



# **Set up ONTAP**

## **ONTAP 9**

NetApp  
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# Set up ONTAP

## Get started with ONTAP cluster set up

You can use System Manager or the ONTAP command line interface (CLI) to set up new ONTAP clusters. Before you begin, you should gather the information you'll need to complete the cluster setup, such as your cluster management interface port and IP address.

NetApp recommends that you [use System Manager to set up new clusters](#). System Manager provides a simple and easy workflow for cluster set up and configuration including assigning a node management IP address, initializing the cluster, creating a local tier, configuring protocols and provisioning initial storage.

It is only necessary to [use the ONTAP CLI to set up your cluster](#) if you are running ONTAP 9.7 or earlier on a MetroCluster configuration. Beginning in ONTAP 9.13.1, on the AFF A800 and FAS8700 platforms, you can also use the ONTAP CLI to create and configure new clusters in IPv6-only networking environments. If you need to use IPv6 in ONTAP 9.13.0 and earlier, or on other platforms in ONTAP 9.13.1 and later, you can use System Manager to create new clusters using IPv4 and then [convert to IPv6](#).

### What you'll need for cluster set up

Setting up the cluster involves gathering the information needed to configure setting up each node, creating the cluster on the first node, and joining any remaining nodes to the cluster.

Get started by gathering all the relevant information in the cluster setup worksheets.

The cluster setup worksheet enables you to record the values that you need during the cluster setup process. If a default value is provided, you can use that value or else enter your own.

### System defaults

The system defaults are the default values for the private cluster network. It is best to use these default values. However, if they do not meet your requirements, you can use the table to record your own values.



For clusters configured to use network switches, each cluster switch must use the 9000 MTU size.

Types of information	Your values
Private cluster network ports	
Cluster network netmask	
Cluster interface IP addresses (for each cluster network port on each node)	
The IP addresses for each node must be on the same subnet.	

### Cluster information


Types of information	Your values
<p>Cluster name</p> <p>The name must begin with a letter, and it must be fewer than 44 characters. The name can include the following special characters:</p> <p>. - _</p>	

### Feature license keys

You can find license keys for your initial or add-on software orders at the NetApp Support Site under **My Support > Software Licenses**.

Types of information	Your values
Feature license keys	

### Admin storage virtual machine (SVM)

Types of information	Your values
<p>Cluster administrator password</p> <p>The password for the admin account that the cluster requires before granting cluster administrator access to the console or through a secure protocol.</p> <div>  <p>For security purposes, recording passwords in this worksheet is not recommended.</p> </div> <p>The default rules for passwords are as follows:</p> <ul style="list-style-type: none"> <li>• A password must be at least eight characters long.</li> <li>• A password must contain at least one letter and one number.</li> </ul>	
<p>Cluster management interface port</p> <p>The physical port that is connected to the data network and enables the cluster administrator to manage the cluster.</p>	

Types of information	Your values
<p>Cluster management interface IP address</p> <p>A unique IPv4 or IPv6 address for the cluster management interface. The cluster administrator uses this address to access the admin SVM and manage the cluster. Typically, this address should be on the data network.</p> <p>You can obtain this IP address from the administrator responsible for assigning IP addresses in your organization.</p> <p>Example: 192.0.2.66</p>	
<p>Cluster management interface netmask (IPv4)</p> <p>The subnet mask that defines the range of valid IPv4 addresses on the cluster management network.</p> <p>Example: 255.255.255.0</p>	
<p>Cluster management interface netmask length (IPv6)</p> <p>If the cluster management interface uses an IPv6 address, then this value represents the prefix length that defines the range of valid IPv6 addresses on the cluster management network.</p> <p>Example: 64</p>	
<p>Cluster management interface default gateway</p> <p>The IP address for the router on the cluster management network.</p>	
<p>DNS domain name</p> <p>The name of your network's DNS domain.</p> <p>The domain name must consist of alphanumeric characters. To enter multiple DNS domain names, separate each name with either a comma or a space.</p>	
<p>Name server IP addresses</p> <p>The IP addresses of the DNS name servers. Separate each address with either a comma or a space.</p>	

