of the response.

6. Verify the upgrade progress and results:

- Select **GET /upgrades/{upgradeld}**.
- Select **Try it out**.
- Enter the upgrade ID from the previous step in **upgradeld**.
- Select **Execute**.
- Do one of the following if there are problems or special requirements during the upgrade:

Option	Steps
<p>You need to correct cluster health issues due to failedHealthChecks message in the response body.</p>	<ol style="list-style-type: none"> 1. Go to the specific KB article listed for each issue or perform the specified remedy. 2. If a KB is specified, complete the process described in the relevant KB article. 3. After you have resolved cluster issues, reauthenticate if needed and select PUT /upgrades/{upgradeld}. 4. Select Try it out. 5. Enter the upgrade ID from the previous step in upgradeld. 6. Enter "action": "resume" in the request body. <div style="border: 1px solid #ccc; padding: 10px; margin-top: 10px;"> <pre> { "action": "resume" } </pre> </div> <ol style="list-style-type: none"> 7. Select Execute.

Option	Steps
<p>You need to pause the upgrade because the maintenance window is closing or for another reason.</p>	<ol style="list-style-type: none"> 1. Reauthenticate if needed and select PUT /upgrades/{upgradeld}. 2. Select Try it out. 3. Enter the upgrade ID from the previous step in upgradeld. 4. Enter "action": "pause" in the request body. <div style="border: 1px solid #ccc; padding: 10px; width: 100%;"> <pre>{ "action": "pause" }</pre> </div> <ol style="list-style-type: none"> 5. Select Execute.

f. Run the **GET /upgrades/{upgradeld}** API multiple times, as needed, until the process is complete.

During the upgrade, the `status` indicates `running` if no errors are encountered. As each node is upgraded, the `step` value changes to `NodeFinished`.

The upgrade has finished successfully when the `percent` value is 100 and the `state` indicates `finished`.

Find more information

[NetApp Element Plug-in for vCenter Server](#)

Upgrade a management node

You can upgrade your management node to management node 12.5 or later from version 12.3.x or later.

Upgrading the management node operating system is no longer required to upgrade Element software on the storage cluster. You can simply upgrade the management services to the latest version to perform Element upgrades using NetApp Hybrid Cloud Control. Follow the management node upgrade procedure for your scenario if you would like to upgrade the management node operating system for other reasons, such as security remediation.



If you require information on upgrading management nodes 12.2 or earlier, see the [NetApp HCI 1.9 management node upgrade documentation](#).

Step 1: Upgrade VM hardware version on a management node

If you are performing an in-place upgrade of an existing management node to Element 12.8 or later, before you upgrade, you must ensure that the VM hardware version on the management node is compatible with ESXi 6.7 (VM hardware version 14) or later depending on your environment.



You can also follow these steps to upgrade the VM hardware version on the Witness Nodes.

Steps

1. Log in to the vSphere Web Client as a vCenter Administrator.
2. From the vSphere Client Menu, select **VMs and Templates**.
3. Right-click on the virtual machine (VM), and select **Power > Shut Down Guest OS**.

Wait until the VM is powered off.

4. Right-click on the VM, and select **Compatibility > Upgrade VM Compatibility**.
5. Select **Yes**.
6. Select ESXi 6.7 or a later version, depending on the version of your vSphere environment.
7. Select **OK**.
8. After the upgrade is completed, right-click on the VM, and select **Power > Power On**.
9. Select **vSphere client refresh** and verify that the VM Compatibility is at the desired version.

Step 2: Upgrade a management node to Element 12.5 or later

Choose one of the following upgrade options:

- [Upgrade a management node to version 12.5 or later from version 12.3.x or later](#)
- [Reconfigure authentication using the management node REST API](#)

Choose this option if you have **sequentially** updated (1) your management services version and (2) your Element storage version and you want to **keep** your existing management node:



If you do not sequentially update your management services followed by Element storage, you cannot reconfigure reauthentication using this procedure. Follow the appropriate upgrade procedure instead.

Upgrade a management node to version 12.5 or later from version 12.3.x or later

You can perform an in-place upgrade of the management node from version 12.3.x or later to version 12.5 or later without needing to provision a new management node virtual machine.



The Element 12.5 or later management node is an optional upgrade. It is not required for existing deployments.

Before you begin

- The RAM of the management node VM is 24GB.
- The management node you are intending to upgrade is version 12.0 and uses IPv4 networking. The management node version 12.5 or later does not support IPv6.



To check the version of your management node, log in to your management node and view the Element version number in the login banner.

- You have updated your management services bundle to the latest version using NetApp Hybrid Cloud

Control. You can access NetApp Hybrid Cloud Control from the following IP:

<https://<ManagementNodeIP>>

- If you are updating your management node to version 12.5 or later, you need management services 2.21.61 or later to proceed.
- You have configured an additional network adapter (if required) using the instructions for [configuring an additional storage NIC](#).



Persistent volumes might require an additional network adapter if eth0 is not able to be routed to the SVIP. Configure a new network adapter on the iSCSI storage network to allow the configuration of persistent volumes.

- Storage nodes are running Element 12.3.x or later.

Steps

1. Log in to the management node virtual machine using SSH or console access.
2. Download the [management node ISO](#) for Element software from the NetApp Support Site to the management node virtual machine.



The name of the ISO is similar to solidfire-fdva-<Element release>-patchX-XX.X.X.XXXX.iso

3. Check the integrity of the download by running md5sum on the downloaded file and compare the output to what is available on the NetApp Support Site for Element software, as in the following example:

```
sudo md5sum -b <path to iso>/solidfire-fdva-<Element release>-patchX-XX.X.X.XXXX.iso
```

4. Mount the management node ISO image and copy the contents to the file system using the following commands:

```
sudo mkdir -p /upgrade
```

```
sudo mount <solidfire-fdva-<Element release>-patchX-XX.X.X.XXXX.iso> /mnt
```

```
sudo cp -r /mnt/* /upgrade
```

5. Change to the home directory, and unmount the ISO file from /mnt:

```
sudo umount /mnt
```

6. Delete the ISO to conserve space on the management node:

```
sudo rm <path to iso>/solidfire-fdva-<Element release>-patchX-  
XX.X.X.XXXX.iso
```

7. On the management node that you are upgrading, run the following command to upgrade your management node OS version. The script retains all necessary configuration files after the upgrade, such as Active IQ collector and proxy settings.

```
sudo /sf/rtfi/bin/sfrtfi_inplace  
file:///upgrade/casper/filesystem.squashfs sf_upgrade=1
```

The management node reboots with a new OS after the upgrade process completes.



After you run the sudo command described in this step, the SSH session is killed. Console access is required for continued monitoring. If no console access is available to you when performing the upgrade, retry the SSH login and verify connectivity after 15 to 30 minutes. Once you log in, you can confirm the new OS version in the SSH banner that indicates that the upgrade was successful.

8. On the management node, run the `redeploy-mnode` script to retain previous management services configuration settings:



The script retains previous management services configuration, including configuration from the Active IQ collector service, controllers (vCenters), or proxy, depending on your settings.

```
sudo /sf/packages/mnode/redeploy-mnode -mu <mnode user>
```



If you had previously disabled SSH functionality on the management node, you need to [disable SSH again](#) on the recovered management node. SSH capability that provides [NetApp Support remote support tunnel \(RST\) session access](#) is enabled on the management node by default.

Reconfigure authentication using the management node REST API

You can keep your existing management node if you have sequentially upgraded (1) management services and (2) Element storage. If you have followed a different upgrade order, see the procedures for in-place management node upgrades.

Before you begin

- You have updated your management services to 2.20.69 or later.
- Your storage cluster is running Element 12.3 or later.
- You have sequentially updated your management services followed by upgrading your Element storage. You cannot reconfigure authentication using this procedure unless you have completed upgrades in the sequence described.

Steps

1. Open the management node REST API UI on the management node:

```
https://<ManagementNodeIP>/mnode
```

2. Select **Authorize** and complete the following:
 - a. Enter the cluster user name and password.
 - b. Enter the client ID as `mnode-client` if the value is not already populated.
 - c. Select **Authorize** to begin a session.
3. From the REST API UI, select **POST /services/reconfigure-auth**.
4. Select **Try it out**.
5. For the **load_images** parameter, select `true`.
6. Select **Execute**.

The response body indicates that reconfiguration was successful.

Find more information

[NetApp Element Plug-in for vCenter Server](#)

Upgrade the Element Plug-in for vCenter Server

For existing vSphere environments with a registered NetApp Element Plug-in for VMware vCenter Server, you can update your plug-in registration after you first update the management services package that contains the plug-in service.

