IBM System Storage N series

# Clustered Data ONTAP 8.2 Cluster and Vserver Peering Express Guide

SC27-6288-00

# Contents

# Preface

## About this guide

This document applies to IBM N series systems running Data ONTAP, including systems with gateway functionality. If the terms *Cluster-Mode* or *clustered Data ONTAP* are used in this document, they refer to the Data ONTAP features and functionality designed for clusters, which are different from 7-Mode and prior Data ONTAP 7.1, 7.2, and 7.3 release families.

In this document, the term *gateway* describes IBM N series storage systems that have been ordered with gateway functionality. Gateways support various types of storage, and they are used with third-party disk storage systems—for example, disk storage systems from IBM, HP®, Hitachi Data Systems®, and EMC®. In this case, disk storage for customer data and the RAID controller functionality is provided by the back-end disk storage system. A gateway might also be used with disk storage expansion units specifically designed for the IBM N series models.

The term *filer* describes IBM N series storage systems that either contain internal disk storage or attach to disk storage expansion units specifically designed for the IBM N series storage systems. Filer storage systems do not support using third-party disk storage systems.

## Supported features

IBM System Storage N series storage systems are driven by NetApp Data ONTAP software. Some features described in the product software documentation are neither offered nor supported by IBM. Please contact your local IBM representative or reseller for further details.

Information about supported features can also be found on the N series support website (accessed and navigated as described in Websites).

## Websites

IBM maintains pages on the World Wide Web where you can get the latest technical information and download device drivers and updates. The following web pages provide N series information:

- A listing of currently available N series products and features can be found at the following web page:

  www.ibm.com/storage/nas/
- The IBM System Storage N series support website requires users to register in order to obtain access to N series support content on the web. To understand how the N series support web content is organized and navigated, and to access the N series support website, refer to the following publicly accessible web page:

  www.ibm.com/storage/support/nseries/

  This web page also provides links to AutoSupport information as well as other important N series product resources.
- IBM System Storage N series products attach to a variety of servers and operating systems. To determine the latest supported attachments, go to the IBM N series interoperability matrix at the following web page:

www.ibm.com/systems/storage/network/interophome.html

- For the latest N series hardware product documentation, including planning, installation and setup, and hardware monitoring, service and diagnostics, see the IBM N series Information Center at the following web page:

  publib.boulder.ibm.com/infocenter/nasinfo/nseries/index.jsp

## Getting information, help, and service

If you need help, service, or technical assistance or just want more information about IBM products, you will find a wide variety of sources available from IBM to assist you. This section contains information about where to go for additional information about IBM and IBM products, what to do if you experience a problem with your IBM N series product, and whom to call for service, if it is necessary.

## Before you call

Before you call, make sure you have taken these steps to try to solve the problem yourself:

- Check all cables to make sure they are connected.
- Check the power switches to make sure the system is turned on.
- Use the troubleshooting information in your system documentation and use the diagnostic tools that come with your system.
- Refer to the N series support website (accessed and navigated as described in Websites) for information on known problems and limitations.

## Using the documentation

The latest versions of N series software documentation, including Data ONTAP and other software products, are available on the N series support website (accessed and navigated as described in Websites).

Current N series hardware product documentation is shipped with your hardware product in printed documents or as PDF files on a documentation CD. For the latest N series hardware product documentation PDFs, go to the N series support website.

Hardware documentation, including planning, installation and setup, and hardware monitoring, service, and diagnostics, is also provided in an IBM N series Information Center at the following web page:

publib.boulder.ibm.com/infocenter/nasinfo/nseries/index.jsp

## Hardware service and support

You can receive hardware service through IBM Integrated Technology Services. Visit the following web page for support telephone numbers:

www.ibm.com/planetwide/

## Firmware updates

IBM N series product firmware is embedded in Data ONTAP. As with all devices, ensure that you run the latest level of firmware. Any firmware updates are posted to the N series support website (accessed and navigated as described in Websites).

**Note:** If you do not see new firmware updates on the N series support website, you are running the latest level of firmware.

Verify that the latest level of firmware is installed on your machine before contacting IBM for technical support.

## How to send your comments

Your feedback helps us to provide the most accurate and high-quality information. If you have comments or suggestions for improving this document, please send them by email to starpubs@us.ibm.com.

Be sure to include the following:

- Exact publication title
- Publication form number (for example, GC26-1234-02)
- Page, table, or illustration numbers
- A detailed description of any information that should be changed

# Deciding whether to use this guide

This guide describes how to create peer relationships between two clusters and between two Vservers. Peer relationships enable clusters to communicate with other clusters and Vservers to communicate with other Vservers. You must create intercluster peer relationships to replicate data between different geographical locations or between Vservers on different clusters.

You should use this guide if you want to create peer relationships and do not want a lot of conceptual background for the tasks. This guide does not cover every option and provides minimal background information.

This guide assumes that the two clusters in the peer relationship that you will create have already been set up and are running the same version of Data ONTAP. The time on the clusters must be synchronized within 300 seconds (five minutes). Cluster peers can be in different time zones.

This guide assumes that you are a cluster administrator. Vserver administrators cannot create cluster peer or Vserver peer relationships.

If these assumptions are not correct for your situation, or if you want more conceptual background information, you should see the following documentation:

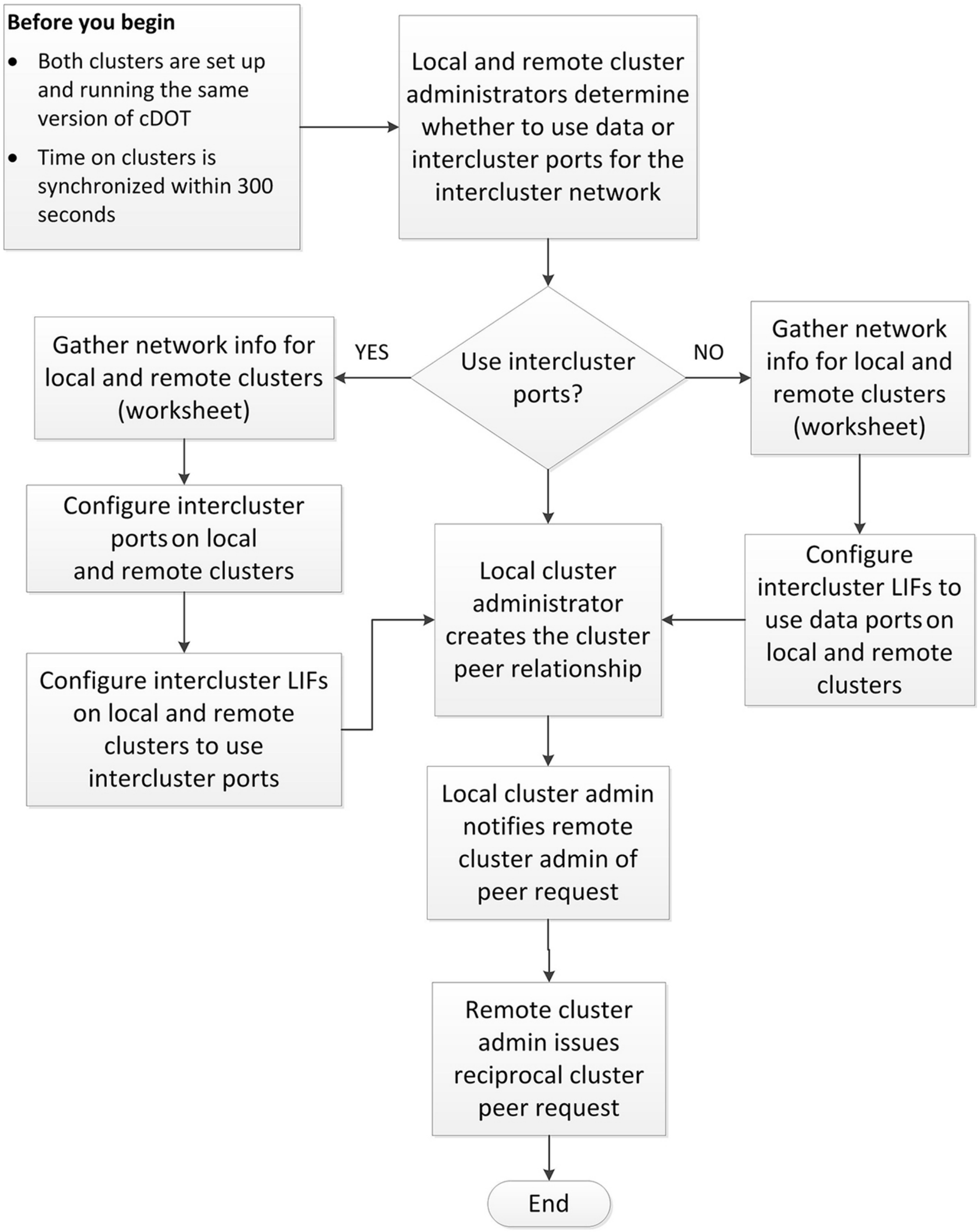
- *Clustered Data ONTAP System Administration Guide for Cluster Administrators*
- *Clustered Data ONTAP Network Management Guide*
- *Technical Report 4015: SnapMirror Configuration and Best Practices Guide for Clustered Data ONTAP*

**Related information**:

IBM N series support website: www.ibm.com/storage/support/nseries

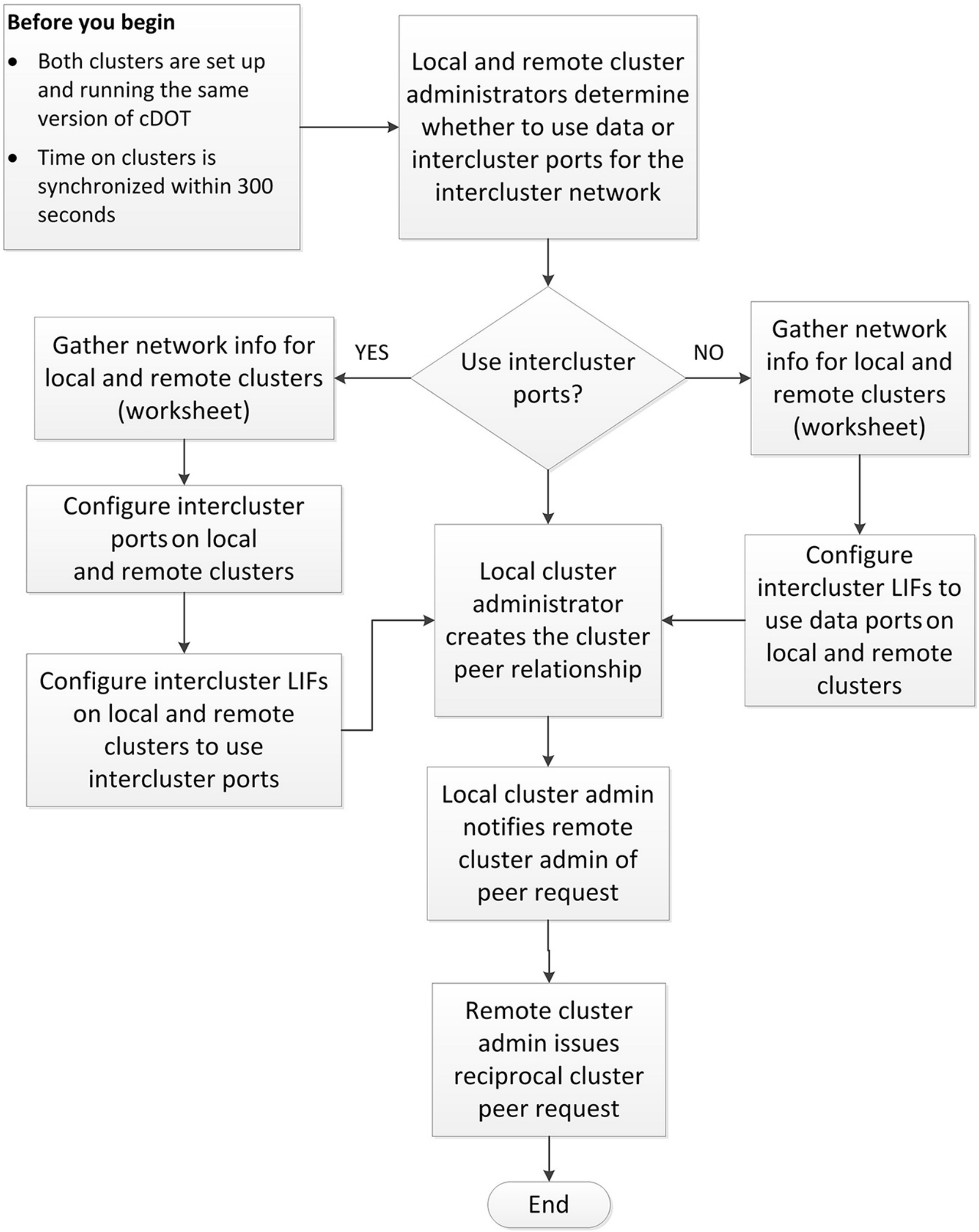
# Cluster peering workflow

When configuring a cluster peer relationship, the administrators of both clusters determine whether to use dedicated ports for intercluster communication or to share ports also used by the data network, create intercluster ports (if necessary), assign intercluster LIFs to the selected ports, and then create the peer relationship.