**Node information (for each node in the cluster)**

Types of information	Your values
<p>Physical location of the controller (optional)</p> <p>A description of the physical location of the controller. Use a description that identifies where to find this node in the cluster (for example, "Lab 5, Row 7, Rack B").</p>	
<p>Node management interface port</p> <p>The physical port that is connected to the node management network and enables the cluster administrator to manage the node.</p>	
<p>Node management interface IP address</p> <p>A unique IPv4 or IPv6 address for the node management interface on the management network. If you defined the node management interface port to be a data port, then this IP address should be a unique IP address on the data network.</p> <p>You can obtain this IP address from the administrator responsible for assigning IP addresses in your organization.</p> <p>Example: 192.0.2.66</p>	
<p>Node management interface netmask (IPv4)</p> <p>The subnet mask that defines the range of valid IP addresses on the node management network.</p> <p>If you defined the node management interface port to be a data port, then the netmask should be the subnet mask for the data network.</p> <p>Example: 255.255.255.0</p>	
<p>Node management interface netmask length (IPv6)</p> <p>If the node management interface uses an IPv6 address, then this value represents the prefix length that defines the range of valid IPv6 addresses on the node management network.</p> <p>Example: 64</p>	

Types of information	Your values
Node management interface default gateway  The IP address for the router on the node management network.	

### NTP server information

Types of information	Your values
NTP server addresses  The IP addresses of the Network Time Protocol (NTP) servers at your site. These servers are used to synchronize the time across the cluster.	

## Configure ONTAP on a new cluster with System Manager

System Manager provides a simple and easy workflow for setting up a new cluster and configuring your storage.

In some cases, such as certain MetroCluster deployments or clusters that require IPv6 network addressing, you might need to use the ONTAP CLI to set up a new cluster. Click [here](#) for more details about these requirements, as well as steps for cluster setup with the ONTAP CLI.

### Before you begin

- You should have installed, cabled and powered on your new storage system according to the installation and setup instructions for your platform model.  
See the [AFF and FAS documentation](#).
- Cluster network interfaces should be configured on each node of the cluster for intra-cluster communication.
- You should be aware of the following System Manager support requirements:
  - When you set up node management manually using the CLI, System Manager supports only IPv4 and does not support IPv6. However, if you launch System Manager after completing your hardware setup using DHCP with an auto assigned IP address and with Windows discovery, System Manager can configure an IPv6 management address.

In ONTAP 9.6 and earlier, System Manager does not support deployments that require IPv6 networking.

- MetroCluster setup support is for MetroCluster IP configurations with two nodes at each site.

In ONTAP 9.7 and earlier, System Manager does not support new cluster setup for MetroCluster configurations.



## Assign a node-management IP address

### Windows System

You should connect your Windows computer to the same subnet as the controllers. This will automatically assign a node-management IP address to your system.

#### Step

1. From the Windows system, open the **Network** drive to discover the nodes.
2. Double-click the node to launch the cluster setup wizard.

### Other systems

You should configure the node-management IP address for one of the nodes in your cluster. You can use this node-management IP address to launch the cluster set up wizard.

See [Creating the cluster on the first node](#) for information about assigning a node-management IP address.

## Initialize the cluster

You initialize the cluster by setting an administrative password for the cluster and setting up the cluster management and node management networks. You can also configure services like a DNS server to resolve host names and an NTP server to synchronize time.

#### Steps

1. On a web browser, enter the node-management IP address that you have configured: "https://node-management-IP"

System Manager automatically discovers the remaining nodes in the cluster.

2. Initialize the storage system by configuring the cluster management network and node management IP addresses for all the nodes.

## Create your local tier

Create local tiers from the available disks or SSDs in your nodes. System Manager automatically calculates the best tier configuration based on your hardware.

#### Steps

1. Click **Dashboard** and then click **Prepare Storage**.

Accept the storage recommendation for your local tier.