You can update the plug-in registration on vCenter Server Virtual Appliance (vCSA) or Windows using the registration utility. You must change your registration for the vCenter Plug-in on every vCenter Server where you need to use the plug-in.

The management services 2.27 bundle includes Element Plug-in for vCenter Server 5.5, which is only compatible with management node 12.8. When you update to management services 2.27, you must change the upgrade sequence and update the management services bundle *after* upgrading to Element 12.8 to have compatibility between the management node and management services.



The management services 2.22.7 bundle includes Element Plug-in for vCenter Server 5.0, which contains the remote plug-in. If you use the Element plug-in, you should upgrade to management services 2.22.7 or later to comply with the VMware directive that removes support for local plug-ins. [Learn more](#).

Element Plug-in for vCenter 5.0 and later

This upgrade procedure covers the following upgrade scenarios:

- You are upgrading to Element Plug-in for vCenter Server 5.5, 5.4, 5.3, 5.2, 5.1, or 5.0.
- You are upgrading to an 8.0 or 7.0 HTML5 vSphere Web Client.



Element Plug-in for vCenter 5.0 or later is not compatible with vCenter Server 6.7 and 6.5.



When you upgrade from Element Plug-in for vCenter Server 4.x to 5.x, the clusters already configured with the plug-in are lost because the data cannot be copied from a vCenter instance to a remote plug-in. You must re-add the clusters to the remote plug-in. This is a one-time activity when upgrading from a local plug-in to a remote plug-in.

Element Plug-in for vCenter 4.10 and earlier

This upgrade procedure covers the following upgrade scenarios:

- You are upgrading to Element Plug-in for vCenter Server 4.10, 4.9, 4.8, 4.7, 4.6, 4.5, or 4.4.
- You are upgrading to a 7.0, 6.7, or 6.5 HTML5 vSphere Web Client.



- The plug-in is not compatible with VMware vCenter Server 8.0 for Element Plug-in for VMware vCenter Server 4.x.
- The plug-in is not compatible with VMware vCenter Server 6.5 for Element Plug-in for VMware vCenter Server 4.6, 4.7, and 4.8.

- You are upgrading to a 6.7 Flash vSphere Web Client.



The plug-in is not compatible with version 6.7 U2 build 13007421 of the HTML5 vSphere Web Client and other 6.7 U2 builds released prior to update 2a (build 13643870). For more information about supported vSphere versions, see the release notes for [your version of the plug-in](#).

What you'll need

- **Admin privileges:** You have vCenter Administrator role privileges to install a plug-in.
- **vSphere upgrades:** You have performed any required vCenter upgrades before upgrading the NetApp Element Plug-in for vCenter Server. This procedure assumes that vCenter upgrades have already been completed.
- **vCenter Server:** Your vCenter Plug-in version 4.x or 5.x is registered with a vCenter Server. From the registration utility (`https://[management node IP]:9443`), select **Registration Status**, complete the necessary fields, and select **Check Status** to verify that the vCenter Plug-in is already registered and the version number of the current installation.
- **Management services updates:** You have updated your [management services bundle](#) to the latest version. Updates to the vCenter plug-in are distributed using management services updates that are released outside of major product releases for NetApp HCI.
- **Management node upgrades:**

Element Plug-in for vCenter 5.0 and later

You are running a management node that has been [upgraded](#) to version 12.3.x or later.

Element Plug-in for vCenter 4.10 and earlier

You are running a management node that has been [upgraded](#) to version 11.3 or later. vCenter Plug-in 4.4 or later requires an 11.3 or later management node with a modular architecture that provides individual services. Your management node must be powered on with its IP address or DHCP address configured.

- **Element storage upgrades:**

- Beginning with Element vCenter plug-in 5.0, you have a cluster running NetApp Element software 12.3.x or later.
- For Element vCenter plug-in 4.10 or earlier, you have a cluster running NetApp Element software 11.3 or later.

- **vSphere Web Client:** You have logged out of the vSphere Web Client before beginning any plug-in upgrade. The web client will not recognize updates made during this process to your plug-in if you do not log out.

Steps

1. Enter the IP address for your management node in a browser, including the TCP port for registration:

`https://[management node IP]:9443`

The registration utility UI opens to the **Manage QoSSIOC Service Credentials** page for the plug-in.

NetApp Element Plug-in for vCenter Server Management Node

QoSSIOC Service Management vCenter Plug-in Registration

QoSSIOC Management

Manage Credentials

Restart QoSSIOC Service

Manage QoSSIOC Service Credentials

Old Password

Current password

Current password is required

New Password

New password

Must contain at least 8 characters with at least one lower-case and upper-case alphabet, a number and a special character like #\$\$%&()/-+@_-

Confirm Password

Confirm New Password

New and confirm passwords must match

SUBMIT CHANGES

Contact NetApp Support at <http://mysupport.netapp.com>

2. Select **vCenter Plug-in Registration**.

Element Plug-in for vCenter 5.0 and later

The vCenter Plug-in Registration page appears:

The screenshot shows the 'Element Plug-in for vCenter Server Management Node' interface. The top navigation bar includes 'NetApp' and 'Element Plug-in for vCenter Server Management Node'. Below the navigation, there are two tabs: 'QoSIOC Service Management' and 'vCenter Plug-in Registration', with 'vCenter Plug-in Registration' being the active tab. On the left, a sidebar titled 'Manage vCenter Plug-in' contains links for 'Register Plug-in' (which is highlighted in grey), 'Update Plug-in', 'Unregister Plug-in', and 'Registration Status'. The main content area is titled 'vCenter Plug-in - Registration' and contains the following fields:

- vCenter Address:** Enter the IPv4, IPv6 or DNS name of the vCenter server to register plug-in on.
- vCenter User Name:** vCenter Admin User Name. Ensure this user is a vCenter user that has administrative privileges for registration.
- vCenter Password:** vCenter Admin Password. The password for the vCenter user name entered.
- Customize URL:** Select to customize the Zip file URL.
- Plug-in Zip URL:** https://10.117.227.44:8333/vcp-ui/plugin.json. URL of XML initialization file.

At the bottom of the main content area is a 'REGISTER' button.

Contact NetApp Support at <http://mysupport.netapp.com>

Element Plug-in for vCenter 4.10 and earlier

The vCenter Plug-in Registration page appears:

QoSIOC Service Management vCenter Plug-in Registration

Manage vCenter Plug-in

Register Plug-in

Update Plug-in

Unregister Plug-in

Registration Status

vCenter Plug-in - Registration

Register version [REDACTED] of the NetApp Element Plug-in for vCenter Server with your vCenter server. The Plug-in will not be deployed until a fresh vCenter login after registration.

vCenter Address
Enter the IPv4, IPv6 or FQDN name of the vCenter server to register plug-in on.

vCenter User Name
Ensure this user is a vCenter user that has administrative privileges for registration.

vCenter Password
The password for the vCenter user name entered.

Customize URL
Select to customize the Zip file URL.

Plug-in Zip URL
URL of XML initialization file.

REGISTER

Contact NetApp Support at <http://mysupport.netapp.com>

3. Within **Manage vCenter Plug-in**, select **Update Plug-in**.

4. Confirm or update the following information:

- The IPv4 address or the FQDN of the vCenter service on which you will register your plug-in.
- The vCenter Administrator user name.



The user name and password credentials you enter must be for a user with vCenter Administrator role privileges.

- The vCenter Administrator password.
- (For in-house servers or dark sites) Depending on your Element Plug-in for vCenter version, a custom URL for the plug-in JSON file or plug-in ZIP:

Element Plug-in for vCenter 5.0 and later

A custom URL for the plug-in JSON file.



You can select **Custom URL** to customize the URL if you are using an HTTP or HTTPS server (dark site) or have modified the JSON file name or network settings. For additional configuration steps if you intend to customize a URL, see Element Plug-in for vCenter Server documentation about modifying vCenter properties for an in-house (dark site) HTTP server.

Element Plug-in for vCenter 4.10 and earlier

A custom URL for the plug-in ZIP.



You can select **Custom URL** to customize the URL if you are using an HTTP or HTTPS server (dark site) or have modified the ZIP file name or network settings. For additional configuration steps if you intend to customize a URL, see Element Plug-in for vCenter Server documentation about modifying vCenter properties for an in-house (dark site) HTTP server.

5. Select **Update**.

A banner appears in the registration utility UI when the registration is successful.