Before you begin
• Both clusters are set up and running the same version of cDOT
• Time on clusters is synchronized within 300 seconds
Local and remote cluster administrators determine whether to use data or intercluster ports for the intercluster network
Use intercluster ports?
YES
NO
Gather network info for local and remote clusters (worksheet)
Configure intercluster ports on local and remote clusters
Configure intercluster LIFs on local and remote clusters to use intercluster ports
Gather network info for local and remote clusters (worksheet)
Configure intercluster LIFs to use data ports on local and remote clusters
Local cluster administrator creates the cluster peer relationship
Local cluster admin notifies remote cluster admin of peer request
Remote cluster admin issues reciprocal cluster peer request
End

## Intercluster Vserver peering workflow

When you configure an intercluster peer relationship for a virtual storage server (Vserver), you ensure there is a suitable Vserver on the destination cluster before creating the peer relationship. When the administrator of the remote cluster accepts the peer request, the Vserver peer relationship is established.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Remote cluster admin issues reciprocal cluster peer request
End

# Considerations for configuring intercluster LIFs

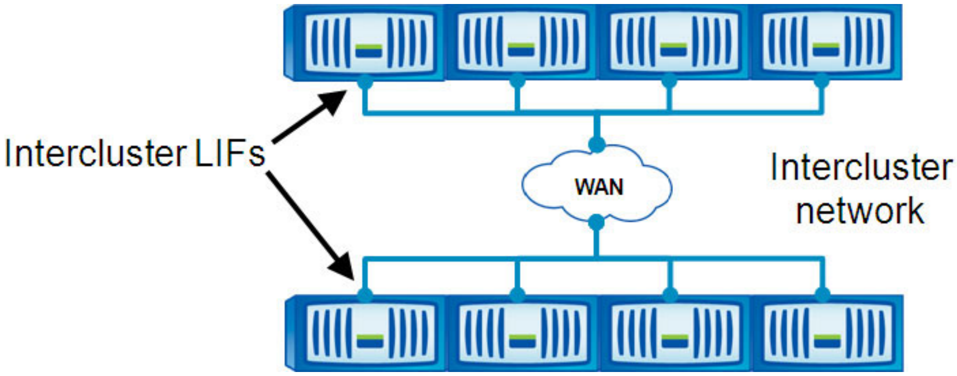
The intercluster network uses logical interfaces, or LIFs, that correspond to IP addresses and represent network access points to a node. The intercluster network uses only intercluster LIFs. You assign intercluster LIFs to ports in conformance with requirements to create a supported peer configuration.

- At least one intercluster LIF must be configured on every node in the local cluster and on every node in the remote cluster.

  Provisioning intercluster LIFs on only some nodes of the cluster is not a supported configuration.

  **Tip:** To make it easier to identify the node where an intercluster LIF resides, it is a good idea to use a naming convention that indicates the node on which the intercluster LIF was created, followed by ic# or icl# to indicate the LIF type and number. For example, the second of two intercluster LIFs on the fourth node of cluster01 might be named cluster01-04_ic02. The first letter of a LIF name should be either a letter or an underscore.
- Each intercluster LIF requires an IP address dedicated for intercluster communication.

  The IP addresses assigned to intercluster LIFs can reside in the same subnet as data LIFs or in a different subnet.
- Your cluster peering topology should use *full-mesh connectivity*, meaning that every intercluster LIF on the local cluster should be able to communicate with every intercluster LIF on the remote cluster.



As intercluster LIFs become available or unavailable, the list of active IP addresses used by the cluster can change. The discovery of active IP addresses is automatic in certain events, such as when a node reboots. The creation of a peer relationship requires only one remote cluster address.

**Note:** If the node hosting the intercluster LIF address goes down and the address becomes unavailable, the cluster peer relationship might not be rediscovered. Therefore, it is a best practice to configure at least one intercluster IP address from each node in both clusters, so that the peer relationship remains stable if a node fails.

# Determining whether to use shared or dedicated ports for intercluster communication

When you configure a cluster peer relationship, you assign intercluster LIFs to ports capable of handling intercluster communications. Before selecting the ports, you have to determine whether to use dedicated ports for intercluster communication or to share ports that are also used by the data network.

Network ports in a cluster have roles that define their purpose and their default behavior. Port roles limit the types of LIFs that can be assigned to a port. Intercluster LIFs use only data ports or intercluster ports.

You can assign any Ethernet port type in the system the role of data or intercluster, including physical ports (such as e0e or e0f) and logical ports (such as a VLAN or an interface group).

- A data port is used for data traffic and can be accessed by NFS, CIFS, FC, or iSCSI clients for data requests.

  You can create VLANs and interface groups on data ports. VLANs and interface groups have the data port role by default.
- An intercluster port is used exclusively for communication between clusters.
- Each intercluster LIF on a cluster in a peer relationship should be routable to every intercluster LIF of the other cluster.

When you assign the intercluster role to a port, Data ONTAP automatically configures a non-modifiable failover group consisting of intercluster ports for the intercluster LIFs. Data protocols cannot fail over or migrate to an intercluster port.

If you used Data ONTAP operating in 7-Mode and used a dedicated port for replication traffic, it is likely that you will want to use a dedicated network for clustered Data ONTAP. Most of the networking considerations you encountered when using replication in 7-Mode also apply to clustered Data ONTAP.

## LAN type and bandwidth

If you have a high-speed network, such as 10 GbE, you might have enough local LAN bandwidth to perform replication using the same 10 GbE ports used for data access.

If you have a 10 GbE network, you should compare your available WAN bandwidth to your LAN bandwidth. If the available WAN bandwidth is significantly less than 10 GbE, you might be limited to the network utilization that the WAN can support.

## Data change rate and replication interval

If you plan to use the peer relationship for replication, consider how your available bandwidth will handle the level of client activity during the replication interval. If the WAN bandwidth is similar to that of the LAN ports and replication will occur during regular client activity, then dedicate Ethernet ports for intercluster communication to avoid contention between replication and the data protocols.

Consider the amount of data that will be replicated in each interval and whether it requires so much bandwidth that it could cause contention with data protocols for shared data ports. If you use the peer relationship for replication and replication is set to occur only when minimal to no client activity occurs, you might be able to use data ports for intercluster replication successfully, even without a 10 GbE LAN connection.

