Contents

Deciding whether to use this guide ................................................................. 4
Cluster expansion workflow ............................................................................. 5
  Verifying the cluster is ready for expansion .............................................. 6
  Verifying the planned configuration ......................................................... 6
  Gathering the required network information ............................................ 7
  Adding or replacing switches ................................................................. 8
Preparing the cluster for expansion ............................................................ 9
  Adding node-locked licenses ................................................................. 9
  Verifying the health of the system ......................................................... 10
  Backing up the cluster configuration .................................................... 11
  Generating an AutoSupport message about starting expansion .......... 11
Installing the new nodes ............................................................................... 11
  Installing the controllers ......................................................................... 12
  Configuring node-management LIFs ....................................................... 13
Upgrading or downgrading the nodes ......................................................... 14
Ensuring hardware-level HA is enabled ....................................................... 15
Adding nodes to a cluster using System Manager ...................................... 16
Joining nodes to the cluster using the CLI ................................................ 17
Completing the expansion .......................................................................... 19
  Configuring the node details in System Manager ................................. 19
  Configuring AutoSupport on the new nodes ......................................... 20
  Configuring the Service Processor network ......................................... 20
  Validating the configuration of the expanded cluster ........................ 22
  Generating an AutoSupport message about completing expansion .......... 23
Updating LUN paths for the new nodes .................................................... 23
Where to find additional information ....................................................... 25
Copyright information ............................................................................... 26
Trademark information ............................................................................. 27
How to send comments about documentation and receive update notifications .................................................. 28
Index ............................................................................................................. 29
Deciding whether to use the Cluster Expansion Express Guide

This guide describes how to quickly and nondisruptively expand an existing cluster by adding an HA pair. A larger cluster increases performance and storage capacity available in the cluster.

You should use this guide only if the following is true:

• The existing cluster meets the following requirements:
  ◦ It is running ONTAP 9.
  ◦ It contains at least two nodes. Although examples in this guide use a two-node cluster, this guide also applies to clusters with more than two nodes.
  ◦ If you want to add a node to a single-node cluster, you must follow a different procedure.
  ◦ It does not use IPv6 addressing or Storage Encryption.
  ◦ It is not a MetroCluster configuration.

• The controller modules that you plan to add meet the following requirements:
  ◦ If they are not new, they have been wiped clean, are no longer part of a cluster, and are ready to be added to the new cluster.
  ◦ They support ONTAP 9.
  ◦ They are running a version of the ONTAP 9 release family.

• You want to use best practices, not explore every available option.

• You do not want to read a lot of conceptual background.
Cluster expansion workflow

Adding two nodes to an existing cluster involves verifying that the cluster is ready for expansion, preparing the cluster, installing the new nodes, and completing the expansion.

Steps

1. **Verifying the cluster is ready for expansion** on page 6  
   Before you start expanding a cluster, you must verify the planned configuration, gather the required network information, and add or replace switches, if necessary.

2. **Preparing the cluster for expansion** on page 9  
   To prepare a cluster for expansion, you must add node-locked licenses, verify the system health, back up the cluster’s configuration, and generate an AutoSupport message.

3. **Installing the new nodes** on page 11  
   After the cluster is prepared, you must install the controllers and configure the node-management LIFs. If the controllers are not running the same ONTAP version as the existing cluster, or are
repurposed and lack hardware-level HA, you must address those issues in Maintenance mode. Finally, you can join the nodes to the cluster.

4. **Completing the expansion** on page 19

   After both nodes are joined to the cluster, you must finish configuring the newly added nodes by configuring AutoSupport and completing the SP network. You then validate the expanded cluster and generate an AutoSupport message to complete the expansion. If the cluster uses SAN, you should update LUN paths.

---

**Verifying the cluster is ready for expansion**

Before you start expanding a cluster, you must verify the planned configuration, gather the required network information, and add or replace switches, if necessary.

**Steps**

1. **Verifying the planned configuration** on page 6
   
   Before you expand a cluster, you must ensure the following: the planned configuration is supported, the required licenses exist, the site is ready, the cluster switches support the expansion, and the existing nodes are using the same version of ONTAP 9.

2. **Gathering the required network information** on page 7
   
   Before you expand a cluster, you must obtain networking information required to later configure the node-management LIFs and the Service Processor IP addresses for both of the nodes.

3. **Adding or replacing switches** on page 8
   
   Before you expand the cluster, you must ensure that the cluster switches support the expanded configuration. If the cluster is switchless, you must add switches. If the existing switches do not have enough ports available to support the new configuration, you must replace the switches.

---

**Verifying the planned configuration**

Before you expand a cluster, you must ensure the following: the planned configuration is supported, the required licenses exist, the site is ready, the cluster switches support the expansion, and the existing nodes are using the same version of ONTAP 9.

**Before you begin**

You must have two sets of credentials—the user name and password required to log in to the cluster as an administrator, and the user name and password required to log in to the NetApp Support Site.

**Steps**

1. Verify the planned configuration:
   
   a. Verify that the platform of the new controllers can be mixed with the cluster's existing controllers.

   b. Verify that the expanded cluster does not exceed the system limits for the platforms.

      *NetApp Hardware Universe*

   c. If your cluster is configured for SAN, verify that the expanded cluster does not exceed the configuration limits for FC, FCoE, and iSCSI.

      *SAN configuration*

      If these requirements are not met, you cannot proceed with the expansion.

2. Ensure that licenses cover the new nodes:
a. On the existing cluster, view the licenses by using the `system license show` command.