6. Log in to the vSphere Web Client as a vCenter Administrator. If you are already logged in to the vSphere Web Client, you must first log out, wait two to three minutes, and then log in again.

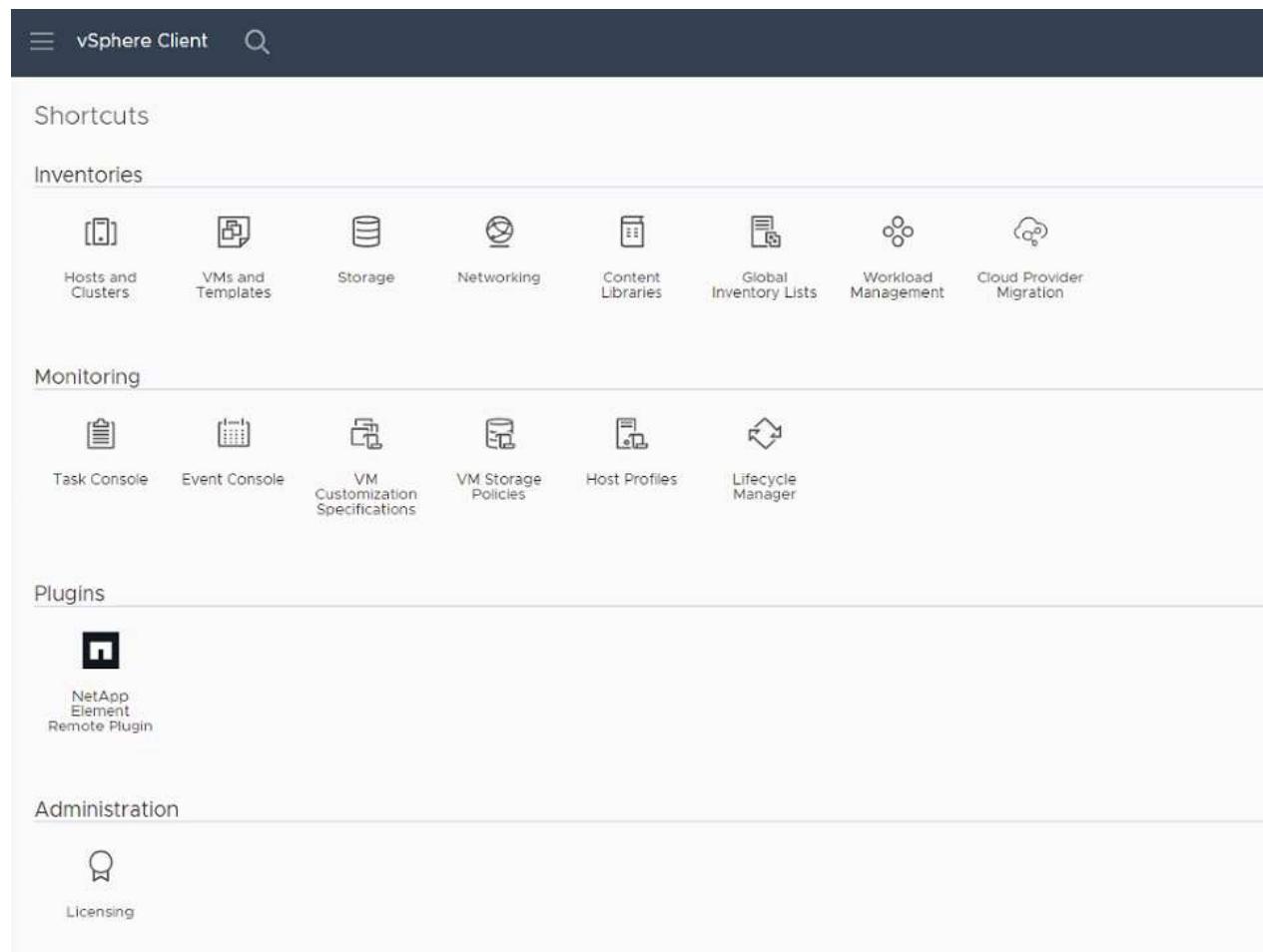


This action creates a new database and completes the installation in the vSphere Web Client.

7. In the vSphere Web Client, look for the following completed tasks in the task monitor to ensure installation has completed: **Download plug-in** and **Deploy plug-in**.
8. Verify that the plug-in extension points appear in the **Shortcuts** tab of the vSphere Web Client and in the side panel.

Element Plug-in for vCenter 5.0 and later

The NetApp Element Remote Plugin extension point appears:

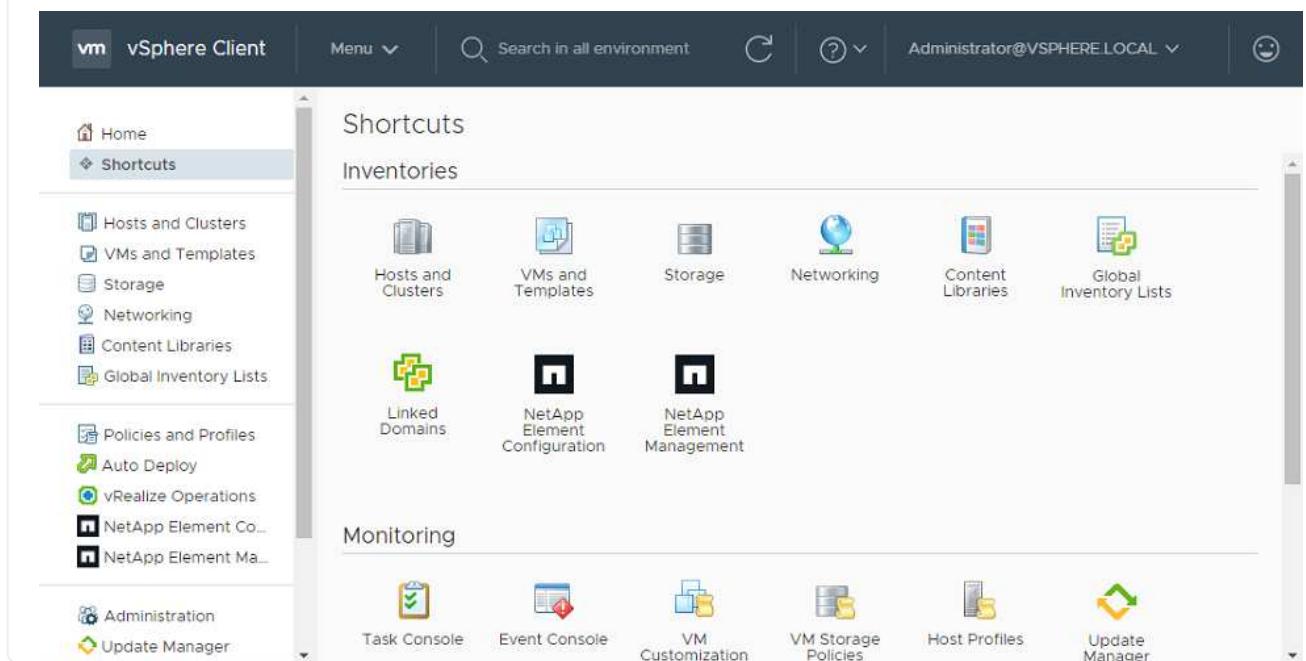


The screenshot shows the vSphere Client interface with the following sections and their contents:

- Shortcuts**: Hosts and Clusters, VMs and Templates, Storage, Networking, Content Libraries, Global Inventory Lists, Workload Management, Cloud Provider Migration.
- Inventories**: Hosts and Clusters, VMs and Templates, Storage, Networking, Content Libraries, Global Inventory Lists, Workload Management, Cloud Provider Migration.
- Monitoring**: Task Console, Event Console, VM Customization Specifications, VM Storage Policies, Host Profiles, Lifecycle Manager.
- Plugins**: NetApp Element Remote Plugin (represented by a square icon with a stylized 'N').
- Administration**: Licensing.

Element Plug-in for vCenter 4.10 and earlier

The NetApp Element Configuration and Management extension points appear:



The screenshot shows the vSphere Client interface with the following sections and their contents:

- Shortcuts**: Home, Hosts and Clusters, VMs and Templates, Storage, Networking, Content Libraries, Global Inventory Lists, Policies and Profiles, Auto Deploy, vRealize Operations, NetApp Element Configuration, NetApp Element Management, Administration, Update Manager.
- Inventories**: Hosts and Clusters, VMs and Templates, Storage, Networking, Content Libraries, Global Inventory Lists, Linked Domains, NetApp Element Configuration, NetApp Element Management.
- Monitoring**: Task Console, Event Console, VM Customization, VM Storage Policies, Host Profiles, Update Manager.