## Configure protocols

Depending on the licenses enabled on your cluster, you can enable the desired protocols on your cluster. You then create network interfaces using which you can access the storage.

### Steps

1. Click **Dashboard** and then click **Configure Protocols**.
  - Enable iSCSI or FC for SAN access.
  - Enable NFS or SMB for NAS access.
  - Enable NVMe for FC-NVMe access.

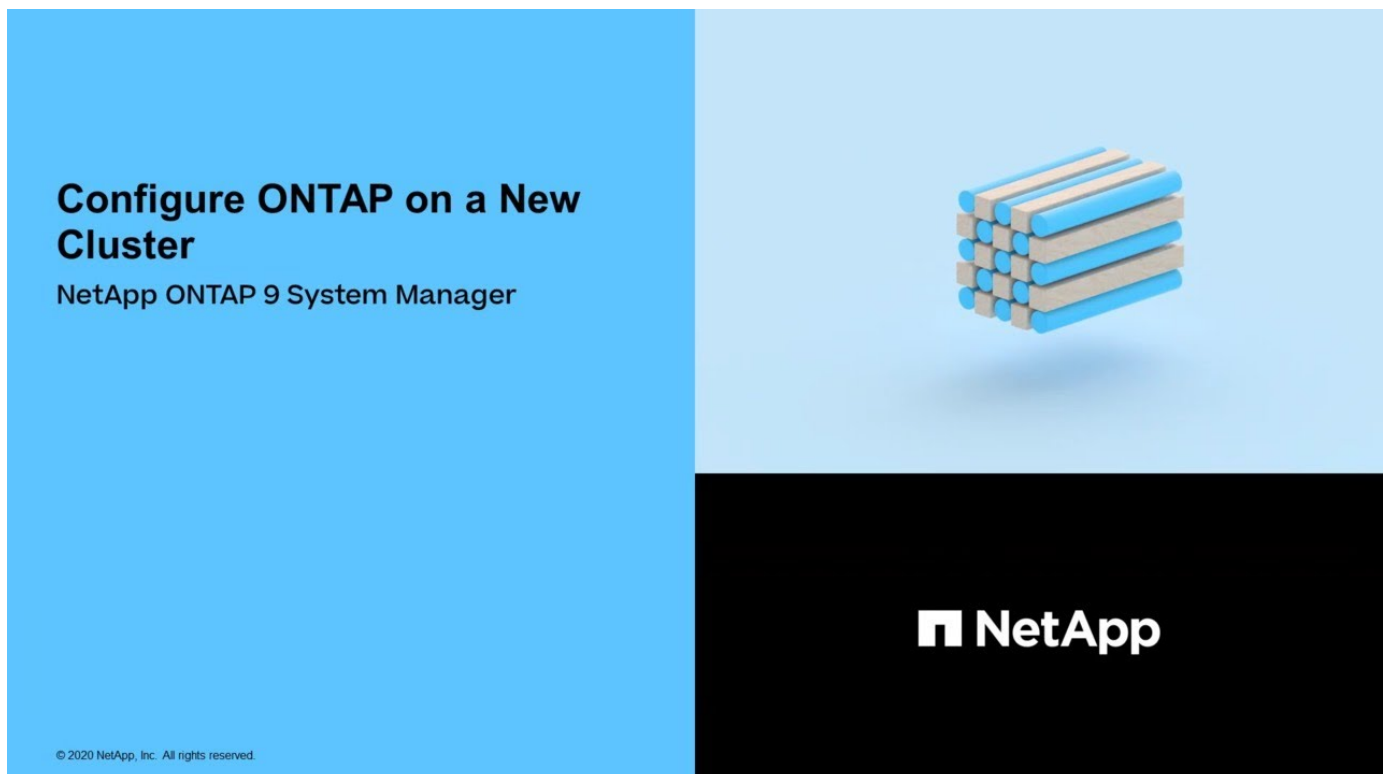
## Provision Storage

After configuring protocols, you can provision storage. The options you see depend on the licenses that are installed.