**Example**

```
cluster1::> system license show
Serial Number: 9-99-999999
Owner: cluster1
Package  Type       Description           Expiration
----------------- ------- --------------------- --------------------
Base              site    Cluster Base License  -
NFS               license NFS License           -
CIFS              license CIFS License          -
...
```

b. Review the output to identify the node-locked licenses (identified by the type `license`) that will be required for the additional nodes.

c. Ensure that the licenses that are included with the additional nodes are consistent with the cluster's existing node-locked licenses.

**NetApp Software License Search**

If you do not have the required licenses for the additional nodes, you must purchase additional licenses before you proceed.

3. Verify that the site is ready for all the new equipment.

**NetApp Hardware Universe**

If the site is not ready, you must prepare the site before continuing with the expansion.

4. Verify that the existing switches support the additional controllers.

**NetApp Hardware Universe**

If the cluster is switchless or if the existing switches do not support the additional nodes, you must obtain cluster switches, which you can install later in the expansion process.

5. Verify that all nodes in the existing cluster are running the same version of ONTAP 9—including the same minor release and patch, if applicable—by using the `cluster image show` command.

**Example**

```
cluster1::> cluster image show
<table>
<thead>
<tr>
<th>Node</th>
<th>Current Version</th>
<th>Installation Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>cluster1-1</td>
<td>8.3RC1</td>
<td>12/15/2014 17:37:26</td>
</tr>
<tr>
<td>cluster1-2</td>
<td>8.3RC1</td>
<td>12/15/2014 17:37:42</td>
</tr>
</tbody>
</table>
```

You should make note of the version of ONTAP software for reference later in this workflow.

**Gathering the required network information**

Before you expand a cluster, you must obtain networking information required to later configure the node-management LIFs and the Service Processor IP addresses for both of the nodes.

**Steps**

1. Obtain the following details to configure two node-management LIFs—one for each of the nodes that you plan to add to the cluster:
   - IP address
   - Network mask
Gateway
Port

2. If your site typically has DNS entries for node-management LIFs, ensure that DNS entries are created for the new nodes.

3. Determine whether the cluster uses automatic or manual network configuration for the SP by using the `system service-processor network auto-configuration show` command.

   If a subnet name is displayed in either the SP IPv4 Subnet Name or SP IPv6 Subnet Name column, the cluster is using automatic SP networking. If both columns are blank, the cluster is using manual SP networking.

   **Example**

   In the following output, the sub1 subnet indicates that cluster1 SP uses automatic network configuration:

   ```
   cluster1::> system service-processor network auto-configuration show
   Cluster Name        SP IPv4 Subnet Name       SP IPv6 Subnet Name
   ------------------- ----------------------------- -------------------
   cluster1            sub1                         -
   ```

   **Example**

   In the following output, the blank subnet fields indicate that cluster1 SP uses manual network configuration:

   ```
   cluster1::> system service-processor network auto-configuration show
   Cluster Name        SP IPv4 Subnet Name       SP IPv6 Subnet Name
   ------------------- ----------------------------- -------------------
   cluster1            -                            -
   ```

4. Depending on the SP network configuration, perform one of the following actions:

   - If the SP uses manual network configuration, obtain two IP addresses that you will use later when configuring SP on the new nodes.
   - If the SP uses automatic network configuration, verify that the subnet used by the SP has available IP addresses for the two new nodes by using the `network subnet show` command.

   **Example**

   In the following output, the sub1 subnet has 2 addresses available:

   ```
   cluster1::> network subnet show
   IPspace: Default
   Subnet Name | Subnet | Broadcast | Domain | Gateway | Avail/Total | Ranges
   --------------------------------------------
   sub1        10.53.33.1/18 | Default | 10.53.0.1 | 2/4    | 10.53.33.3-10.53.33.6
   ```

   **Adding or replacing switches**

   Before you expand the cluster, you must ensure that the cluster switches support the expanded configuration. If the cluster is switchless, you must add switches. If the existing switches do not have enough ports available to support the new configuration, you must replace the switches.

   **Choices**

   - If the cluster is currently a two-node switchless cluster, migrate the cluster to a two-node switched cluster using the type of switch you prefer.
Preparing the cluster for expansion

To prepare a cluster for expansion, you must add node-locked licenses, verify the system health, back up the cluster's configuration, and generate an AutoSupport message.

Steps

1. Adding node-locked licenses on page 9
   If the cluster has features that use node-locked licenses (which entitle only specific nodes to the licensed functionality), you must ensure that node-locked licenses are installed for the new nodes. You should add the licenses before the nodes are joined to the cluster.

2. Verifying the health of the system on page 10
   Before you expand a cluster, you must verify that all components of the cluster are healthy by running the Config Advisor tool and running several ONTAP CLI commands.

3. Backing up the cluster configuration on page 11
   Before you expand a cluster, you should use advanced privilege to create a backup file to save the cluster configuration information and optionally save the node configurations.

4. Generating an AutoSupport message about starting expansion on page 11
   Immediately before you expand a cluster, you should send an AutoSupport message to indicate that you are about to start the expansion process. The message informs internal and external support staff about expansion and acts as a timestamp for any troubleshooting that might be required later.

Adding node-locked licenses

If the cluster has features that use node-locked licenses (which entitle only specific nodes to the licensed functionality), you must ensure that node-locked licenses are installed for the new nodes. You should add the licenses before the nodes are joined to the cluster.

Steps

1. Add each license key by using the `system license add` command.

   **Example**

   ```
   cluster1:~> system license add -license-code AAAAAAAAAAAAAA
   ```

2. View the existing licenses by using the `system license show` command.

   **Example**

   ```
   cluster1:~> system license show
   ```

   ```
   Serial Number: 9-99-999999
   Owner: cluster1
   Package | Type | Description | Expiration
   --------|------|-------------|--------------
   ```
3. Review the output to ensure that a node-locked license is displayed for all serial numbers, including serial numbers for existing and new nodes.