If the vCenter Plug-in icons are not visible, see [Element Plug-in for vCenter Server](#) documentation about troubleshooting the plug-in.



After upgrading to NetApp Element Plug-in for vCenter Server 4.8 or later with VMware vCenter Server 6.7U1, if the storage clusters are not listed or a server error appears in the **Clusters** and **QoSIOC Settings** sections of the NetApp Element Configuration, see [Element Plug-in for vCenter Server](#) documentation about troubleshooting these errors.

9. Verify the version change in the **About** tab in the **NetApp Element Configuration** extension point of the plug-in.

You should see the following version details:

```
NetApp Element Plug-in Version: 5.5
NetApp Element Plug-in Build Number: 16
```



The vCenter Plug-in contains online Help content. To ensure that your Help contains the latest content, clear your browser cache after upgrading your plug-in.

Find more information

[NetApp Element Plug-in for vCenter Server](#)

Run compute node health checks prior to upgrading compute firmware

You must run health checks prior to upgrading compute firmware to ensure all compute nodes in your cluster are ready to be upgraded. Compute node health checks can only be run against compute clusters of one or more managed NetApp HCI compute nodes.

What you'll need

- **Management services:** You have updated to the latest management services bundle (2.11 or later).
- **Management node:** You are running management node 11.3 or later.
- **Element software:** Your storage cluster is running NetApp Element software 11.3 or later.
- **End User License Agreement (EULA):** Beginning with management services 2.20.69, you must accept and save the EULA before using the NetApp Hybrid Cloud Control UI or API to run compute node health checks:

1. Open the IP address of the management node in a web browser:

```
https://<ManagementNodeIP>
```

2. Log in to NetApp Hybrid Cloud Control by providing the storage cluster administrator credentials.
3. Select **Upgrade** near the top right of the interface.
4. The EULA pops up. Scroll down, select **I accept for current and all future updates**, and select **Save**.

Health check options

You can run health checks using NetApp Hybrid Cloud Control UI or NetApp Hybrid Cloud Control API:

- [Use NetApp Hybrid Cloud Control to run compute node health checks prior to upgrading firmware](#) (Preferred method)
- [Use API to run compute node health checks prior to upgrading firmware](#)

You can also find out more about compute node health checks that are run by the service:

- [Compute node health checks made by the service](#)

Use NetApp Hybrid Cloud Control to run compute node health checks prior to upgrading firmware

Using NetApp Hybrid Cloud Control, you can verify that a compute node is ready for a firmware upgrade.



If you have multiple two-node storage cluster configurations, each within their own vCenter, Witness Nodes health checks might not report accurately. Therefore, when you are ready to upgrade ESXi hosts, you must only shut down the Witness Node on the ESXi host that is being upgraded. You must ensure that you always have one Witness Node running in your NetApp HCI installation by powering off the Witness Nodes in an alternate fashion.

Steps

1. Open the IP address of the management node in a web browser:

```
https://<ManagementNodeIP>/hcc
```

2. Log in to NetApp Hybrid Cloud Control by providing the storage cluster administrator credentials.

3. Select **Upgrade** near the top right of the interface.

4. On the **Upgrades** page, select the **Compute firmware** tab.

- 5.



Select the health check  for the cluster you want to check for upgrade readiness.

6. On the **Compute Health Check** page, select **Run Health Check**.

7. If there are issues, the page provides a report. Do the following:

- a. Go to the specific KB article listed for each issue or perform the specified remedy.
- b. If a KB is specified, complete the process described in the relevant KB article.
- c. After you have resolved cluster issues, select **Re-Run Health Check**.

After the health check completes without errors, the compute nodes in the cluster are ready to upgrade. See [Update compute node firmware](#) to proceed.

Use API to run compute node health checks prior to upgrading firmware

You can use REST API to verify that compute nodes in a cluster are ready to be upgraded. The health check verifies that there are no obstacles to upgrading, such as ESXi host issues or other vSphere issues. You will need to run compute node health checks for each compute cluster in your environment.

Steps

1. Locate the controller ID and cluster ID:
 - a. Open the inventory service REST API UI on the management node:

```
https://<ManagementNodeIP>/inventory/1/
```
 - b. Select **Authorize** and complete the following:
 - i. Enter the cluster user name and password.
 - ii. Enter the client ID as `mnode-client` if the value is not already populated.
 - iii. Select **Authorize** to begin a session.
 - c. From the REST API UI, select **GET /installations**.
 - d. Select **Try it out**.
 - e. Select **Execute**.
 - f. From the code 200 response body, copy the "`id`" for the installation you plan to use for health checks.
 - g. From the REST API UI, select **GET /installations/{id}**.
 - h. Select **Try it out**.
 - i. Enter the installation ID.
 - j. Select **Execute**.
 - k. From the code 200 response body, copy the IDs for each of the following:
 - i. The cluster ID ("`clusterID`")
 - ii. A controller ID ("`controllerId`")

```
{
  "_links": {
    "collection":
      "https://10.117.187.199/inventory/1/installations",
      "self":
      "https://10.117.187.199/inventory/1/installations/xx94f6f0-12a6-412f-8b5e-4cf2z58329x0"
  },
  "compute": {
    "errors": [],
    "inventory": {
      "clusters": [
        {
          "clusterId": "domain-1",
          "controllerId": "abc12c3a-aa87-4e33-9f94-xx588c2cdcf6",
          "datacenterName": "NetApp-HCI-Datacenter-01",
          "installationId": "xx94f6f0-12a6-412f-8b5e-4cf2z58329x0",
          "installationName": "test-nde-mnode",
          "inventoryType": "managed",
          "name": "NetApp-HCI-Cluster-01",
          "summary": {
            "nodeCount": 2,
            "virtualMachineCount": 2
          }
        }
      ],
    }
  }
}
```

2. Run health checks on the compute nodes in the cluster:

a. Open the compute service REST API UI on the management node:

```
https://<ManagementNodeIP>/vcenter/1/
```

b. Select **Authorize** and complete the following:

- Enter the cluster user name and password.
- Enter the client ID as `mnode-client` if the value is not already populated.
- Select **Authorize** to begin a session.

c. Select **POST /compute/{CONTROLLER_ID}/health-checks**.

d. Select **Try it out**.

e. Enter the "controllerId" you copied from the previous step in the **Controller_ID** parameter field.

f. In the payload, enter the "clusterId" that you copied from the previous step as the "cluster" value and remove the "nodes" parameter.

```
{  
  "cluster": "domain-1"  
}
```

g. Select **Execute** to run a health check on the cluster.

The code 200 response gives a "resourceLink" URL with the task ID appended that is needed to confirm the health check results.

```
{  
  "resourceLink":  
    "https://10.117.150.84/vcenter/1/compute/tasks/[This is the task ID  
    for health check task results]",  
  "serviceName": "vcenter-v2-svc",  
  "taskId": "ab12c345-06f7-42d7-b87c-7x64x56x321x",  
  "taskName": "VCenter service health checks"  
}
```

h. Copy the task ID portion of the "resourceLink" URL to verify the task result.

3. Verify the result of the health checks:

a. Return to the compute service REST API UI on the management node:

```
https://<ManagementNodeIP>/vcenter/1/
```

b. Select **GET /compute/tasks/{task_id}**.

c. Select **Try it out**.

d. Enter the task ID portion of the "resourceLink" URL from the **POST /compute/{CONTROLLER_ID}/health-checks** code 200 response in the `task_id` parameter field.

e. Select **Execute**.

f. If the `status` returned indicates that there were problems regarding compute node health, do the following:

i. Go to the specific KB article (KbLink) listed for each issue or perform the specified remedy.

ii. If a KB is specified, complete the process described in the relevant KB article.

iii. After you have resolved cluster issues, run **POST /compute/{CONTROLLER_ID}/health-checks** again (see step 2).

If health checks complete without issues, the response code 200 indicates a successful result.

Compute node health checks made by the service

Compute health checks, whether performed by NetApp Hybrid Cloud Control or API methods, make the following checks per node. Depending on your environment, some of these checks might be skipped. You

should re-run health checks after resolving any detected issues.