### Steps

1. Click **Dashboard** and then click **Provision Storage**.
  - To [provision SAN access](#), click **Add LUNs**.
  - To [provision NAS access](#), click **Add Volumes**.
  - To [provision NVMe storage](#), click **Add Namespaces**.

## Configure ONTAP on a new cluster video



# Set up a cluster with the CLI

## Create the cluster on the first node

You use the Cluster Setup wizard to create the cluster on the first node. The wizard helps you to configure the cluster network that connects the nodes, create the cluster admin storage virtual machine (SVM), add feature license keys, and create the node management interface for the first node.

### Before you begin

- You should have installed, cabled and powered on your new storage system according to the installation and setup instructions for your platform model.  
See the [AFF and FAS documentation](#).
- Cluster network interfaces should be configured on each node of the cluster for intra-cluster communication.
- If you are configuring IPv6 on your cluster, IPv6 should be configured on the Base Management Controller (BMC) so that you can access the system using SSH.

### Steps

1. Power on all the nodes you are adding to the cluster. This is required to enable discovery for your cluster setup.
2. Connect to the console of the first node.

The node boots, and then the Cluster Setup wizard starts on the console.

```
Welcome to the cluster setup wizard....
```

3. Acknowledge the AutoSupport statement.

```
Type yes to confirm and continue {yes}: yes
```



AutoSupport is enabled by default.

4. Follow the instructions on the screen to assign an IP address to the node.

Beginning in ONTAP 9.13.1, you can assign IPv6 addresses for management LIFs on A800 and FAS8700 platforms. For ONTAP releases earlier than 9.13.1, or for 9.13.1 and later on other platforms, you must assign IPv4 addresses for management LIFs, then convert to IPv6 after you complete cluster setup.

5. Press **Enter** to continue.

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

6. Create a new cluster: `create`

7. Accept the system defaults or enter your own values.
8. After setup is completed, log in to the cluster and verify that the cluster is active and the first node is healthy by entering the ONTAP CLI command: `cluster show`

The following example shows a cluster in which the first node (cluster1-01) is healthy and eligible to participate:

```
cluster1::> cluster show
Node                      Health  Eligibility
-----
cluster1-01              true    true
```

You can access the Cluster Setup wizard to change any of the values you entered for the admin SVM or node SVM by using the `cluster setup` command.

### After you finish

If needed, [convert from IPv4 to IPv6](#).

## Join remaining nodes to the cluster

After creating a new cluster, you use the Cluster Setup wizard to join each remaining node to the cluster one at a time. The wizard helps you to configure each node's node management interface.

When you join two nodes in a cluster, you are creating a high availability (HA) pair. If you join 4 nodes, you create two HA pairs. To learn more about HA, see [Learn about HA](#).

You can only join one node to the cluster at a time. When you start to join a node to the cluster, you must complete the join operation for that node, and the node must be part of the cluster before you can start to join the next node.

**Best Practice:** If you have a FAS2720 with 24 or fewer NL-SAS drives, you should verify that the storage configuration default is set to active/passive to optimize performance.

For more information, see [Setting up an active-passive configuration on nodes using root-data partitioning](#)

1. Log in to the node you plan to join in the cluster.

Cluster Setup wizard starts on the console.

```
Welcome to the cluster setup wizard....
```

2. Acknowledge the AutoSupport statement.



AutoSupport is enabled by default.

```
Type yes to confirm and continue {yes}: yes
```

3. Follow the instructions on the screen to assign an IP address to the node.

Beginning in ONTAP 9.13.1, you can assign IPv6 addresses for management LIFs on A800 and FAS8700 platforms. For ONTAP releases earlier than 9.13.1, or for 9.13.1 and later on other platforms, you must assign IPv4 addresses for management LIFs, then convert to IPv6 after you complete cluster setup.