**Verifying the health of the system**

Before you expand a cluster, you must verify that all components of the cluster are healthy by running the Config Advisor tool and running several ONTAP CLI commands.

**Steps**

1. Verify that you have the latest version of Config Advisor:
   - If you do not have Config Advisor on your laptop, download it.
     
     *NetApp Downloads: Config Advisor*
   - If you have Config Advisor, start it, click **Help > Check for Updates**, and follow the prompts to upgrade it if necessary.
     
     **Note:** Do not uninstall the previous version of the tool or delete the data folder during the upgrade. The tool uninstalls the previous version and replaces it with the latest version. It renames the data folder as the latest folder and retains all of the contents in the folder.

2. Verify the cabling and configuration by running Config Advisor:
   - a. Connect your laptop to the management network for the cluster.
   - b. Click **Collect Data**.
     
     Config Advisor displays any problems found.
   - c. If problems are found, correct them and run the tool again.

3. Optional: Check the health of the system with the following commands:
   - a. Verify that the cluster is in a healthy state by using the `system health status show` command and verifying that the Status is `ok`.
     
     **Example**

     ```
     cluster1::> system health status show
     Status
     ------------
     ok
     ```

   - b. Verify that all nodes in the cluster are in a healthy state by using the `cluster show` command and verifying that the Health of each node is `true`.
     
     **Example**

     ```
     cluster1::> cluster show
     Node          Health  Eligibility
     ----------------- ------ ------------
     cluster1-1     true   true
     cluster1-2     true   true
     2 entries were displayed.
     ```
Backing up the cluster configuration

Before you expand a cluster, you should use advanced privilege to create a backup file to save the cluster configuration information and optionally save the node configurations.

Steps

1. Set the privilege level to advanced by using the `set -privilege advanced` command.
2. Create a backup file of the cluster configuration by using the `system configuration backup create` command with the `-backup-type cluster` parameter.

Example

```
cluster1:~> system configuration backup create -node cluster1-1 -backup-name clusterbeforeexpansion.7z -backup-type cluster
[Job 5573] Job is queued: Cluster Backup OnDemand Job.
```

3. Optional: Create a backup file of each node's configuration by using the `system configuration backup create` command with the `-backup-type node` parameter for each node.
4. Return the privilege level to admin by using the `set -privilege admin` command.

Generating an AutoSupport message about starting expansion

Immediately before you expand a cluster, you should send an AutoSupport message to indicate that you are about to start the expansion process. The message informs internal and external support staff about expansion and acts as a timestamp for any troubleshooting that might be required later.

Before you begin

AutoSupport must be set up.

Step

1. For each node in the cluster, send an AutoSupport message by using the `system node autosupport invoke` command.

Example

```
cluster1:~> system node autosupport invoke -node * -message "cluster expansion started" -type all
The AutoSupport was successfully invoked on node "cluster1-1". To view the status of the AutoSupport, use the "system node autosupport history show" command.
Note: It may take several minutes for the AutoSupport to appear in the history list.
The AutoSupport was successfully invoked on node "cluster1-2". To view the status of the AutoSupport, use the "system node autosupport history show" command.
Note: It may take several minutes for the AutoSupport to appear in the history list.
2 entries were acted on.
```

Installing the new nodes

After the cluster is prepared, you must install the controllers and configure the node-management LIFs. If the controllers are not running the same ONTAP version as the existing cluster, or are
repurposed and lack hardware-level HA, you must address those issues in Maintenance mode. Finally, you can join the nodes to the cluster.

**Steps**

1. **Installing the controllers** on page 12
   When you install controllers that will be added to an existing cluster, you must follow the first three steps of the appropriate *Installation and Setup Instructions*.

2. **Configuring node-management LIFs** on page 13
   After the controller modules are physically installed, you can power on each one and configure its node-management LIF.

3. **Upgrading or downgrading the nodes** on page 14
   Before joining the newly installed nodes to the cluster, you must ensure that they are running the same version of ONTAP that the cluster is running. If the nodes are running a different version, you must upgrade or downgrade the nodes to match the cluster.

4. **Ensuring hardware-level HA is enabled** on page 15
   If the newly installed controller modules are reused—not new—you must enter Maintenance mode and ensure that their HA state is set to HA.

5. **Adding nodes to a cluster using System Manager** on page 16
   You can use System Manager to increase the size and capabilities of your storage system by adding nodes to an existing cluster. This feature is automatically enabled in System Manager when the effective cluster version is ONTAP 9.2.

6. **Joining nodes to the cluster using the CLI** on page 17
   When the newly installed controller modules are ready, you can add each one to the cluster by using the `cluster setup` command.

**Installing the controllers**

When you install controllers that will be added to an existing cluster, you must follow the first three steps of the appropriate *Installation and Setup Instructions*.

**About this task**

**Note:** As of ONTAP 9.0, HA mode is enabled by default on new hardware.

**Steps**

1. Obtain the *Installation and Setup Instructions* for the FAS model number of the controller module that you plan to add to the cluster.
   - For a new controller module, the document is available in the box.
   - For a repurposed controller module, you can download the document.

**NetApp Documentation**

2. Follow the *Prepare for installation* section with the following exceptions:
   - You can skip any instructions about downloading software or a worksheet.
   - You must provide a serial console connection even if it is not mentioned in the *Installation and Setup Instructions*.
     You require a serial console because you must use the nodeshell CLI to configure node-management LIFs.
     If the ONTAP section does not mention the serial console, you can see the 7-mode section.

3. Follow the *Install hardware section*. 
4. Follow the *Cable storage* section.

5. Skip most of the *Complete System Setup* section with the following exceptions:
   - If instructed to, you must power on all disk shelves and check IDs.
   - You must cable the serial console so that you can access the node.
     If the ONTAP section does not mention the serial console, you can see the 7-mode section.