Check description	Node/cluster	Action needed to resolve	Knowledgebase article with procedure
Is DRS enabled and fully automated?	Cluster	Turn on DRS and make sure it is fully automated.	See this KB . NOTE: If you have standard licensing, put the ESXi host into maintenance mode and ignore this health check failure warning.
Is DPM disabled in vSphere?	Cluster	Turn off Distributed Power Management.	See this KB .
Is HA admission control disabled in vSphere?	Cluster	Turn off HA admission control.	See this KB .
Is FT enabled for a VM on a host in the cluster?	Node	Suspend Fault Tolerance on any affected virtual machines.	See this KB .
Are there critical alarms in vCenter for the cluster?	Cluster	Launch vSphere and resolve and/or acknowledge any alerts before proceeding.	No KB needed to resolve issue.
Are there generic/global informational alerts in vCenter?	Cluster	Launch vSphere and resolve and/or acknowledge any alerts before proceeding.	No KB needed to resolve issue.
Are management services up to date?	HCI system	You must update management services before you perform an upgrade or run pre-upgrade health checks.	No KB needed to resolve issue. See this article for more information.
Are there errors on the current ESXi node in vSphere?	Node	Launch vSphere and resolve and/or acknowledge any alerts before proceeding.	No KB needed to resolve issue.
Is virtual media mounted to a VM on a host in the cluster?	Node	Unmount all virtual media disks (CD/DVD/floppy) from the VMs.	No KB needed to resolve issue.
Is BMC version the minimum required version that has RedFish support?	Node	Manually update your BMC firmware.	No KB needed to resolve issue.
Is ESXi host up and running?	Node	Start your ESXi host.	No KB needed to resolve issue.
Do any virtual machines reside on local ESXi storage?	Node/VM	Remove or migrate local storage attached to virtual machines.	No KB needed to resolve issue.

Check description	Node/cluster	Action needed to resolve	Knowledgebase article with procedure
Is BMC up and running?	Node	Power on your BMC and ensure it is connected to a network this management node can reach.	No KB needed to resolve issue.
Are there partner ESXi host(s) available?	Node	Make one or more ESXi host(s) in cluster available (not in maintenance mode) to migrate virtual machines.	No KB needed to resolve issue.
Are you able to connect with BMC via IPMI protocol?	Node	Enable IPMI protocol on Baseboard Management Controller (BMC).	No KB needed to resolve issue.
Is ESXi host mapped to hardware host (BMC) correctly?	Node	The ESXi host is not mapped to the Baseboard Management Controller (BMC) correctly. Correct the mapping between ESXi host and hardware host.	No KB needed to resolve issue. See this article for more information.
What is the status of the Witness Nodes in the cluster? None of the witness nodes identified are up and running.	Node	A Witness Node is not running on an alternate ESXi host. Power on the Witness Node on an alternate ESXi host and re-run the health check. One Witness Node must be running in the HCI installation at all times.	See this KB
What is the status of the Witness Nodes in the cluster? The witness node is up and running on this ESXi host and the alternate witness node is not up and running.	Node	A Witness Node is not running on an alternate ESXi host. Power on the Witness Node on an alternate ESXi host. When you are ready to upgrade this ESXi host, shut down the witness node running on this ESXi host and re-run the health check. One Witness Node must be running in the HCI installation at all times.	See this KB

Check description	Node/cluster	Action needed to resolve	Knowledgebase article with procedure
What is the status of the Witness Nodes in the cluster? Witness node is up and running on this ESXi host and the alternate node is up but is running on the same ESXi host.	Node	Both Witness Nodes are running on this ESXi host. Relocate one Witness Node to an alternate ESXi host. When you are ready to upgrade this ESXi host, shut down the Witness Node remaining on this ESXi host and re-run the health check. One Witness Node must be running in the HCI installation at all times.	See this KB
What is the status of the Witness Nodes in the cluster? Witness node is up and running on this ESXi host and the alternate witness node is up and running on another ESXi host.	Node	A Witness Node is running locally on this ESXi host. When you are ready to upgrade this ESXi host, shut down the Witness Node only on this ESXi host and re-run the health check. One Witness Node must be running in the HCI installation at all times.	See this KB

Find more information

[NetApp Element Plug-in for vCenter Server](#)

Update compute node drivers

For any H-series compute node, you can update the drivers used on the nodes using VMware Update Manager.

What you'll need

See the firmware and driver matrix for your hardware at [supported firmware and ESXi driver versions](#).

About this task

Perform only one of these update operations at a time.

You should check the current ESXi driver version before you attempt compute firmware upgrades. If the driver is out of date, upgrade the driver first. Then upgrade the compute firmware for your compute nodes.

Steps

1. Browse to the [NetApp HCI software downloads](#) page and select the download link for correct version of NetApp HCI.
2. Select **ESXI_drivers** from the drop-down list.
3. Accept the End User License Agreement.

4. Download the driver package for your node type and ESXi version.
5. Extract the downloaded driver bundle on your local computer.



The NetApp driver bundle includes one or more VMware Offline Bundle ZIP files; do not extract these ZIP files.

6. Go to **VMware Update Manager** in VMware vCenter.
7. Import the driver offline bundle file for the compute nodes into the **Patch Repository**.

For VMware ESXi 6.x and 7.0 to 7.0 U3, perform the following steps to import the driver offline bundle file:

- a. Select the **Updates** tab.
- b. Select **UPLOAD FROM FILE**.
- c. Browse to the offline bundle that was previously downloaded and select **IMPORT**.

8. Create a new host baseline for the compute node.
9. Choose **Host Extension** for Name and Type and select all imported driver packages to be included in the new baseline.
10. In the **Host and Clusters** menu in vCenter, select the cluster with the compute nodes you would like to update and navigate to the **Update Manager** tab.
11. Select **Remediate** and the select the newly created host baseline. Ensure that drivers included in the baseline are selected.
12. Proceed through the wizard to the **Host Remediation Options** and ensure that the **Do Not Change VM Power State** option is selected to keep virtual machines online during the driver update.



If VMware Distributed Resource Scheduler (DRS) is enabled on the cluster (this is the default in NetApp HCI installations), virtual machines will automatically be migrated to other nodes in the cluster.

13. Proceed to the **Ready to Complete** page in the wizard and select **Finish**.

The drivers for all compute nodes in the cluster are updated one node at a time while virtual machines stay online.

Find more information

[NetApp Element Plug-in for vCenter Server](#)

Upgrade compute node firmware

For H-series compute nodes, you can upgrade the firmware for hardware components such as the BMC, BIOS, and NIC. To upgrade compute node firmware, you can use the NetApp Hybrid Cloud Control UI, REST API, a USB drive with the latest firmware image, or the BMC UI.

After the upgrade, the compute node boots into ESXi and works as before, retaining the configuration.

What you'll need

- **Compute drivers:** You have upgraded your compute node drivers. If compute node drivers are not compatible with the new firmware, the upgrade will not start. See the [Interoperability Matrix Tool \(IMT\)](#) for driver and firmware compatibility information, and check the latest [compute node firmware release notes](#) for important late-breaking firmware and driver details.
- **Admin privileges:** You have cluster administrator and BMC administrator permissions to perform the upgrade.
- **System ports:** If you are using NetApp Hybrid Cloud Control for upgrades, you have ensured that the necessary ports are open. See [Network ports](#) for more information.
- **Minimum BMC and BIOS versions:** The node you intend to upgrade using NetApp Hybrid Cloud Control meets the following minimum requirements:

Model	Minimum BMC version	Minimum BIOS version
H300E/H500E/H700E	6.84.00	NA2.1
H410C	All versions supported (no upgrade required)	All versions supported (no upgrade required)
H610C	3.96.07	3B01
H615C	4.68.07	3B08.CO



H615C compute nodes must update BMC firmware to version 4.68 using the [compute firmware bundle 2.27](#) to enable NetApp Hybrid Cloud Control to perform future firmware upgrades.



For a complete matrix of firmware and driver firmware for your hardware, see [supported firmware and ESXi driver versions](#).