4. Press **Enter** to continue.

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

5. Join the node to the cluster: `join`
6. Follow the instructions on the screen to set up the node and join it to the cluster.
7. After setup is completed, verify that the node is healthy and eligible to participate in the cluster: `cluster show`

The following example shows a cluster after the second node (cluster1-02) has been joined to the cluster:

```
cluster1::> cluster show
Node                      Health  Eligibility
-----
cluster1-01              true    true
cluster1-02              true    true
```

You can access the Cluster Setup wizard to change any of the values you entered for the admin SVM or node SVM by using the cluster setup command.

8. Repeat this task for each remaining node.

#### After you finish

If needed, [convert from IPv4 to IPv6](#).

## Convert management LIFs from IPv4 to IPv6

Beginning in ONTAP 9.13.1, you can assign IPv6 addresses to management LIFs on A800 and FAS8700 platforms during the initial cluster setup. For ONTAP releases earlier than 9.13.1, or for 9.13.1 and later on other platforms, you must first assign IPv4 addresses to management LIFs, and then convert to IPv6 addresses after you complete cluster setup.

#### Steps

1. Enable IPv6 for the cluster:

```
network options ipv6 modify -enable true
```

2. Set privilege to advanced:

```
set priv advanced
```

3. View the list of RA prefixes learned on various interfaces:

```
network ndp prefix show
```

4. Create an IPv6 management LIF:

Use the format `prefix::id` in the address parameter to construct the IPv6 address manually.

```
network interface create -vserver <svm_name> -lif <LIF> -home-node  
<home_node> -home-port <home_port> -address <IPv6prefix::id> -netmask  
-length <netmask_length> -failover-policy <policy> -service-policy  
<service_policy> -auto-revert true
```

5. Verify that the LIF was created:

```
network interface show
```

6. Verify that the configured IP address is reachable:

```
network ping6
```

7. Mark the IPv4 LIF as administratively down:

```
network interface modify -vserver <svm_name> -lif <lif_name> -status  
-admin down
```

8. Delete the IPv4 management LIF:

```
network interface delete -vserver <svm_name> -lif <lif_name>
```

9. Confirm that the IPv4 management LIF is deleted:

```
network interface show
```

## Check your cluster with Active IQ Config Advisor

After you have joined all the nodes to your new cluster, you should run Active IQ Config Advisor to validate your configuration and check for common configuration errors.

Config Advisor is a web-based application that you install on your laptop, virtual machine or a server, and works across Windows, Linux, and Mac platforms.

Config Advisor runs a series of commands to validate your installation and check the overall health of the configuration, including the cluster and storage switches.

1. Download and install Active IQ Config Advisor.

[Active IQ Config Advisor](#)

2. Launch Active IQ, and set up a passphrase when prompted.
3. Review your settings and click **Save**.
4. On the **Objectives** page, click **ONTAP Post-Deployment Validation**.
5. Choose either Guided or Expert mode.

If you choose Guided mode, connected switches are discovered automatically.

6. Enter the cluster credentials.
7. (Optional) Click **Form Validate**.
8. To begin collecting data, click **Save & Evaluate**.
9. After data collection is complete, under **Job Monitor > Actions**, view the data collected by clicking **Data View** icon, and view the results by clicking the **Results** icon.
10. Resolve the issues identified by Config Advisor.

## Synchronize the system time across the cluster

Synchronizing the time ensures that every node in the cluster has the same time, and prevents CIFS and Kerberos failures.

A Network Time Protocol (NTP) server should be set up at your site. Beginning with ONTAP 9.5, you can set up your NTP server with symmetric authentication.

For more information, see [Managing the cluster time \(cluster administrators only\)](#).

You synchronize the time across the cluster by associating the cluster with one or more NTP servers.

1. Verify that the system time and time zone is set correctly for each node.

All nodes in the cluster should be set to the same time zone.

- a. Use the cluster date show command to display the current date, time, and time zone for each node.

```
cluster1::> cluster date show
```

Node	Date	Time zone
cluster1-01	01/06/2015 09:35:15	America/New_York
cluster1-02	01/06/2015 09:35:15	America/New_York
cluster1-03	01/06/2015 09:35:15	America/New_York
cluster1-04	01/06/2015 09:35:15	America/New_York

4 entries were displayed.