### Network utilization by data protocols

If the network utilization generated by the data protocols (CIFS, NFS, iSCSI) is above 50%, then you should dedicate ports for intercluster communication to allow for non-degraded performance if a node failover occurs.

### Port availability

Sharing ports for data and intercluster communication eliminates the extra port counts required when using dedicated ports. When data ports for intercluster communication are shared, the intercluster LIFs can be migrated to any other intercluster-capable port on the same node.

**Note:** If you decide to dedicate ports for intercluster communication, it is a best practice to configure at least two intercluster ports per node. An intercluster LIF cannot fail over to a port on a different node; its failover group contains only intercluster-capable ports on the same node. If you use intercluster ports, Data ONTAP uses only intercluster ports in the failover group for an intercluster LIF. Therefore, if you use intercluster ports, you should configure at least two intercluster ports per node so that there is a port to which the intercluster LIF can fail over.

When physical 10 GbE ports are used for both data and intercluster communication, you can create VLAN ports and use dedicated logical ports for intercluster communication.

Using dedicated ports for intercluster communication requires additional switch ports and cable runs.

### Performance characteristics

For best performance, all paths used by intercluster LIFs should have equal performance characteristics. If a node has one intercluster LIF on a slow path and another intercluster LIF on a fast path, performance will be adversely affected because data is multiplexed across the slow and fast paths simultaneously.

## Required network information

The administrators of the local and remote clusters both have to gather IP addresses, ports, and other network information for the intercluster LIFs before configuring a cluster peer relationship.

Configure at least one intercluster IP address from each node in both clusters, so that the peer relationship remains stable if a node fails.

If you plan to use intercluster ports, configure at least two intercluster ports per node.

## Intercluster LIFs for the local cluster

You must configure at least one intercluster LIF for each node in the cluster. Each intercluster LIF requires an IP address dedicated for intercluster communication.

| **Type of information** | | **Your values** |
|---|---|---|
| Node 1 | Intercluster LIF name | |
| | Intercluster LIF port(s) | |
| | Intercluster LIF IP address | |
| | Default route gateway | |
| | Network mask | |
| Node 2 | Intercluster LIF name | |
| | Intercluster LIF port(s) | |
| | Intercluster LIF IP address | |
| | Default route gateway | |
| | Network mask | |
| Node 3 | Intercluster LIF name | |
| | Intercluster LIF port(s) | |
| | Intercluster LIF IP address | |
| | Default route gateway | |
| | Network mask | |
| Node 4 | Intercluster LIF name | |
| | Intercluster LIF port(s) | |
| | Intercluster LIF IP address | |
| | Default route gateway | |
| | Network mask | |
| Node 5 | Intercluster LIF name | |
| | Intercluster LIF port(s) | |
| | Intercluster LIF IP address | |
| | Default route gateway | |
| | Network mask | |
| Node 6 | Intercluster LIF name | |
| | Intercluster LIF port(s) | |
| | Intercluster LIF IP address | |
| | Default route gateway | |
| | Network mask | |

| Type of information | | Your values |
|---|---|---|
| Node 7 | Intercluster LIF name | |
| | Intercluster LIF port(s) | |
| | Intercluster LIF IP address | |
| | Default route gateway | |
| | Network mask | |
| Node 8 | Intercluster LIF name | |
| | Intercluster LIF port(s) | |
| | Intercluster LIF IP address | |
| | Default route gateway | |
| | Network mask | |

## Intercluster LIFs for the remote cluster

You must configure at least one intercluster LIF for each node in the cluster. Each intercluster LIF requires an IP address dedicated for intercluster communication.

| Type of information | | Your values |
|---|---|---|
| Node 1 | Intercluster LIF name | |
| | Intercluster LIF port(s) | |
| | Intercluster LIF IP address | |
| | Default route gateway | |
| | Network mask | |
| Node 2 | Intercluster LIF name | |
| | Intercluster LIF port(s) | |
| | Intercluster LIF IP address | |
| | Default route gateway | |
| | Network mask | |
| Node 3 | Intercluster LIF name | |
| | Intercluster LIF port(s) | |
| | Intercluster LIF IP address | |
| | Default route gateway | |
| | Network mask | |
| Node 4 | Intercluster LIF name | |
| | Intercluster LIF port(s) | |
| | Intercluster LIF IP address | |
| | Default route gateway | |
| | Network mask | |

| Type of information | | Your values |
|---|---|---|
| Node 5 | Intercluster LIF name | |
| | Intercluster LIF port(s) | |
| | Intercluster LIF IP address | |
| | Default route gateway | |
| | Network mask | |
| Node 6 | Intercluster LIF name | |
| | Intercluster LIF port(s) | |
| | Intercluster LIF IP address | |
| | Default route gateway | |
| | Network mask | |
| Node 7 | Intercluster LIF name | |
| | Intercluster LIF port(s) | |
| | Intercluster LIF IP address | |
| | Default route gateway | |
| | Network mask | |
| Node 8 | Intercluster LIF name | |
| | Intercluster LIF port(s) | |
| | Intercluster LIF IP address | |
| | Default route gateway | |
| | Network mask | |

# Connecting clusters in a peer relationship

To connect clusters in a peer relationship, you configure intercluster LIFs by using either shared ports or dedicated ports, and then create the peer relationship.

### Before you begin

You must have decided whether to use dedicated ports for intercluster communication or to assign your intercluster LIFs to shared data ports.

### About this task

If you are not the administrator of the remote cluster, you must coordinate with the administrator to configure intercluster LIFs on the nodes of the remote cluster and to create the peer relationship. You and the administrator of the remote cluster can configure cluster peering without sharing credential information if you both issue the commands while logged into your respective clusters.

This guide provides two, mutually exclusive procedures for configuring intercluster LIFs: one for using dedicated ports and one for using shared ports. You have to perform one or the other before creating the cluster peer relationship.

**Tip:** Configuring cluster peering can be very repetitive, because you must configure intercluster LIFs on every node in both clusters to establish full-mesh connectivity. Consider using wildcards in the commands to save time. (For better clarity, the examples do not show the use of wildcards.)

## Configuring intercluster LIFs to use dedicated intercluster ports

Configuring intercluster LIFs to use dedicated data ports allows greater bandwidth than using shared data ports on your intercluster networks for cluster peer relationships.

### About this task

In this example, a two-node cluster exists in which each node has two data ports, e0e and e0f, which are dedicated for intercluster replication. In your own environment, you would replace the ports, networks, IP addresses, subnet masks, and subnets with those specific to your environment.