6. Skip the *Complete configuration* section.

**Configuring node-management LIFs**

After the controller modules are physically installed, you can power on each one and configure its node-management LIF.

**About this task**

You must perform this procedure on both the nodes.

**Steps**

1. Access the controller module through the serial console.

2. Power on the controller module, and wait while the node boots and the Cluster Setup wizard automatically starts on the console.

   Welcome to the cluster setup wizard.

   You can enter the following commands at any time:
   "help" or "?" - if you want to have a question clarified,
   "back" - if you want to change previously answered questions, and
   "exit" or "quit" - if you want to quit the cluster setup wizard.
   Any changes you made before quitting will be saved.

   You can return to cluster setup at any time by typing "cluster setup".
   To accept a default or omit a question, do not enter a value.

3. Follow the prompts in the web-based Cluster Setup wizard to configure a node management LIF using the networking information you gathered earlier.

4. Type

   `exit`

   after node management LIF configuration is complete to exit the setup wizard and complete the administration tasks.

**Example**

Use your web browser to complete cluster setup by accessing https://10.63.11.29

Otherwise, press Enter to complete cluster setup using the command line interface:

   exit

5. Log in to the node as the *admin* user, which does not require a password.

**Example**

Tue Mar 4 23:13:33 UTC 2015
login: admin
******************************************************************************
* This is a serial console session. Output from this *
* session is mirrored on the SP console session. *
6. Repeat the entire procedure for the second newly installed controller module.

**Upgrading or downgrading the nodes**

Before joining the newly installed nodes to the cluster, you must ensure that they are running the same version of ONTAP that the cluster is running. If the nodes are running a different version, you must upgrade or downgrade the nodes to match the cluster.

**Before you begin**

You must know the version of ONTAP installed on the cluster (`cluster image show`).

**Steps**

1. Set the privilege level to advanced, entering `y` when prompted to continue:
   ```bash
   set —privilege advanced
   ```
   The advanced prompt (`*>`) appears.

2. View the current version of ONTAP on the nodes:
   a. On the first node, view the software version:
      ```bash
      system node image show
      ```
      Example:
      ```bash
      ::*> system node image show
      
      Node | Image | Is Default | Current Version | Install Date
      --- | ----- | --------- | --------------- | ------------
      localhost | image1 | false | false | 8.3RC1 | 12/19/2014 03:01:02
      image1 | true | true | 8.3RC1 | 01/05/2015 17:36:06
      2 entries were displayed.
      ```
   b. Repeat the previous step for the second node.

3. Compare the versions of ONTAP on the cluster and the nodes, and perform either of the following actions:
   - If the versions are the same, skip the remaining steps in this procedure.
   - If the versions are different, install a different version of ONTAP on the nodes by following the remaining steps of this procedure.

4. Obtain the appropriate software image:
   a. Identify an HTTP or FTP server from which the software image will be served.
   b. Locate the target ONTAP software in the **Software Downloads** area of the NetApp Support Site.
      Ensure that you select the software image for the platform module.
      ```
      NetApp Downloads
      ```
   c. Copy the software image (for example, `830_q_image.tgz`) to the HTTP or FTP server.
   d. Identify the IP address of the HTTP or FTP server, because the server's host name is not resolvable by the node.

5. Install the software on the first node:
a. On the first node, install the software image:

```bash
system node image update
```

**Example**

::* system node image update -package http://10.56.94.15/ONTAP_update/830_q_image.tgz -replace-package true -setdefault true -background true

b. Monitor the progress of the installation:

```bash
system node image show-update-progress
```

c. After the installation is complete, reboot the node:

```bash
system node reboot
```

The `-inhibit-takeover` parameter is not required because the nodes are not yet part of an HA pair.

d. Wait while the node boots and the Cluster Setup wizard automatically starts on the console.

e. Press Enter four times to accept the existing settings for the node management LIF.

f. Set the privilege level to admin:

```
-set privilege admin
```

g. Log in to the node as the `admin` user, which does not require a password.

h. Set the privilege level to advanced:

```
set -privilege advanced
```

i. Verify that the software version on the node is correct:

```
system node image show
```

6. Repeat the previous step to install the software on the second node.

**Ensuring hardware-level HA is enabled**

If the newly installed controller modules are reused—not new—you must enter Maintenance mode and ensure that their HA state is set to HA.

**About this task**

If you are using new controller modules, you can skip this procedure because HA is enabled by default. Otherwise, you must perform this procedure on both the nodes.

**Steps**

1. On the first node, enter Maintenance mode:

   a. Exit the nodeshell by entering `halt`.

      The LOADER prompt is displayed.

   b. Enter Maintenance mode by entering `boot_ontap maint`.

      After some information is displayed, the Maintenance mode prompt is displayed.
2. In Maintenance mode, ensure that the controller module and chassis are in HA state:
   a. Display the HA state of the controller module and chassis by entering `ha-config show`.
   b. If the displayed state of the controller is not HA, enter `ha-config modify controller ha`.
   c. If the displayed state of the chassis is not HA, enter `ha-config modify chassis ha`.
   d. Verify that HA is enabled on both the controller module and chassis by entering `ha-config show`.

3. Return to ONTAP:
   a. Enter `halt` to exit Maintenance mode.
   b. Boot ONTAP by entering `boot_ontap`.
   c. Wait while the node boots and the Cluster Setup wizard automatically starts on the console.
   d. Press Enter four times to accept the existing settings for the node-management LIF.
   e. Log in to the node as the `admin` user, which does not require a password.