- b. Use the cluster date modify command to change the date or time zone for all of the nodes.

This example changes the time zone for the cluster to be GMT:

```
cluster1::> cluster date modify -timezone GMT
```

2. Use the cluster time-service ntp server create command to associate the cluster with your NTP server.

- To set up your NTP server without symmetric authentication enter the following command: `cluster time-service ntp server create -server server_name`
- To set up your NTP server with symmetric authentication, enter the following command: `cluster time-service ntp server create -server server_ip_address -key-id key_id`



Symmetric authentication is available Beginning with ONTAP 9.5. It is not available in ONTAP 9.4 or earlier.

This example assumes that DNS has been configured for the cluster. If you have not configured DNS, you must specify the IP address of the NTP server:

```
cluster1::> cluster time-service ntp server create -server
ntp1.example.com
```

3. Verify that the cluster is associated with an NTP server: `cluster time-service ntp server show`

```
cluster1::> cluster time-service ntp server show
```

Server	Version
ntp1.example.com	auto

## Related information

[System administration](#)

## Commands for managing symmetric authentication on NTP servers

Beginning with ONTAP 9.5, Network Time Protocol (NTP) version 3 is supported. NTPv3 includes symmetric authentication using SHA-1 keys which increases network security.

To do this...	Use this command...
Configure an NTP server without symmetric authentication	<pre>cluster time-service ntp server create -server server_name</pre>
Configure an NTP server with symmetric authentication	<pre>cluster time-service ntp server create -server server_ip_address -key-id key_id</pre>
Enable symmetric authentication for an existing NTP server  An existing NTP server can be modified to enable authentication by adding the required key-id.	<pre>cluster time-service ntp server modify -server server_name -key-id key_id</pre>
Configure a shared NTP key	<pre>cluster time-service ntp key create -id shared_key_id -type shared_key_type -value shared_key_value</pre> <p><b>Note:</b> Shared keys are referred to by an ID. The ID, its type, and value must be identical on both the node and the NTP server</p>
Configure an NTP server with an unknown key ID	<pre>cluster time-service ntp server create -server server_name -key-id key_id</pre>
Configure a server with a key ID not configured on the NTP server.	<pre>cluster time-service ntp server create -server server_name -key-id key_id</pre> <p><b>Note:</b> The key ID, type, and value must be identical to the key ID, type, and value configured on the NTP server.</p>
Disable symmetric authentication	<pre>cluster time-service ntp server modify -server server_name -authentication disabled</pre>

## Additional system configuration tasks to complete

After setting up a cluster, you can use either System Manager or the ONTAP command-line interface (CLI) to continue configuring the cluster.



System configuration task	Resource
Configure networking: <ul style="list-style-type: none"> <li>• Create broadcast domains</li> <li>• Create subnets</li> <li>• Create IP spaces</li> </ul>	<a href="#">Setting up the network</a>
Set up the Service Processor	<a href="#">System administration</a>
Lay out your aggregates	<a href="#">Disk and aggregate management</a>
Create and configure data storage virtual machines (SVMs)	<a href="#">NFS configuration</a> <a href="#">SMB configuration</a> <a href="#">SAN administration</a>
Configure event notifications	<a href="#">EMS configuration</a>

## Configure All-Flash SAN Array software

### All-Flash SAN Array software configuration overview

The NetApp All-Flash SAN Arrays (ASAs) are available beginning with ONTAP 9.7. ASAs are all-flash SAN-only solutions built on proven AFF NetApp platforms.

ASA platforms use symmetric active-active for multipathing. All paths are active/optimized so in the event of a storage failover, the host does not need to wait for the ALUA transition of the failover paths to resume I/O. This reduces time to failover.

#### Set up an ASA

All-Flash SAN Arrays (ASAs) follow the same setup procedure as non-ASA systems.

System Manager guides you through the procedures necessary to initialize your cluster, create a local tier, configure protocols, and provision storage for your ASA.