To learn more about LIFs and port types, see the *Clustered Data ONTAP Network Management Guide*

### Procedure

1. Check the role of the ports in the cluster by using the **`network port show`** command.

```
cluster01::> network port show
                                      Auto-Negot  Duplex     Speed(Mbps)
Node   Port   Role         Link MTU   Admin/Oper  Admin/Oper Admin/Oper
------ ------ ------------ ---- ----- ----------- ---------- ----------
cluster01-01
       e0a    cluster      up   1500  true/true   full/full  auto/1000
       e0b    cluster      up   1500  true/true   full/full  auto/1000
       e0c    data         up   1500  true/true   full/full  auto/1000
       e0d    data         up   1500  true/true   full/full  auto/1000
       e0e    data         up   1500  true/true   full/full  auto/1000
       e0f    data         up   1500  true/true   full/full  auto/1000
cluster01-02
       e0a    cluster      up   1500  true/true   full/full  auto/1000
       e0b    cluster      up   1500  true/true   full/full  auto/1000
       e0c    data         up   1500  true/true   full/full  auto/1000
       e0d    data         up   1500  true/true   full/full  auto/1000
       e0e    data         up   1500  true/true   full/full  auto/1000
       e0f    data         up   1500  true/true   full/full  auto/1000
```

2. Determine whether any of the LIFs are using ports that are dedicated for replication by using the **network interface show** command.

```
cluster01::> network interface show
            Logical    Status     Network            Current       Current Is
Vserver     Interface  Admin/Oper Address/Mask       Node          Port    Home
----------- ---------- ---------- ------------------ ------------- ------- ----
cluster01
            cluster_mgmt up/up    192.168.0.xxx/24   cluster01-01  e0c     true
vs1
            vs1_lif1     up/up    192.168.0.151/24   cluster01-01  e0e     true
```

3. If a LIF is using one of the ports dedicated to replication, then assign the LIF to a different home port by using the **network interface modify** command. The LIF cannot remain on the port you want to dedicate to replication, because intercluster ports cannot host data LIFs.

   The **network interface modify** operation is nondisruptive, because the LIF has not yet moved from port e0e. The **network interface modify** command shown below changes the port to which the LIF returns when the **network interface revert** command is issued.

```
cluster01::> network interface modify -vserver vs1 -lif vs_lif1 -home-node cluster01-01 -home-port e0d

cluster01::> network interface show
            Logical    Status     Network            Current       Current Is
Vserver     Interface  Admin/Oper Address/Mask       Node          Port    Home
----------- ---------- ---------- ------------------ ------------- ------- ----
cluster01
            cluster_mgmt up/up    192.168.0.xxx/24   cluster01-01  e0c     true
vs1
            vs1_lif1     up/up    192.168.0.151/24   cluster01-01  e0e     false
```

4. Revert the LIF to its new home port by using the **network interface revert** command. Assigning the LIF to a different port by combining the **network interface modify** and **network interface revert** commands avoids the risk that the LIF might fail back to its original port.

```
cluster01::> network interface revert -vserver vs1 -lif vs_lif1

cluster01::> network interface show
            Logical    Status     Network            Current       Current Is
Vserver     Interface  Admin/Oper Address/Mask       Node          Port    Home
----------- ---------- ---------- ------------------ ------------- ------- ----
cluster01
            cluster_mgmt up/up    192.168.0.xxx/24   cluster01-01  e0c     true
vs1
            vs1_lif1     up/up    192.168.0.151/24   cluster01-01  e0d     true
```

5. After all LIFs have been migrated off the ports dedicated for replication, change the role of the port used on each node to **intercluster** by using the **network port modify** command.

```
cluster01::> network port modify -node cluster01-01 -port e0e -role intercluster

cluster01::> network port modify -node cluster01-01 -port e0f -role intercluster

cluster01::> network port modify -node cluster01-02 -port e0e -role intercluster

cluster01::> network port modify -node cluster01-02 -port e0f -role intercluster
```

6. Verify that the roles of the correct ports have been changed to **intercluster** by using the **`network port show`** command with the `-role` **intercluster** parameter.

```
cluster01::> network port show –role intercluster
                                   Auto-Negot  Duplex     Speed(Mbps)
Node   Port   Role         Link MTU   Admin/Oper  Admin/Oper Admin/Oper
------ ------ ------------ ---- ----- ----------- ---------- ----------
cluster01-01
       e0e    intercluster up   1500  true/true   full/full  auto/1000
       e0f    intercluster up   1500  true/true   full/full  auto/1000
cluster01-02
       e0e    intercluster up   1500  true/true   full/full  auto/1000
       e0f    intercluster up   1500  true/true   full/full  auto/1000
```

7. Create an intercluster LIF on each node in cluster01 by using the **`network interface create`** command. This example uses the LIF naming convention *nodename*_icl# for the intercluster LIF.

```
cluster01::> network interface create -vserver cluster01-01 -lif cluster01-01_icl01 -role
intercluster -home-node cluster01-01 -home-port e0e
-address 192.168.1.201 -netmask 255.255.255.0
Info: Your interface was created successfully; the routing group i192.168.1.0/24 was created

cluster01::> network interface create -vserver cluster01-02 -lif cluster01-02_icl01 -role
intercluster -home-node cluster01-02 -home-port e0e
-address 192.168.1.202 -netmask 255.255.255.0
Info: Your interface was created successfully; the routing group i192.168.1.0/24 was created
```

8. Verify that the intercluster LIFs are configured for redundancy by using the **`network interface show`** command with the `-role` **intercluster** and `-failover` parameters. The LIFs in this example are assigned the e0e home port on each node. If the e0e port fails, the LIF can fail over to the e0f port because e0f is also assigned the role of intercluster.