4. Repeat this procedure on the other node that you are adding to the cluster.

Adding nodes to a cluster using System Manager

You can use System Manager to increase the size and capabilities of your storage system by adding nodes to an existing cluster. This feature is automatically enabled in System Manager when the effective cluster version is ONTAP 9.2.

Before you begin

- New compatible nodes must be cabled to the cluster.
  Only the ports that are in the default broadcast domain will be listed in the Network window.
- All of the nodes in the cluster must be up and running.
- All of the nodes must be of the same version.

Step

1. Add the new compatible nodes to the cluster:

<table>
<thead>
<tr>
<th>If you are...</th>
<th>Do this...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not logged in to System Manager</td>
<td>a. Log in to System Manager.</td>
</tr>
<tr>
<td></td>
<td>Note: The new compatible nodes are automatically detected by System Manager at login. System Manager prompts you to add the new compatible nodes to the cluster.</td>
</tr>
<tr>
<td></td>
<td>b. Click Add Nodes to Cluster.</td>
</tr>
<tr>
<td></td>
<td>c. Modify the name of the nodes.</td>
</tr>
<tr>
<td></td>
<td>d. Specify the node licenses.</td>
</tr>
<tr>
<td></td>
<td>e. Click Submit and Proceed.</td>
</tr>
<tr>
<td>If you are...</td>
<td>Do this...</td>
</tr>
<tr>
<td>--------------</td>
<td>------------</td>
</tr>
</tbody>
</table>
| Logged in to System Manager | a. Depending on the System Manager version that you are running, perform one of the following steps:  
  - ONTAP 9.4 or earlier: Click **Configuration > Cluster Expansion**.  
  - Starting with ONTAP 9.5: Click **Configuration > Cluster > Expansion**  
  System Manager searches for newly added nodes. If any warnings are displayed, you must fix them before proceeding. If new compatible nodes are discovered, proceed to the next step.  
  
  b. Modify the name of the nodes.  
  
  c. Specify the node licenses.  
  
  d. Click **Submit and Proceed**. |

### Joining nodes to the cluster using the CLI

When the newly installed controller modules are ready, you can add each one to the cluster by using the `cluster setup` command.

**About this task**

- You must perform this procedure on both nodes.
- You must join each node one at a time, not concurrently.

**Steps**

1. Start the Cluster Setup wizard by using the `cluster setup` command at the CLI prompt.

**Example**

```
::> cluster setup  
Welcome to the cluster setup wizard....  
Use your web browser to complete cluster setup by accessing https://10.63.11.29  
Otherwise, press Enter to complete cluster setup using the command line interface:  
```

**Note:** For instructions using the GUI-based cluster setup wizard, see the topic *Adding nodes to the cluster using System Manager* in this guide.

2. Press Enter to use the CLI to complete this task. When prompted to create a new cluster or join an existing one, enter `join`.

**Example**

```
Do you want to create a new cluster or join an existing cluster? {create, join}:  
join  
```

3. When prompted with the existing cluster interface configuration, press **Enter** to accept it.
Example

Existing cluster interface configuration found:

<table>
<thead>
<tr>
<th>Port</th>
<th>MTU</th>
<th>IP</th>
<th>Netmask</th>
</tr>
</thead>
<tbody>
<tr>
<td>e1a</td>
<td>9000</td>
<td>169.254.87.75</td>
<td>255.255.0.0</td>
</tr>
</tbody>
</table>

Do you want to use this configuration? [yes, no] [yes]:

4. Follow the prompts to join the existing cluster.

Example

Step 1 of 3: Join an Existing Cluster
You can type "back", "exit", or "help" at any question.

Enter the name of the cluster you would like to join [cluster1]: cluster1

Joining cluster cluster1
Starting cluster support services ..

This node has joined the cluster cluster1.

Step 2 of 3: Configure Storage Failover (SFO)
You can type "back", "exit", or "help" at any question.

SFO will be enabled when the partner joins the cluster.

Step 3 of 3: Set Up the Node
Cluster setup is now complete.

The node is automatically renamed to match the name of the cluster.

5. On the cluster, verify that the node is part of the cluster by using the `cluster show` command.

Example

```
cluster1::> cluster show
       Node                  Health  Eligibility
                  ----------- -------  -----------
          cluster1-1            true    true
          cluster1-2            true    true
          cluster1-3            true    true
3 entries were displayed.
```

6. Repeat steps 4 through 5 for the second newly installed controller module.

The Cluster Setup wizard differs on the second node in the following ways:

- It defaults to joining the existing cluster because its partner is already part of a cluster.
- It automatically enables storage failover on both nodes.

7. Verify that storage failover is enabled and possible by using the `storage failover show` command.

Example

The following output shows that storage failover is enabled and possible on all nodes of the cluster, including the newly added nodes:

```
cluster1::> storage failover show
       Takeover                Partner                  Possible State
                  Node            Possible       -------------------------
                  ----------  ----------------  ---------------
          cluster1-1            true  Connected to cluster1-2
          cluster1-2            true  Connected to cluster1-1
          cluster1-3            true  Connected to cluster1-4
          cluster1-4            true  Connected to cluster1-3
4 entries were displayed.
```
Completing the expansion

After both nodes are joined to the cluster, you must finish configuring the newly added nodes by configuring AutoSupport and completing the SP network. You then validate the expanded cluster and generate an AutoSupport message to complete the expansion. If the cluster uses SAN, you should update LUN paths.

Steps

1. **Configuring the node details in System Manager** on page 19
   You can use System Manager to configure the node management LIF and Service Processor settings for the newly added nodes.

2. **Configuring AutoSupport on the new nodes** on page 20
   After you add nodes to a cluster, you must configure AutoSupport on the nodes.