- **BIOS boot order:** Manually change the boot order in the BIOS setup for each node to ensure USB CD/DVD appears in the boot list. See this [article](#) for more information.
- **BMC credentials:** Update the credentials NetApp Hybrid Cloud Control uses to connect to the compute node BMC. You can do this using either the NetApp Hybrid Cloud Control [UI](#) or [API](#). Updating BMC information prior to upgrade refreshes the inventory and ensures that management node services are aware of all hardware parameters needed to complete the upgrade.
- **Attached media:** Disconnect any physical USB or ISO before starting a compute node upgrade.
- **KVM ESXi console:** Close all open Serial-Over-LAN (SOL) sessions and active KVM sessions in the BMC UI before starting a compute node upgrade.
- **Witness Node requirements:** In two- and three-node storage clusters, one [Witness Node](#) must be running in the NetApp HCI installation at all times.
- **Compute node health check:** You have verified that the node is ready to be upgraded. See [Run compute node health checks prior to upgrading compute firmware](#).
- **End User License Agreement (EULA):** Beginning with management services 2.20.69, you must accept and save the EULA before using the NetApp Hybrid Cloud Control UI or API to upgrade compute node firmware:
 1. Open the IP address of the management node in a web browser:

`https://<ManagementNodeIP>`

2. Log in to NetApp Hybrid Cloud Control by providing the storage cluster administrator credentials.
3. Select **Upgrade** near the top right of the interface.
4. The EULA pops up. Scroll down, select **I accept for current and all future updates**, and select **Save**.

About this task

In production environments, upgrade the firmware on one compute node at a time.



The ESXi host must be taken out of lockdown mode prior to running a health check and proceeding with the firmware upgrade. See [How to disable lockdown mode on ESXi host](#) and [VMware lockdown mode behavior](#) for more information.

For NetApp Hybrid Cloud Control UI or API upgrades, your ESXi host will be automatically placed in maintenance mode during the upgrade process if you have the DRS feature and required licensing. The node will be rebooted and after the upgrade process is complete, the ESXi host will be taken out of maintenance mode. For USB and BMC UI options, you will need to place the ESXi host in maintenance mode manually, as described in each procedure.



Before upgrading, make sure you check the current ESXi driver version. If the driver is out of date, upgrade the driver first. Then upgrade the compute firmware for your compute nodes.

Upgrade options

Choose the option that is relevant to your upgrade scenario:

- [Use NetApp Hybrid Cloud Control UI to upgrade a compute node](#) (Recommended)
- [Use NetApp Hybrid Cloud Control API to upgrade a compute node](#)
- [Use a USB drive imaged with the latest compute firmware bundle](#)
- [Use the Baseboard Management Controller \(BMC\) user interface \(UI\)](#)

Use NetApp Hybrid Cloud Control UI to upgrade a compute node

Starting with management services 2.14, you can upgrade a compute node using the NetApp Hybrid Cloud Control UI. From the list of nodes, you must select the node to upgrade. The **Current Versions** tab shows the current firmware versions and the **Proposed Versions** tab shows the available upgrade versions, if any.



For a successful upgrade, ensure that the health check on the vSphere cluster is successful.



Upgrading the NIC, BIOS, and BMC can take approximately 60 minutes per node depending on the speed of network connectivity between the management node and the BMC host.



Using the NetApp Hybrid Cloud Control UI to upgrade compute firmware on H300E/H500E/H700E compute nodes is no longer supported. To upgrade, you should use a [USB drive](#) or the [BMC UI](#) to mount the compute firmware bundle.

What you'll need

- If your management node is not connected to the internet, you have downloaded the compute firmware bundle from the [NetApp Support Site](#).



You should extract the TAR.GZ file to a TAR file, and then extract the TAR file to the compute firmware bundle.

Steps

1. Open the IP address of the management node in a web browser:

```
https://<ManagementNodeIP>
```

2. Log in to NetApp Hybrid Cloud Control by providing the storage cluster administrator credentials.
3. Select **Upgrade** near the top right of the interface.
4. On the **Upgrades** page, select **Compute firmware**.
5. Select the cluster you are upgrading.

You will see the nodes in the cluster listed along with the current firmware versions and newer versions, if available for upgrade.

6. Select **Browse** to upload the compute firmware bundle that you downloaded from the [NetApp Support Site](#).
7. Wait for the upload to complete. A progress bar shows the status of the upload.



The file upload will happen in the background if you navigate away from the browser window.

An on-screen message is displayed after the file is successfully uploaded and validated. Validation might take several minutes.

8. Select the compute firmware bundle.
9. Select **Begin Upgrade**.

After you select **Begin Upgrade**, the window shows failed health checks, if any.



The upgrade cannot be paused after you begin. Firmware will be updated sequentially in the following order: NIC, BIOS, and BMC. Do not log in to the BMC UI during upgrade. Logging into the BMC terminates the Hybrid Cloud Control Serial-Over-LAN (SOL) session that monitors upgrade process.

10. If the health checks at the cluster or node level passed with warnings, but without critical failures, you will see **Ready to be Upgraded**. Select **Upgrade Node**.



While the upgrade is in progress, you can leave the page and come back to it later to continue monitoring the progress. During the upgrade, the UI shows various messages about the status of the upgrade.



While upgrading the firmware on H610C and H615C compute nodes, do not open the Serial-Over-LAN (SOL) console through the BMC web UI. This might cause the upgrade to fail.

The UI displays a message after the upgrade is complete. You can download logs after the upgrade is complete. For information about the various upgrade status changes, see [Upgrade status changes](#).



If a failure happens during the upgrade, NetApp Hybrid Cloud Control will reboot the node, take it out of maintenance mode, and display the failure status with a link to the error log. You can download the error log, which contains specific instructions or links to KB articles, to diagnose and correct any issue. For additional insight into compute node firmware upgrade issues using NetApp Hybrid Cloud Control, see this [KB article](#).

Upgrade status changes

Here are the different states that the UI shows before, during, and after the upgrade process:

Upgrade state	Description
Node failed one or more health checks. Expand to view details.	One or more health checks failed.
Error	An error has occurred during the upgrade. You can download the error log and send it to NetApp Support.
Unable to Detect	This status is displayed if NetApp Hybrid Cloud Control is unable to query the compute node when the compute node asset does not have the hardware tag.
Ready to be Upgraded.	All the health checks passed successfully, and the node is ready to be upgraded.
An error has occurred during the upgrade.	The upgrade fails with this notification when a critical error occurs. Download the logs by selecting the Download Logs link to help resolve the error. You can try upgrading again after you resolve the error.
Node upgrade is in progress.	The upgrade is in progress. A progress bar shows the upgrade status.

Use NetApp Hybrid Cloud Control API to upgrade a compute node

You can use APIs to upgrade each compute node in a cluster to the latest firmware version. You can use an automation tool of your choice to run the APIs. The API workflow documented here uses the REST API UI available on the management node as an example.



Using the NetApp Hybrid Cloud Control UI to upgrade compute firmware on H300E/H500E/H700E compute nodes is no longer supported. To upgrade, you should use a [USB drive](#) or the [BMC UI](#) to mount the compute firmware bundle.

What you'll need

Compute node assets, including vCenter and hardware assets, must be known to management node assets. You can use the inventory service APIs to verify assets (<https://<ManagementNodeIP>/inventory/1/>).

Steps

1. Go to the NetApp HCI software [download page](#) and download the latest compute firmware bundle to a device that is accessible to the management node.
2. Upload the compute firmware bundle to the management node:
 - a. Open the management node REST API UI on the management node:

```
https://<ManagementNodeIP>/package-repository/1/
```

- b. Select **Authorize** and complete the following:
 - i. Enter the cluster user name and password.
 - ii. Enter the client ID as `mnode-client`.
 - iii. Select **Authorize** to begin a session.
 - iv. Close the authorization window.
- c. From the REST API UI, select **POST /packages**.
- d. Select **Try it out**.
- e. Select **Browse** and select the compute firmware bundle.
- f. Select **Execute** to initiate the upload.
- g. From the response, copy and save the compute firmware bundle ID ("id") for use in a later step.

3. Verify the status of the upload.
 - a. From the REST API UI, select **GET /packages/{id}/status**.
 - b. Select **Try it out**.
 - c. Enter the compute firmware bundle ID you copied in the previous step in **id**.
 - d. Select **Execute** to initiate the status request.

The response indicates `state` as `SUCCESS` when complete.

- e. From the response, copy and save the compute firmware bundle name ("name") and version ("version") for use in a later step.

4. Locate the compute controller ID and node hardware ID for the node you intend to upgrade:
 - a. Open the inventory service REST API UI on the management node:

```
https://<ManagementNodeIP>/inventory/1/
```

- b. Select **Authorize** and complete the following:
 - i. Enter the cluster user name and password.
 - ii. Enter the client ID as `mnode-client`.
 - iii. Select **Authorize** to begin a session.
 - iv. Close the authorization window.
- c. From the REST API UI, select **GET /installations**.
- d. Select **Try it out**.
- e. Select **Execute**.
- f. From the response, copy the installation asset ID ("id").
- g. From the REST API UI, select **GET /installations/{id}**.
- h. Select **Try it out**.