   The intercluster LIF is assigned to an intercluster port; therefore, a non-modifiable failover group is created automatically, and contains all ports with the intercluster role on that node. Intercluster failover groups are node-specific; therefore, if changes are required, they must be managed for each node because different nodes might use different ports for replication.

```
cluster01::> network interface show -role intercluster –failover
         Logical         Home                  Failover       Failover
Vserver  Interface       Node:Port             Group Usage    Group
-------- --------------- --------------------- -------------- --------
cluster01-01
         cluster01-01_icl01 cluster01-01:e0e   system-defined
                            Failover Targets: cluster01-01:e0e,
                                              cluster01-01:e0f
cluster01-02
         cluster01-02_icl01 cluster01-02:e0e   system-defined
                            Failover Targets: cluster01-02:e0e,
                                              cluster01-02:e0f
```

9. Verify that the intercluster LIFs were created properly by using the **`network interface show`** command.

```
cluster01::> network interface show
            Logical    Status     Network            Current       Current Is
Vserver     Interface  Admin/Oper Address/Mask       Node          Port    Home
----------- ---------- ---------- ------------------ ------------- ------- ----
cluster01
            cluster_mgmt up/up    192.168.0.xxx/24   cluster01-01  e0c     true
cluster01-01
            cluster01-01_icl01
                         up/up    192.168.1.201/24   cluster01-01  e0e     true
            clus1        up/up    169.254.xx.xx/24   cluster01-01  e0a     true
            clus2        up/up    169.254.xx.xx/24   cluster01-01  e0b     true
            mgmt1        up/up    192.168.0.xxx/24   cluster01-01  e0c     true
cluster01-02
            cluster01-02_icl01
                         up/up    192.168.1.202/24   cluster01-02  e0e     true
            clus1        up/up    169.254.xx.xx/24   cluster01-02  e0a     true
            clus2        up/up    169.254.xx.xx/24   cluster01-02  e0b     true
            mgmt1        up/up    192.168.0.xxx/24   cluster01-02  e0c     true
```

10. Display routing groups by using the **network routing-group show** command with the -role **intercluster** parameter to determine whether the intercluster network needs intercluster routes. An intercluster routing group is created automatically for the intercluster LIFs.

```
cluster01::> network routing-group show –role intercluster
          Routing
Vserver   Group     Subnet          Role         Metric
--------- --------- --------------- ------------ -------
cluster01-01
          i192.168.1.0/24
                    192.168.1.0/24  intercluster 40
cluster01-02
          i192.168.1.0/24
                    192.168.1.0/24  intercluster 40
```

11. Display the routes in the cluster by using the **network routing-group show** command to determine whether intercluster routes are available or you must create them. Creating a route is required only if the intercluster addresses in both clusters are not on the same subnet and a specific route is needed for communication between the clusters. In this example, no intercluster routes are available.

```
cluster01::> network routing-group route show
          Routing
Vserver   Group     Destination     Gateway         Metric
--------- --------- --------------- --------------- ------
cluster01
          c192.168.0.0/24
                    0.0.0.0/0       192.168.0.1     20
cluster01-01
          n192.168.0.0/24
                    0.0.0.0/0       192.168.0.1     10
cluster01-02
          n192.168.0.0/24
                    0.0.0.0/0       192.168.0.1     10
```

12. If communication between intercluster LIFs in different clusters requires routing, create an intercluster route by using the **network routing-groups route create** command. The intercluster networks apply to each node; therefore, you must create an intercluster route on each node. In this example, 192.168.1.1 is the gateway address for the 192.168.1.0/24 network.

    **Note:** If the destination is specified as 0.0.0.0/0, then it becomes the default route for the intercluster network.

```
cluster01::> network routing-groups route create -server cluster01-01 -routing-group
i192.168.1.0/24 -destination 0.0.0.0/0 -gateway 192.168.1.1 -metric 40

cluster01::> network routing-groups route create -server cluster01-02 -routing-group
i192.168.1.0/24 -destination 0.0.0.0/0 -gateway 192.168.1.1 -metric 40
```

13. Display the newly created routes by using the **network routing-groups route show** command to confirm that you created the routes correctly. Although the intercluster routes do not have an assigned role, they are assigned to the

routing group i192.168.1.0/24, which is assigned the role of **intercluster** . These routes are only used for intercluster communication.

```
cluster01::> network routing-group route show
          Routing
Vserver   Group     Destination     Gateway         Metric
--------- --------- --------------- --------------- ------
cluster01
          c192.168.0.0/24
                    0.0.0.0/0       192.168.0.1     20
cluster01-01
          n192.168.0.0/24
                    0.0.0.0/0       192.168.0.1     10
          i192.168.1.0/24
                    0.0.0.0/0       192.168.1.1     40
cluster01-02
          n192.168.0.0/24
                    0.0.0.0/0       192.168.0.1     10
          i192.168.1.0/24
                    0.0.0.0/0       192.168.1.1     40
```

14. Repeat these steps to configure intercluster networking in the other cluster.
15. Verify that the ports have access to the proper subnets, VLANs, and so on. Dedicating ports for replication in one cluster does not require dedicating ports in all clusters; one cluster might use dedicated ports, while the other cluster shares data ports for intercluster replication.

## Configuring intercluster LIFs to share data ports

Configuring intercluster LIFs to share data ports enables you to use existing data ports to create intercluster networks for cluster peer relationships. Sharing data ports reduces the number of ports you might need for intercluster networking.

### Before you begin

You should have reviewed the considerations for sharing data ports and determined that this is an appropriate intercluster networking configuration.

### About this task

Creating intercluster LIFs that share data ports means assigning LIFs to existing data ports and, possibly, creating an intercluster route. In this procedure, a two-node cluster exists in which each node has two data ports, e0c and e0d. These are the two data ports that are shared for intercluster replication. In your own environment, you replace the ports, networks, IP addresses, subnet masks, and subnets with those specific to your environment.

To learn more about LIFs and port types, see the *Clustered Data ONTAP Network Management Guide*

### Procedure

1. Check the role of the ports in the cluster by using the **`network port show`** command.

```
cluster01::> network port show
                                      Auto-Negot  Duplex     Speed(Mbps)
Node   Port   Role         Link MTU   Admin/Oper  Admin/Oper Admin/Oper
------ ------ ------------ ---- ----- ----------- ---------- ----------
cluster01-01
       e0a    cluster      up   1500  true/true   full/full  auto/1000
       e0b    cluster      up   1500  true/true   full/full  auto/1000
       e0c    data         up   1500  true/true   full/full  auto/1000
       e0d    data         up   1500  true/true   full/full  auto/1000
cluster01-02
       e0a    cluster      up   1500  true/true   full/full  auto/1000
       e0b    cluster      up   1500  true/true   full/full  auto/1000
       e0c    data         up   1500  true/true   full/full  auto/1000
       e0d    data         up   1500  true/true   full/full  auto/1000
```

2. Create a failover group on each node on both clusters for the data ports you want to share for intercluster communications by using the **network interface failover-groups create** command. The first of the following commands creates the failover group failover_cluster01-01_icl01 and assigns port e0c to the failover group. The second command adds port e0d to the failover group.

```
cluster01::> network interface failover-groups create -failover-group
failover_cluster01-01_icl01 -node cluster01-01 -port e0c

cluster01::> network interface failover-groups create -failover-group
failover_cluster01-01_icl01 -node cluster01-01 -port e0d
```