3. **Configuring the Service Processor network** on page 20
   After you expand a cluster, you must configure the Service Processor (SP) network on the new nodes. If the SP uses manual network configuration, you must configure the IP addresses for the SP on the new nodes. If the SP uses automatic network configuration, you must identify the IP addresses that were selected.

4. **Validating the configuration of the expanded cluster** on page 22
   After you expand the cluster, you must validate the configuration by running Config Advisor and using some commands that verify cluster health and cluster replication rings.

5. **Generating an AutoSupport message about completing expansion** on page 23
   After you expand a cluster, you should send an AutoSupport message to indicate that the expansion process is complete. This message communicates to internal and external support staff that the expansion is complete and acts as a timestamp for any troubleshooting that might be required later.

6. **Updating LUN paths for the new nodes** on page 23
   If your cluster is configured for SAN, you must create SAN LIFs on the newly added nodes and then update paths.

Configuring the node details in System Manager

You can use System Manager to configure the node management LIF and Service Processor settings for the newly added nodes.

**Before you begin**

- Sufficient number of ports must be present in the default IPspace for LIF creation.
- All the ports must be up and running.

**Steps**

1. Configure node management:
   a. Enter the IP address in the **IP Address** field.
   b. Select the port for node management in the **Port** field.
   c. Enter the netmask and gateway details.

2. Configure Service Processor settings:
a. Select the **Override defaults** check box to override the default values.

b. Enter the IP address, netmask, and gateway details.

3. Click **Submit and Proceed** to complete the network configuration of the nodes.

4. Verify the details of the nodes in the **Summary** page.

**After you finish**

- If your cluster is protected, you should create the required number of intercluster LIFs in the newly added nodes to avoid partial peering and unhealthy protection.
- If SAN data protocols are enabled in your cluster, you should create the required number of SAN Data LIFs for serving data.

**Configuring AutoSupport on the new nodes**

After you add nodes to a cluster, you must configure AutoSupport on the nodes.

**Before you begin**

AutoSupport must be set up on the cluster's existing nodes.

**About this task**

You must perform this procedure on both the nodes.

**Steps**

1. View the AutoSupport configuration using the `system node autosupport show` command with the `-node` parameter set to one of the nodes in the original cluster.

   **Example**

   ```
   cluster1::> system node autosupport show -node cluster1-1
   Node: cluster1-1
   State: enable
   SMTP Mail Hosts: smtp.example.com
   ...
   ```

2. On one of the newly added nodes, configure AutoSupport in the same way that it is configured on the existing nodes by using the `system node autosupport modify` command.

   **Example**

   ```
   cluster1::> system node autosupport modify -node cluster1-3 -state enable -mail-hosts smtp.example.com -from alerts@node3.example.com -to support@example.com -support enable -transport https -noteto pda@example.com -retry-interval 23m
   ```

3. Repeat the previous step for the other newly added node.

**Configuring the Service Processor network**

After you expand a cluster, you must configure the Service Processor (SP) network on the new nodes. If the SP uses manual network configuration, you must configure the IP addresses for the SP on the
new nodes. If the SP uses automatic network configuration, you must identify the IP addresses that were selected.

Steps

1. If the cluster SP uses manual network configuration, configure IP addresses on both nodes for the SP network by using the `system service-processor network modify` command.

Example

The following commands configure the SP network in cluster1-3 and cluster1-4 nodes:

```
cluster1::> system service-processor network modify -node cluster1-3 -address-family IPv4 -enable true -ip-address 192.168.123.98 -netmask 255.255.255.0 -gateway 192.168.123.1
cluster1::> system service-processor network modify -node cluster1-4 -address-family IPv4 -enable true -ip-address 192.168.123.99 -netmask 255.255.255.0 -gateway 192.168.123.1
```

2. Verify that the SP network is configured correctly on both the new nodes by using the `system service-processor network show` command for each node.

The status should be succeeded. Verification is required in all situations. Even if the SP network was automatically configured, you should verify that it was configured successfully, and you must determine which IP addresses were assigned.

Example

The following output indicates that both the cluster1-3 and the cluster1-4 nodes have successful SP network setup:

```
cluster1::> system service-processor network show -node cluster1-3
<table>
<thead>
<tr>
<th>Node</th>
<th>Status</th>
<th>Family</th>
<th>Link State</th>
<th>IP Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>cluster1-3</td>
<td>online</td>
<td>IPv4</td>
<td>up</td>
<td>192.168.123.98</td>
</tr>
<tr>
<td>DHCP: none</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAC Address: 00:a0:98:43:a1:1e</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network Gateway: 10.60.172.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network Mask (IPv4 only): 255.255.255.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prefix Length (IPv6 only): -</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IPv6 RA Enabled: -</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subnet Name: -</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SP Network Setup Status: succeeded</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

cluster1::> system service-processor network show -node cluster1-4
<table>
<thead>
<tr>
<th>Node</th>
<th>Status</th>
<th>Family</th>
<th>Link State</th>
<th>IP Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>cluster1-4</td>
<td>online</td>
<td>IPv4</td>
<td>up</td>
<td>192.168.123.99</td>
</tr>
<tr>
<td>DHCP: none</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAC Address: 00:a0:98:43:a1:1e</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network Gateway: 10.60.172.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network Mask (IPv4 only): 255.255.255.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prefix Length (IPv6 only): -</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>IPv6 RA Enabled: -</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Subnet Name: -</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SP Network Setup Status: succeeded</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

3. If your site typically has DNS entries for the SP network, verify that the DNS entries are created for the new nodes.
Validating the configuration of the expanded cluster

After you expand the cluster, you must validate the configuration by running Config Advisor and using some commands that verify cluster health and cluster replication rings.

Steps

1. Check the health of the configuration by running Config Advisor:
   a. Start Config Advisor, and then click Collect Data.
      Config Advisor displays any problems found.
   b. If problems are found, correct them and run the tool again.

2. Ensure that all nodes in the cluster are in a healthy state by using the cluster show command.

Example