- i. Paste the installation asset ID into the **id** field.
- j. Select **Execute**.
- k. From the response, copy and save the cluster controller ID ("controllerId") and node hardware ID ("hardwareId") for use in a later step:

```
"compute": {
  "errors": [],
  "inventory": {
    "clusters": [
      {
        "clusterId": "Test-1B",
        "controllerId": "a1b23456-c1d2-11e1-1234-a12bcdef123a",
        "hardwareId": "123a4567-01b1-1243-a12b-11ab11ab0a15",
        "id": "e1111d10-1ala-12d7-1a23-ab1cde23456f",
        "model": "H410C",
        "nodeId": "111930011231",
        "nodeType": "Compute"
      }
    ]
  }
}
```

```
"nodes": [
  {
    "bmcDetails": {
      "bmcAddress": "10.111.0.111",
      "credentialsAvailable": true,
      "credentialsValidated": true
    },
    "chassisSerialNumber": "111930011231",
    "chassisSlot": "D",
    "hardwareId": "123a4567-01b1-1243-a12b-11ab11ab0a15",
    "hardwareTag": "00000000-0000-0000-0000-ab1c2de34f5g",
    "id": "e1111d10-1ala-12d7-1a23-ab1cde23456f",
    "model": "H410C",
    "nodeId": "111930011231",
    "nodeType": "Compute"
  }
]
```

5. Run the compute node firmware upgrade:

- a. Open the hardware service REST API UI on the management node:

```
https://<ManagementNodeIP>/hardware/2/
```

- b. Select **Authorize** and complete the following:
 - i. Enter the cluster user name and password.
 - ii. Enter the client ID as `mnode-client`.
 - iii. Select **Authorize** to begin a session.
 - iv. Close the authorization window.
- c. Select **POST /nodes/{hardware_id}/upgrades**.
- d. Select **Try it out**.
- e. Enter the hardware host asset ID ("hardwareId" saved from a previous step) in the parameter field.

f. Do the following with the payload values:

- i. Retain the values "force": false and "maintenanceMode": true so that health checks are performed on the node and the ESXi host is set to maintenance mode.
- ii. Enter the cluster controller ID ("controllerId" saved from a previous step).
- iii. Enter the compute firmware bundle name and version that you saved from a previous step.

```
{  
  "config": {  
    "force": false,  
    "maintenanceMode": true  
  },  
  "controllerId": "a1b23456-c1d2-11e1-1234-a12bcdef123a",  
  "packageName": "compute-firmware-12.2.109",  
  "packageVersion": "12.2.109"  
}
```

g. Select **Execute** to initiate the upgrade.



The upgrade cannot be paused after you begin. Firmware will be updated sequentially in the following order: NIC, BIOS, and BMC. Do not log in to the BMC UI during upgrade. Logging into the BMC terminates the Hybrid Cloud Control Serial-Over-LAN (SOL) session that monitors upgrade process.

h. Copy the upgrade task ID that is part of the resource link ("resourceLink") URL in the response.

6. Verify the upgrade progress and results:

- a. Select **GET /task/{task_id}/logs**.
- b. Select **Try it out**.
- c. Enter the task ID from the previous step in **task_id**.
- d. Select **Execute**.
- e. Do one of the following if there are problems or special requirements during the upgrade:

Option	Steps
You need to correct cluster health issues due to failedHealthChecks message in the response body.	<ol style="list-style-type: none">1. Go to the specific KB article listed for each issue or perform the specified remedy.2. If a KB is specified, complete the process described in the relevant KB article.3. After you have resolved cluster issues, reauthenticate if needed and select POST /nodes/{hardware_id}/upgrades.4. Repeat the steps as described previously in the upgrade step.

Option	Steps
The upgrade fails and the mitigation steps are not listed in upgrade log.	1. See this KB article (login required).

f. Run the **GET /task/{task_id}/logs** API multiple times, as needed, until the process is complete.

During the upgrade, the `status` indicates `running` if no errors are encountered. As each step finishes, the `status` value changes to `completed`.

The upgrade has finished successfully when the status for each step is `completed` and the `percentageCompleted` value is 100.

7. (Optional) Confirm upgraded firmware versions for each component:

a. Open the hardware service REST API UI on the management node:

```
https://<ManagementNodeIP>/hardware/2/
```

b. Select **Authorize** and complete the following:

- Enter the cluster user name and password.
- Enter the client ID as `mnode-client`.
- Select **Authorize** to begin a session.
- Close the authorization window.

c. From the REST API UI, select **GET /nodes/{hardware_id}/upgrades**.

d. (Optional) Enter date and status parameters to filter the results.

e. Enter the hardware host asset ID ("hardwareId" saved from a previous step) in the parameter field.

f. Select **Try it out**.

g. Select **Execute**.

h. Verify in the response that firmware for all components has been successfully upgraded from the previous version to the latest firmware.

Use a USB drive imaged with the latest compute firmware bundle

You can insert a USB drive with the latest compute firmware bundle downloaded to a USB port on the compute node. As an alternative to using the USB thumb drive method described in this procedure, you can mount the compute firmware bundle on the compute node using the **Virtual CD/DVD** option in the Virtual Console in the Baseboard Management Controller (BMC) interface. The BMC method takes considerably longer than the USB thumb drive method. Ensure that your workstation or server has the necessary network bandwidth and that your browser session with the BMC does not time out.

What you'll need

- If your management node is not connected to the internet, you have downloaded the compute firmware bundle from the [NetApp Support Site](#).



You should extract the `TAR.GZ` file to a `TAR` file, and then extract the `TAR` file to the compute firmware bundle.

Steps

1. Use the Etcher utility to flash the compute firmware bundle to a USB drive.
2. Place the compute node in maintenance mode using VMware vCenter, and evacuate all virtual machines from the host.

 If VMware Distributed Resource Scheduler (DRS) is enabled on the cluster (this is the default in NetApp HCI installations), virtual machines will automatically be migrated to other nodes in the cluster.

3. Insert the USB thumb drive into a USB port on the compute node and reboot the compute node using VMware vCenter.
4. During the compute node POST cycle, press **F11** to open the Boot Manager. You may need to press **F11** multiple times in quick succession. You can perform this operation by connecting a video/keyboard or by using the console in BMC.
5. Select **One Shot > USB Flash Drive** from the menu that appears. If the USB thumb drive does not appear in the menu, verify that USB Flash Drive is part of the legacy boot order in the BIOS of the system.
6. Press **Enter** to boot the system from the USB thumb drive. The firmware flash process begins.

After firmware flashing is complete and the node reboots, it might take a few minutes for ESXi to start.

7. After the reboot is complete, exit maintenance mode on the upgraded compute node using vCenter.
8. Remove the USB flash drive from the upgraded compute node.
9. Repeat this task for other compute nodes in your ESXi cluster until all compute nodes are upgraded.

Use the Baseboard Management Controller (BMC) user interface (UI)

You must perform the sequential steps to load the compute firmware bundle and reboot the node to the compute firmware bundle to ensure that the upgrade is successful. The compute firmware bundle should be located on the system or virtual machine (VM) hosting the web browser. Verify that you have downloaded the compute firmware bundle before you start the process.



The recommendation is to have the system or VM and the node on the same network.



It takes approximately 25 to 30 minutes for the upgrade via the BMC UI.

- [Upgrade firmware on H410C and H300E/H500E/H700E nodes](#)
- [Upgrade firmware on H610C/H615C nodes](#)

Upgrade firmware on H410C and H300E/H500E/H700E nodes

If your node is part of a cluster, you must place the node in maintenance mode before the upgrade, and take it out of maintenance mode after the upgrade.



Ignore the following informational message you see during the process: Untrusty Debug Firmware Key is used, SecureFlash is currently in Debug Mode

Steps

1. If your node is part of a cluster, place it in maintenance mode as follows. If not, skip to step 2.

- a. Log in to the VMware vCenter web client.
- b. Right-click the host (compute node) name and select **Maintenance Mode > Enter Maintenance Mode**.
- c. Select **OK**.
VMs on the host will be migrated to another available host. VM migration can take time depending on the number of VMs that need to be migrated.