[Get started with ONTAP cluster set up.](#)

#### ASA host settings and utilities

Host settings for setting up All-Flash SAN Arrays (ASAs) are the same as those for all other SAN hosts.

You can download the [NetApp Host Utilities software](#) for your specific hosts from the support site.

#### Ways to identify an ASA system

You can identify an ASA system using System Manager or using the ONTAP command line interface (CLI).

- **From the System Manager dashboard:** Click **Cluster > Overview** and then select the system node.

The **PERSONALITY** is displayed as **All-Flash SAN Array**.

- **From the CLI:** Enter the `san config show` command.

The "All-Flash SAN Array" value returns as true for ASA systems.

#### Related information

- [Technical Report 4968: NetApp All-SAN Array Data Availability and Integrity](#)
- [NetApp Technical Report 4080: Best Practices for Modern SAN](#)

## All-Flash SAN Array configuration limits and support

All-Flash SAN Array (ASA) configuration limits and support varies by ONTAP version.

The most current details on supported configuration limits are available in [NetApp Hardware Universe](#).

### SAN protocols and supported number of nodes per cluster

The supported SAN protocols and maximum number of nodes per cluster depends on whether you have a non-MetroCluster or MetroCluster configuration:

### Non-MetroCluster configurations

The following table shows the ASA support for SAN protocols and the supported number of nodes per cluster in non-MetroCluster configurations:

Beginning with ONTAP...	Protocol support	Maximum nodes per cluster
9.11.1	<ul style="list-style-type: none"><li>• NVMe/TCP</li><li>• NVMe/FC</li></ul>	12
9.10.1	<ul style="list-style-type: none"><li>• NVMe/TCP</li></ul>	2
9.9.1	<ul style="list-style-type: none"><li>• NVMe/FC</li></ul>	2
	<ul style="list-style-type: none"><li>• FC</li><li>• iSCSI</li></ul>	12
9.7	<ul style="list-style-type: none"><li>• FC</li><li>• iSCSI</li></ul>	2

### MetroCluster IP configurations

The following table shows the ASA support for SAN protocols and the supported number of nodes per cluster in MetroCluster IP configurations:

Beginning with ONTAP...	Protocol support	Maximum nodes per cluster
9.15.1	<ul style="list-style-type: none"><li>• NVMe/TCP</li></ul>	2 nodes per cluster in four-node MetroCluster IP configurations
9.12.1	<ul style="list-style-type: none"><li>• NVMe/FC</li></ul>	2 nodes per cluster in four-node MetroCluster IP configurations
9.9.1	<ul style="list-style-type: none"><li>• FC</li><li>• iSCSI</li></ul>	4 nodes per cluster in eight-node MetroCluster IP configurations
9.7	<ul style="list-style-type: none"><li>• FC</li><li>• iSCSI</li></ul>	2 nodes per cluster in four-node MetroCluster IP configurations

### Support for persistent ports

Beginning with ONTAP 9.8, persistent ports are enabled by default on All-Flash SAN Arrays (ASAs) that are configured to use the FC protocol. Persistent ports are only available for FC and require zone membership identified by World Wide Port Name (WWPN).

Persistent ports reduce the impact of takeovers by creating a shadow LIF on the corresponding physical port of the high-availability (HA) partner. When a node is taken over, the shadow LIF on the partner node assumes the identity of the original LIF, including the WWPN. Before the status of path to the taken over node is changed

to faulty, the shadow LIF appears as an Active/Optimized path to the host MPIO stack, and I/O is shifted. This reduces I/O disruption because the host always sees the same number of paths to the target, even during storage failover operations.

For persistent ports, the following FCP port characteristics should be identical within the HA pair:

- FCP port counts
- FCP port names
- FCP port speeds
- FCP LIF WWPN-based zoning

If any of these characteristics are not identical within the HA pair, the following EMS message is generated:

```
EMS : scsiblade.lif.persistent.ports.fcp.init.error
```

For more information on persistent ports, see [NetApp Technical Report 4080: Best Practices for Modern SAN](#).

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