ONTAP® 9

Cluster and SVM Peering Power Guide

June 2021 | 215-12601_2021-06_en-us
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Updated for ONTAP 9.9.1

NetApp®

Contents

Deciding whether to use the Cluster and SVM Peering Power Guide

This guide describes how to create peer relationships between source and destination clusters and between source and destination storage virtual machines (SVMs). You must create peer relationships between these entities before you can replicate Snapshot copies using SnapMirror.

ONTAP 9.3 offers enhancements that simplify the way you configure peer relationships between clusters and SVMs. This guide describes the cluster and SVMs peering procedure for all ONTAP 9 versions. You should use the appropriate procedure for your version of ONTAP.

You should use this guide under the following circumstance:

- You want to use the command-line interface (CLI), not ONTAP System Manager or an automated scripting tool.
  If you are creating peer relationships using System Manager, see the *Cluster and SVM Peering Express Guide.*
  Cluster and SVM peering express configuration

If you require additional configuration or conceptual information, you should choose among the following documentation:

- ONTAP conceptual background
  ONTAP concepts
- SnapMirror replication
  Data protection
- Command reference
  ONTAP 9 commands
- Automation of management tasks
  NetApp Documentation: OnCommand Workflow Automation (current releases)

Preparing for cluster and SVM peering

You must create *peer relationships* between source and destination clusters and between source and destination SVMs before you can replicate Snapshot copies using SnapMirror. A peer relationship defines network connections that enable clusters and SVMs to exchange data securely.

Peering basics

Clusters and SVMs in peer relationships communicate over the intercluster network using *intercluster logical interfaces (LIFs).* An intercluster LIF is a LIF that supports the "intercluster-core" network interface service and is typically created using the "default-intercluster" network interface service policy. You must create intercluster LIFs on every node in the clusters being peered.

Intercluster LIFs use routes that belong to the system SVM to which they are assigned. ONTAP automatically creates a system SVM for cluster-level communications within an IPspace.

Fan-out and cascade topologies are both supported. In a cascade topology, you need only create intercluster networks between the primary and secondary clusters and between the secondary and tertiary clusters. You need not create an intercluster network between the primary and the tertiary cluster.

Note: It is possible (but not advisable) for an administrator to remove the intercluster-core service from the default-intercluster service policy. If this occurs, LIFs created using "default-intercluster" will not actually be intercluster LIFs. To confirm that the default-intercluster service policy contains the intercluster-core service, use the following command:

```
network interface service-policy show -policy default-intercluster
```

Prerequisites for cluster peering

Before you set up cluster peering, you should confirm that the connectivity, port, IP address, subnet, firewall, and cluster-naming requirements are met.

Connectivity requirements

Every intercluster LIF on the local cluster must be able to communicate with every intercluster LIF on the remote cluster.

Although it is not required, it is typically simpler to configure the IP addresses used for intercluster LIFs in the same subnet. The IP addresses can reside in the same subnet as data LIFs, or in a different subnet. The subnet used in each cluster must meet the following requirements:

- The subnet must belong to the broadcast domain that contains the ports that are used for intercluster communication.
- The subnet must have enough IP addresses available to allocate to one intercluster LIF per node.

  For example, in a six-node cluster, the subnet used for intercluster communication must have six available IP addresses.

Each node must have an intercluster LIF with an IP address on the intercluster network.

Intercluster LIFs can have an IPv4 address or an IPv6 address.

Note: ONTAP 9 enables you to migrate your peering networks from IPv4 to IPv6 by optionally allowing both protocols to be present simultaneously on the intercluster LIFs. In earlier releases, all intercluster relationships for an entire cluster were either IPv4 or IPv6. This meant that changing protocols was a potentially disruptive event.