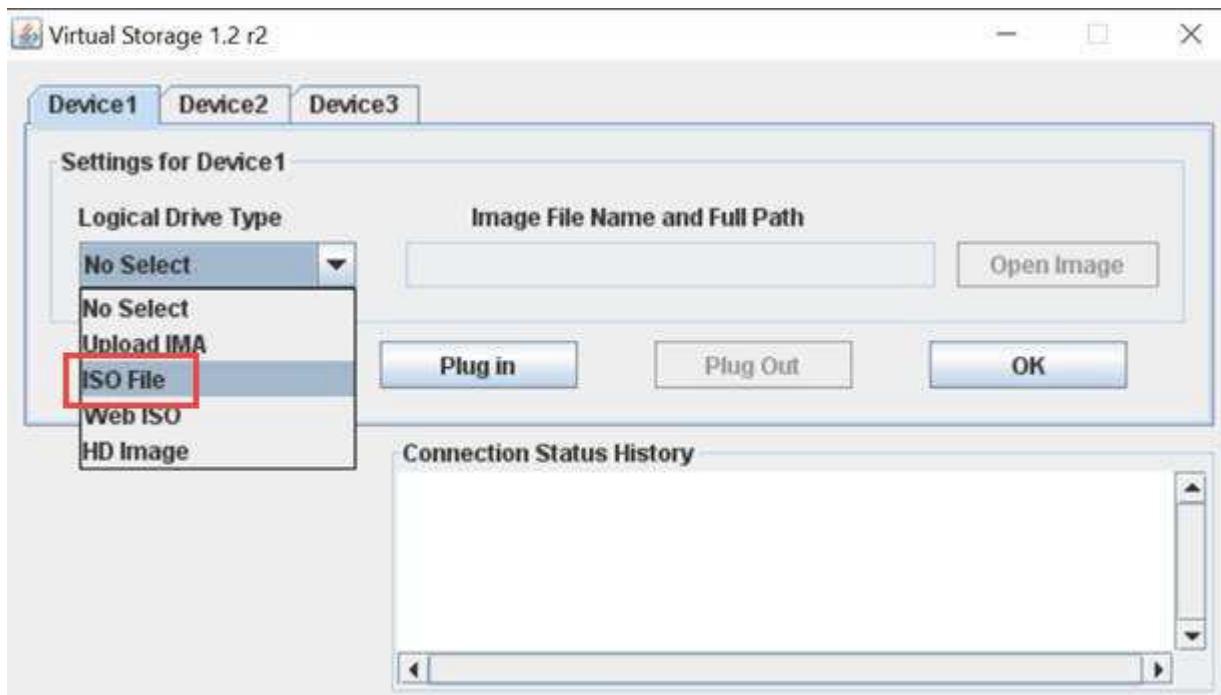
Ensure that all the VMs on the host are migrated before you proceed.

2. Navigate to the BMC UI, <https://BMCIP/#login>, where BMCIP is the IP address of the BMC.
3. Log in using your credentials.
4. Select **Remote Control > Console Redirection**.
5. Select **Launch Console**.



You might have to install Java or update it.

6. When the console opens, select **Virtual Media > Virtual Storage**.
7. On the **Virtual Storage** screen, select **Logical Drive Type**, and select **ISO File**.



8. Select **Open Image** to browse to the folder where you downloaded the compute firmware bundle file, and select the compute firmware bundle file.
9. Select **Plug In**.
10. When the connection status shows **Device#: VM Plug-in OK!!**, select **OK**.
11. Reboot the node by pressing **F12** and selecting **Restart** or selecting **Power Control > Set Power Reset**.
12. During reboot, press **F11** to select the boot options and load the compute firmware bundle. You might have to press F11 a few times before the boot menu is displayed.

You will see the following screen:



13. On the above screen, press **Enter**. Depending on your network, it might take a few minutes after you press **Enter** for the upgrade to begin.



Some of the firmware upgrades might cause the console to disconnect and/or cause your session on the BMC to disconnect. You can log back into the BMC, however some services, such as the console, may not be available due to the firmware upgrades. After the upgrades have completed, the node will perform a cold reboot, which can take approximately five minutes.

14. Log back in to the BMC UI and select **System** to verify the BIOS version and build time after booting to the OS. If the upgrade completed correctly, you see the new BIOS and BMC versions.



The BIOS version will not show the upgraded version until the node has finished fully booting.

15. If the node is part of a cluster, complete the steps below. If it is a standalone node, no further action is needed.
 - a. Log in to the VMware vCenter web client.
 - b. Take the host out of maintenance mode. This might show a disconnected red flag. Wait until all statuses are cleared.
 - c. Power on any of the remaining VMs that were powered off.

Upgrade firmware on H610C/H615C nodes

The steps vary depending on whether the node is standalone or part of a cluster. The procedure can take approximately 25 minutes and includes powering the node off, uploading the compute firmware bundle, flashing the devices, and powering the node back on after the upgrade.

Steps

1. If your node is part of a cluster, place it in maintenance mode as follows. If not, skip to step 2.
 - a. Log in to the VMware vCenter web client.
 - b. Right-click the host (compute node) name and select **Maintenance Mode > Enter Maintenance Mode**.
 - c. Select **OK**.VMs on the host will be migrated to another available host. VM migration can take time depending on the number of VMs that need to be migrated.



Ensure that all the VMs on the host are migrated before you proceed.

2. Navigate to the BMC UI, <https://BMCIIP/#login>, where BMC IP is the IP address of the BMC.

3. Log in using your credentials.
4. Select **Remote Control > Launch KVM (Java)**.
5. In the console window, select **Media > Virtual Media Wizard**.



6. Select **Browse** and select the compute firmware .iso file.

7. Select **Connect**.

A popup indicating success is displayed, along with the path and device showing at the bottom. You can close the **Virtual Media** window.



8. Reboot the node by pressing **F12** and selecting **Restart** or selecting **Power Control > Set Power Reset**.
9. During reboot, press **F11** to select the boot options and load the compute firmware bundle.
10. Select **AMI Virtual CDROM** from the list displayed and select **Enter**. If you do not see AMI Virtual CDROM in the list, go into the BIOS and enable it in the boot list. The node will reboot after you save. During the reboot, press **F11**.



11. On the screen displayed, select **Enter**.



Some of the firmware upgrades might cause the console to disconnect and/or cause your session on the BMC to disconnect. You can log back into the BMC, however some services, such as the console, might not be available due to the firmware upgrades. After the upgrades have completed, the node will perform a cold reboot, which can take approximately five minutes.

12. If you get disconnected from the console, select **Remote Control** and select **Launch KVM** or **Launch KVM (Java)** to reconnect and verify when the node has finished booting back up. You might need multiple reconnects to verify that the node booted successfully.



During the powering on process, for approximately five minutes, the KVM console displays **No Signal**.

13. After the node is powered on, select **Dashboard > Device Information > More info** to verify the BIOS and BMC versions. The upgraded BIOS and BMC versions are displayed. The upgraded version of the BIOS will not be displayed until the node has fully booted up.
14. If you placed the node in maintenance mode, after the node boots to ESXi, right-click the host (compute node) name, and select **Maintenance Mode > Exit Maintenance Mode**, and migrate the VMs back to the host.
15. In vCenter, with the host name selected, configure and verify the BIOS version.

Find more information

[NetApp Element Plug-in for vCenter Server](#)

Automate compute node firmware upgrades with Ansible

You can update system firmware on NetApp HCI compute nodes, including firmware for components such as the BMC, BIOS, and NIC using workflows in NetApp Hybrid Cloud Control. For installations with large compute clusters, you can automate the workflows by using Ansible to perform a rolling upgrade of the entire cluster.



While the Ansible role to automate compute node firmware upgrades is made available by NetApp, the automation is an auxiliary component that requires additional set up and software components to run. Modification of the Ansible automation is supported only on a best effort basis.



The Ansible role for upgrades works only on NetApp HCI H-series compute nodes. You cannot use this role to upgrade third-party compute nodes.

What you'll need

- **Readiness and prerequisites for firmware upgrades:** Your NetApp HCI installation must be ready for firmware upgrade as outlined in the instructions for [performing firmware upgrades](#).
- **Readiness to run automation on Ansible control node:** A physical or virtual server to run firmware update automation in Ansible.

About this task

In a production environment, you should update compute nodes in a cluster in a NetApp HCI installation in a rolling fashion; one node after the other, one node at a time. APIs in NetApp Hybrid Cloud Control orchestrate the overall compute node firmware upgrade process for a single compute node, including running health checks, placing ESXi on the compute nodes into maintenance, and rebooting the compute node to apply the firmware upgrades. The Ansible role provides the option to orchestrate the firmware upgrade for a group of compute nodes or entire clusters.

Get started with firmware upgrade automation

To get started, navigate to the [NetApp Ansible repository on GitHub](#) and download the `nar_compute_nodes_firmware_upgrades` role and documentation.

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