```
cluster-1::> cluster show
Node     Health  Eligibility
--------- ------- ------------
cluster1-1 true    true
cluster1-2 true    true
cluster1-3 true    true
cluster1-4 true    true
4 entries were displayed.
```

3. Ensure that the cluster replication rings have the same epoch, database epoch, and database transaction numbers on all nodes in the cluster:
   The easiest way to compare transaction numbers is to view them for one unit name at a time.
   a. Set the privilege level to advanced by using the set -privilege advanced command.
   b. View cluster ring information about the first unit name by using the cluster ring show command with the -unitname mgmt parameter, and verify that all nodes have the same number in the Epoch, DB Epoch, and DB Trnxs columns.
      Example
      ```
      cluster-1::*> cluster ring show -unitname mgmt
      Node     UnitName Epoch    DB Epoch DB Trnxs Master    Online
      --------- -------- -------- -------- -------- --------- ---------
      cluster1-1 mgmt 2        2        959      cluster1-1 master
      cluster1-2 mgmt 2        2        959      cluster1-2 secondary
      cluster1-3 mgmt 2        2        959      cluster1-3 master
      cluster1-4 mgmt 2        2        959      cluster1-3 secondary
      4 entries were displayed.
      ```
   c. Repeat the command with the -unitname vldb parameter.
   d. Repeat the command with the -unitname vifmgr parameter.
   e. Repeat the command with the -unitname bcomd parameter.
   f. Repeat the command with the -unitname crs parameter.
g. Return the privilege level to admin by using the set -privilege admin command.

**Generating an AutoSupport message about completing expansion**

After you expand a cluster, you should send an AutoSupport message to indicate that the expansion process is complete. This message communicates to internal and external support staff that the expansion is complete and acts as a timestamp for any troubleshooting that might be required later.

**Before you begin**

AutoSupport must be set up.

**Step**

1. For each node in the cluster, send an AutoSupport message by using the system node autosupport invoke command.

   You must issue the message once for each node in the cluster, including the newly added nodes.

**Example**

If you added two nodes to a two-node cluster, you must send the message four times.

```
cluster1::> system node autosupport invoke -node * -message "cluster expansion complete" -type all
The AutoSupport was successfully invoked on node "cluster1-1". To view the status of the AutoSupport, use the "system node autosupport history show" command. The AutoSupport was successfully invoked on node "cluster1-2". To view the status of the AutoSupport, use the "system node autosupport history show" command. Note: It may take several minutes for the AutoSupport to appear in the history list. The AutoSupport was successfully invoked on node "cluster1-3". To view the status of the AutoSupport, use the "system node autosupport history show" command. Note: It may take several minutes for the AutoSupport to appear in the history list. The AutoSupport was successfully invoked on node "cluster1-4". To view the status of the AutoSupport, use the "system node autosupport history show" command. Note: It may take several minutes for the AutoSupport to appear in the history list. 4 entries were acted on.
```

**Updating LUN paths for the new nodes**

If your cluster is configured for SAN, you must create SAN LIFs on the newly added nodes and then update paths.

**About this task**

This procedure is required only if the cluster contains LUNs. If the cluster contains only files, you can skip this procedure.

**Steps**

1. For each storage virtual machine (SVM) in the cluster, create new LIFs on the newly added nodes:

   a. Identify the SVMs that use FC or iSCSI protocols by using the vserver show command with the -fields allowed-protocols parameter and reviewing the output.
Example

```
cluster1::> vserver show -fields allowed-protocols
vserver allowed-protocols
-------- -----------------
vs1     cifs,ndmp
vs2     fcp
vs3     iscsi
...
```

b. For each SVM that uses FC or iSCSI, create at least two data LIFs on each of the newly added nodes by using the `network interface create` command with the `-role data` parameter.

Example