3. Create an intercluster LIF on each node in cluster01 by using the **network interface create** command. The following commands create an intercluster LIF on each of the two nodes in cluster01 and assign the intercluster LIF to the failover group you created that contains the data ports.

```
cluster01::> network interface create -vserver cluster01-01 -lif cluster01-01_icl01 -role
intercluster -home-node cluster01-01 -home-port e0c -address 192.168.1.201 -netmask
255.255.255.0 -failover-group failover_cluster01-01_icl01 -failover-policy nextavail
Info: Your interface was created successfully; the routing group i192.168.1.0/24 was created

cluster01::> network interface create -vserver cluster01-02 -lif cluster01-02_icl01 -role
intercluster -home-node cluster01-02 -home-port e0c -address 192.168.1.202 -netmask
255.255.255.0 -failover-group failover_cluster01-02_icl01 -failover-policy nextavail
Info: Your interface was created successfully; the routing group i192.168.1.0/24 was created
```

4. Verify that the intercluster LIFs were created properly by using the **network interface show** command with the `-role` **intercluster** parameter.

```
cluster01::> network interface show –role intercluster
            Logical    Status     Network            Current       Current Is
Vserver     Interface  Admin/Oper Address/Mask       Node          Port    Home
----------- ---------- ---------- ------------------ ------------- ------- ----
cluster01-01
            cluster01-01_icl01
                       up/up      192.168.1.201/24   cluster01-01  e0c     true
cluster01-02
            cluster01-02_icl01
                       up/up      192.168.1.202/24   cluster01-02  e0c     true
```

5. Verify that the intercluster LIFs are configured to be redundant by using the **network interface show** command with the `-role` **intercluster** and `-failover` parameters. The LIFs in this example are assigned the e0c port on each node. If the e0c port fails, the LIF can fail over to the e0d port.

```
cluster01::> network interface show -role intercluster –failover
         Logical         Home                  Failover        Failover
Vserver  Interface       Node:Port             Group Usage     Group
-------- --------------- --------------------- --------------- --------
cluster01-01
         cluster01-01_icl01 cluster01-01:e0c   nextavail       failover_cluster01-01_icl01
                             Failover Targets: cluster01-01:e0c,
                                               cluster01-01:e0d
cluster01-02
         cluster01-02_icl01 cluster01-02:e0c   nextavail       failover_cluster01-02_icl01
                             Failover Targets: cluster01-02:e0c,
                                               cluster01-02:e0d
```

6. Display routing groups by using the **network routing-group show** command with the `-role` **intercluster** parameter. An intercluster routing group is created automatically for the intercluster LIFs.

```
cluster01::> network routing-group show –role intercluster
          Routing
Vserver   Group     Subnet          Role         Metric
--------- --------- --------------- ------------ -------
cluster01-01
          i192.168.1.0/24
                    192.168.1.0/24  intercluster 40
cluster01-02
          i192.168.1.0/24
                    192.168.1.0/24  intercluster 40
```

7. Display the routes in the cluster by using the **network routing-group show** command to determine whether intercluster routes are available or you must

create them. Creating a route is required only if the intercluster addresses in both clusters are not on the same subnet and a specific route is needed for communication between the clusters. In this example, no intercluster routes are available.

```
cluster01::> network routing-group route show
          Routing
Vserver   Group     Destination     Gateway         Metric
--------- --------- --------------- --------------- ------
cluster01
          c192.168.0.0/24
                    0.0.0.0/0       192.168.0.1     20
cluster01-01
          n192.168.0.0/24
                    0.0.0.0/0       192.168.0.1     10
cluster01-02
          n192.168.0.0/24
                    0.0.0.0/0       192.168.0.1     10
```

8. If communication between intercluster LIFs in different clusters requires routing, create an intercluster route by using the **`network routing-groups route create`** command. The intercluster networks apply to each node; therefore, you must create an intercluster route on each node. In this example, 192.168.1.1 is the gateway address for the 192.168.1.0/24 network.

   **Note:** If the destination is specified as 0.0.0.0/0, then it becomes the default route for the intercluster network.

```
cluster01::> network routing-groups route create -server cluster01-01
-routing-group i192.168.1.0/24 -destination 0.0.0.0/0 -gateway 192.168.1.1 -metric 40

cluster01::> network routing-groups route create -server cluster01-02
-routing-group i192.168.1.0/24 -destination 0.0.0.0/0 -gateway 192.168.1.1 -metric 40
```

9. Display the newly created routes by using the **`network routing-groups route show`** command. Although the intercluster routes do not have an assigned role, they are assigned to the routing group i192.168.1.0/24, which is assigned the role of intercluster. These routes are only used for intercluster communication.

```
cluster01::> network routing-group route show
          Routing
Vserver   Group     Destination     Gateway         Metric
--------- --------- --------------- --------------- ------
cluster01
          c192.168.0.0/24
                    0.0.0.0/0       192.168.0.1     20
cluster01-01
          n192.168.0.0/24
                    0.0.0.0/0       192.168.0.1     10
          i192.168.1.0/24
                    0.0.0.0/0       192.168.1.1     40
cluster01-02
          n192.168.0.0/24
                    0.0.0.0/0       192.168.0.1     10
          i192.168.1.0/24
                    0.0.0.0/0       192.168.1.1     40
```

10. Repeat these steps on the cluster to which you want to connect.

## Creating the cluster peer relationship

You create the cluster peer relationship using a set of intercluster designated logical interfaces to make information about one cluster available to the other cluster for use in cluster peering applications.

### Before you begin

You should have the intercluster network configured.

## Procedure

1. Create the cluster peer relationship from the local cluster by using the **`cluster peer create`** command, and then notify the administrator of the remote cluster of your peer request. Unilaterally creating a cluster peer relationship requires the login credentials of the remote cluster administrator. Alternatively, you can create a cluster peer relationship without exchanging credentials by having both cluster administrators issue the **`cluster peer create`** command from their respective clusters.

   When the remote cluster administrator issues the reciprocal cluster peer request, Data ONTAP creates the peer relationship. In the following example, cluster01 is peered with a remote cluster named cluster02. Cluster02 is a two-node cluster that has one intercluster LIF per node. The IP addresses of the intercluster LIFs created in cluster02 are 192.168.2.203 and 192.168.2.204. These IP addresses are used to create the cluster peer relationship.

   ```
   cluster01::> cluster peer create -peer-addrs 192.168.2.203,192.168.2.204
   ```

   When issuing the reciprocal **`cluster peer create`** command, the administrator of cluster02 specifies the IP addresses of the intercluster LIFs in cluster01.