```
cluster1::> network interface create -vserver vs1 -lif lif5 -role data -data-protocol iscsi -home-node cluster1-3 -home-port e0b -address 192.168.2.72 -netmask 255.255.255.0
```

c. For each SVM, verify that it has LIFs on all nodes in the cluster by using the `network interface show` command with the `-vserver` parameter.

2. Update port sets:
   a. Determine whether port sets exist by using the `lun portset show` command.

   b. If you want to make the new LIFs visible to existing hosts, add each new LIF to the port sets by using the `lun portset add` command—once for each LIF.

3. If you use FC or FCoE, update zoning:
   a. Verify that zoning is set up correctly to enable the existing initiator ports on the host to connect to the new target ports on the new nodes.
   b. Update switch zoning to connect the new nodes to existing initiators.
      
      Zoning setup varies depending on the switch that you use.
   c. If you plan to move LUNs to the new nodes, expose the new paths to the hosts by using the `lun mapping add-reporting-nodes` command.

4. On all host operating systems, rescan to discover the newly added paths.
5. Depending on the host operating systems, remove any stale paths.
6. Add or remove paths to your MPIO configuration.

Related information

- *SAN configuration*
- *SAN administration*
Where to find additional information

After you expand a cluster, you can start storing data on the new nodes either by creating new volumes on the new nodes or by moving existing data to the new nodes. There are express guides and comprehensive documentation to help you achieve these goals.

Express guides
If you want to create storage virtual machines (SVMs) or volumes on the newly added nodes, you can use any of the express guides about setting up CIFS, NFS, iSCSI, and FC protocols.

ONTAP 9 Documentation Center

Data protection
If you are using SnapMirror or SnapVault relationships in your cluster to protect your data, see the Cluster and SVM peering express configuration guide to set up appropriate intercluster LIFs for your new nodes.

Comprehensive guides
If you want to move data to the newly added nodes, you can use the following comprehensive guides:

- **SAN administration**
  Describes how to configure and manage the iSCSI, FCoE, and FC protocols for clustered SAN environments, including configuration of LUNs, igroups, and targets.

- **Logical storage management**
  Describes how to manage logical storage resources in clusters, including FlexVol volumes, FlexClone volumes, files and LUNs, and FlexCache volumes, using deduplication, compression, qtrees, and quotas.

- **ONTAP concepts**
  Describes conceptual information about logical storage resources in clusters, including FlexVol volumes, FlexClone volumes, files and LUNs, and FlexCache volumes, using deduplication, compression, qtrees, and quotas.
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Index

A

about this guide  
   deciding whether to use the Cluster Expansion Express Guide 4  
adding  
   switches before cluster expansion 8  
ASUP  
   See AutoSupport  
audience  
   for the guide 4  
AutoSupport  
   configuring on new nodes 20  
   generating message after expansion 23  
   generating message before expansion 11  

B

backup files  
   creating before expansion 11  
block access  
   updating LUN paths 23  

C

cabling  
   new nodes 12  
cluster expansion  
   where to find additional information after data protection 25  
cluster rings  
   verifying after expansion 22  
clusters  
   adding nodes to 17  
   backing up configuration information before expansion 11  
   cabling and installing nodes 12  
   expanding by adding new nodes 16  
   preparing for expansion 9  
   requirements for using this guide to expand 4  
   upgrading or downgrading nodes for expansion 14  
   verifying cluster is ready for expansion 6  
   verifying expansion limits for 6  
   verifying health after expansion 22  
   verifying health before expansion 10  
   workflow for adding two nodes to an existing cluster 5  

comments  
   how to send feedback about documentation 28  
Config Advisor  
   running after expansion 22  
   updating and verifying configuration health before expansion 10  
configurations  
   saving before expansion 11  
configuring  
   network details of the nodes 19  
   node management LIFs 19  

Service Processor settings 19  
controller modules  
   reused, ensuring HA state 15  

documentation  
   additional information 25  
   how to receive automatic notification of changes to 28  
   how to send feedback about 28  
downgrading  
   nodes for cluster expansion 14  

expansion  
   adding licenses 9  
   adding or replacing switches for cluster 8  
   cabling and installing nodes 12  
   cluster, requirements for using this guide 4  
   completing 19  
   configuring AutoSupport after 20  
   creating backups before 11  
   gathering networking and login information 7  
   generating AutoSupport message after 23  
   generating AutoSupport message before 11  
   preparing cluster for 9  
   verifying limits for cluster 6  
   verifying system health after 22  
   verifying system health before 10  
   verifying the cluster is ready for expansion 6  
   workflow for cluster 5  
express guides  
   additional documentation 25  
   cluster expansion workflow 5  
   requirements for using this guide 4  

F

FC  
   updating paths 23  
feedback  
   how to send comments about documentation 28  
flowcharts  
   cluster expansion workflow 5  

H

health  
   verifying after expansion 22  
   high availability  
      enabling at hardware-level 15  

I

information
installing nodes before cluster expansion 12
IP addresses
for SPs 20
gathering for node management LIFs 7
gathering for SPs 7
iSCSI
updating paths 23
joining nodes to the cluster 17
licenses
adding node-locked 9
verifying before a cluster expansion 6
LIFs
configuring node management 13
creating for new nodes 23
limits
verifying before a cluster expansion 6
LUNs
updating paths 23
messages
generating AutoSupport 11
generating AutoSupport message after expansion 23
MPIO
updating 23
netmask
See network mask
network mask
networking information
gathering before cluster expansion 7
networks
SPs 7
node management LIFs
configuring for new nodes 19
node-locked licenses
verifying before a cluster expansion 6
nodes
adding 12
adding licenses 9
adding to expand a cluster 16
adding to the cluster 17
backing up configuration information before expansion 11
configuring AutoSupport 20
configuring network details 19
configuring node management LIFs 13
installing new 11
requirements for using this guide to add to an existing cluster 4
upgrading or downgrading to match the cluster 14
workflow for adding two nodes to an existing cluster 5
paths
updating to LUNs 23
Platforms
verifying they can be mixed 6
verifying they support ONTAP 9.0 6
ports
gathering before cluster expansion 7
post-requisites
configuring AutoSupport after expansion 20
generating AutoSupport message after expansion 23
verifying system health after expansion 22
powering on nodes 13
prerequisites
adding licenses 9
backing up configuration information 11
generating AutoSupport message before expansion 11
verifying system health before expansion 10
protocols
where to get information about setting up 25
racking
nodes 12
replacing switches before cluster expansion 8
repurposed controller modules, ensuring HA state 15
SAN
updating paths 23
verifying iSCSI, FC/FCoE configuration limits before cluster expansion 6
Service processor
configuring the service processor network 20
Service Processor settings
configuring for new nodes 19
Service Processors
See SPs
SP on the new nodes
configuring the service processor network 20
SPs
configuring the service processor network 20
gathering before cluster expansion 7
subnets
for SPs 7
suggestions
how to send feedback about documentation 28
SVMs
where to get information about creating 25
switches
   adding or replacing before cluster expansion 8
   verifying they are ready for cluster expansion 6
switchless
   adding switches before cluster expansion 8
system health
   verifying after expansion 22
   verifying before expansion 10
system limits
   verifying before a cluster expansion 6

T
Twitter
   how to receive automatic notification of
documentation changes 28

U
upgrading

nodes for cluster expansion 14

V
verifying system health
   after expansion 22
version
   verifying consistency before a cluster expansion 6
volumes
   where to get information about creating 25

W
workflows
   cluster expansion 5