   If DNS is configured to resolve host names for the intercluster IP addresses, you can use host names in the `–peer-addrs` option. It is not likely that intercluster IP addresses frequently change; however, using host names allows intercluster IP addresses to change without having to modify the cluster peer relationship.

2. Display the cluster peer relationship by using the **`cluster peer show`** command with the `-instance` parameter.

   ```
   cluster01::> cluster peer show –instance
   Peer Cluster Name: cluster02
   Remote Intercluster Addresses: 192.168.2.203,192.168.2.204
   Availability: Available
   Remote Cluster Name: cluster02
   Active IP Addresses: 192.168.2.203,192.168.2.204
   Cluster Serial Number: 1-80-000013
   ```

3. Preview the health of the cluster peer relationship by using the **`cluster peer health show`** command.

   ```
   cluster01::> cluster peer health show
   Node       cluster-Name               Node-Name
                Ping-Status              RDB-Health Cluster-Health  Avail...
   ---------- --------------------------- ---------  --------------- --------
   cluster01-01
              cluster02                   cluster02-01
                Data: interface_reachable
                ICMP: interface_reachable true       true            true
                                          cluster02-02
                Data: interface_reachable
                ICMP: interface_reachable true       true            true
   cluster01-02
              cluster02                   cluster02-01
                Data: interface_reachable
                ICMP: interface_reachable true       true            true
                                          cluster02-02
                Data: interface_reachable
                ICMP: interface_reachable true       true            true
   ```

# Connecting Vservers in a peer relationship

Cluster administrators can create peer relationships between two Vservers either existing within a cluster or in peered clusters. Vserver peer relationships provide an infrastructure for applications and tasks that require communication between the two peer Vservers.

One Vserver can be peered with multiple Vservers either within a cluster or across clusters.

**Note:** Vserver names must be unique. When creating a Vserver, use the fully qualified domain name (FQDN) of the Vserver or another convention that ensures unique Vserver names.

For better clarity, the examples in this guide show simple Vserver names, vserverA and vserverB.

For more information about Vserver peer relationships, see the *Clustered Data ONTAP System Administration Guide for Cluster Administrators*.

## Creating a Vserver peer relationship

Cluster administrators can create an authorization infrastructure for running applications between Vservers by establishing a peer relationship between the Vservers.

### Before you begin

- If you want to create an intercluster Vserver peer relationship, both clusters must be peered with each other.
- The admin state of the Vservers to be peered must not be `initializing` or `deleting`.
- The names of Vservers in the peered clusters must be unique across the two clusters.

### About this task

When you create a Vserver peer relationship, you can specify the applications that will communicate over the peer relationship. In clustered Data ONTAP 8.2, only SnapMirror is supported as an application over the peer relationship. If you do not specify the application for the peer relationship as **snapmirror**, a Vserver administrator cannot set up SnapMirror relationships between the peered Vservers.

### Procedure

1. Use the **`vserver peer create`** command to create a Vserver peer relationship.

```
cluster01::> vserver peer create -vserver vserverA -peer-vserver
vserverB -applications snapmirror -peer-cluster cluster02

 Info: [Job 43] 'vserver peer create' job queued
```

At this point, the state of the intercluster Vserver peer relationship is `initiated`. A Vserver peer relationship is not established until the cluster administrator of the peered cluster accepts the Vserver peer request.

2. Use the **`vserver peer show-all`** command to view the status and other details of the Vserver peer relationship.

```
cluster01::> vserver peer show-all
                   Peer              Peer                        Peering
Vserver            Vserver           State       Peer Cluster    Applications
-----------        -----------       ---------- -------------- ---------------
vserverA           vserverB          initiated   cluster02         snapmirror
```

```
cluster02::> vserver peer show-all
                   Peer               Peer                       Peering
Vserver            Vserver            State   Peer Cluster   Applications
-----------       ---------------    --------- ------------- ---------------
vserverB          vserverA           pending   cluster01       snapmirror
vserverD          vserverC           peered    cluster02       snapmirror
```

For more information about these commands, see the man pages.

## What to do next

If you have initiated an intercluster Vserver peer relationship, you must inform the cluster administrator of the remote cluster about the Vserver peer request. After the cluster administrator of the remote cluster accepts the Vserver peer request, the Vserver peer relationship is established.

# Accepting a Vserver peer relationship

When a cluster administrator creates an intercluster Vserver peer relationship, the cluster administrator of the remote cluster can accept the Vserver peer request to establish the peer relationship.

## Procedure

1. Use the **`vserver peer show`** command to view the Vserver peer requests.

```
cluster02::> vserver peer show

                   Peer               Peer
Vserver            Vserver            State
-----------        -----------        ------------
vserverB           vserverA           pending
```

2. Use the **`vserver peer accept`** command to accept the Vserver peer request and establish the Vserver peer relationship.

```
cluster02::> vserver peer accept -vserver vserverB -peer-vserver vserverA

Info: [Job 46] 'vserver peer accept' job queued
```

The Vserver peer relationship is established and the state is `peered`.

3. Use the **`vserver peer show`** command on either of the peered clusters to view the state of the Vserver peer relationship.

```
cluster02::> vserver peer show
                 Peer               Peer
Vserver          Vserver            State
-----------     ---------------     ------------
vserverB        vserverA            peered
```

For more information about these commands, see the man pages.

# Where to find additional information

There are additional documents to help you learn more about cluster and Vserver peering and other related subjects.

All of the following documentation is available from the N series support website (accessed and navigated as described in Websites):

*Technical Report 4015: SnapMirror Configuration and Best Practices Guide for Clustered Data ONTAP*

Provides information and best practices related to configuring replication in clustered Data ONTAP.

**Note:** This technical report contains information about NetApp products that IBM licenses and in some cases customizes. Technical reports might contain information about models and features that are not supported by IBM.

*Clustered Data ONTAP Data Protection Guide*

Describes how to manage your backup and recover data on clustered systems.

*Clustered Data ONTAP Logical Storage Management Guide*

Describes how to efficiently manage your logical storage resources on systems running clustered Data ONTAP, using volumes, FlexClone volumes, files and LUNs, FlexCache volumes, deduplication, compression, qtrees, and quotas.

*Clustered Data ONTAP Network Management Guide*

Describes how to connect your cluster to your Ethernet networks and how to manage logical interfaces (LIFs).

*Clustered Data ONTAP System Administration Guide for Cluster Administrators*

Describes general system administration for IBM systems running clustered Data ONTAP.

**Related information**:

IBM N series support website: www.ibm.com/storage/support/nseries

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