Port requirements

You can use dedicated ports for intercluster communication, or share ports used by the data network. Ports must meet the following requirements:

- All ports that are used to communicate with a given remote cluster must be in the same IPspace.
  You can use multiple IPspaces to peer with multiple clusters. Pair-wise full-mesh connectivity is required only within an IPspace.
- The broadcast domain that is used for intercluster communication must include at least two ports per node so that intercluster communication can fail over from one port to another port.
  Ports added to a broadcast domain can be physical network ports, VLANs, or interface groups (ifgrps).
- All ports must be cabled.
- All ports must be in a healthy state.
- The MTU settings of the ports must be consistent.

Firewall requirements

Firewalls and the intercluster firewall policy must allow the following protocols:

- ICMP service
- TCP to the IP addresses of all the intercluster LIFs over the ports 10000, 11104, and 11105
- Bidirectional HTTPS between the intercluster LIFs
  Although HTTPS is not required when you set up cluster peering using the CLI, HTTPS is required later if you use ONTAP System Manager to configure data protection.

The default **`intercluster`** firewall policy allows access through the HTTPS protocol and from all IP addresses (0.0.0.0/0). You can modify or replace the policy if necessary.

Cluster requirements

Clusters must meet the following requirements:

- A cluster cannot be in a peer relationship with more than 255 clusters.

Using shared or dedicated ports

You can use dedicated ports for intercluster communication, or share ports used by the data network. In deciding whether to share ports, you need to consider network bandwidth, the replication interval, and port availability.

Note: You can share ports on one peered cluster while using dedicated ports on the other.

Network 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.

Even then, you should compare your available WAN bandwidth to your LAN bandwidth. If the available WAN bandwidth is significantly less than 10 GbE, you might need to use dedicated ports.

Tip: The one exception to this rule might be when all or many nodes in the cluster replicate data, in which case bandwidth utilization is typically spread across nodes.

If you are not using dedicated ports, the maximum transmission unit (MTU) size of the replication network should typically be the same as the MTU size of the data network.

Replication interval

If replication takes place in off-peak hours, you should be able to use data ports for replication even without a 10-GbE LAN connection.

If replication takes place during normal business hours, you need to consider the amount of data that will be replicated and whether it requires so much bandwidth that it could cause contention with data protocols. If network utilization by data protocols (SMB, NFS, iSCSI) is above 50%, you should use dedicated ports for intercluster communication, to allow for non-degraded performance if node failover occurs.

Port availability

If you determine that replication traffic is interfering with data traffic, you can migrate intercluster LIFs to any other intercluster-capable shared port on the same node.

You can also dedicate VLAN ports for replication. The bandwidth of the port is shared between all VLANs and the base port.

Related tasks

Configuring intercluster LIFs on shared data ports on page 8
You can configure intercluster LIFs on ports shared with the data network. Doing so reduces the number of ports you need for intercluster networking.

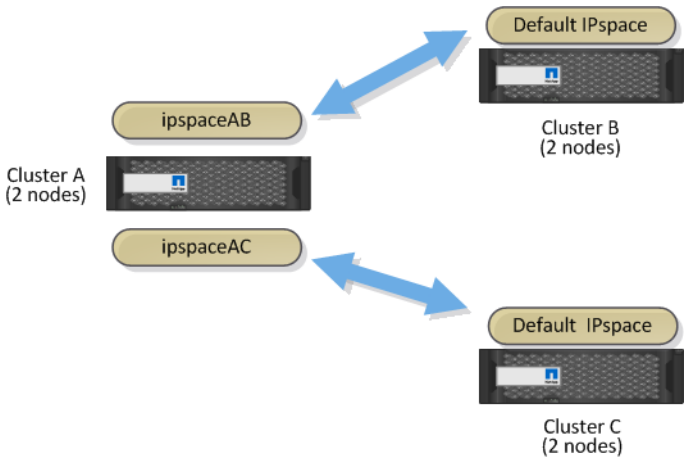
Configuring intercluster LIFs on dedicated ports on page 9
You can configure intercluster LIFs on dedicated ports. Doing so typically increases the available bandwidth for replication traffic.

Using custom IPspaces to isolate replication traffic

You can use custom IPspaces to separate the interactions that a cluster has with its peers. Called *designated intercluster connectivity*, this configuration allows service providers to isolate replication traffic in multitenant environments.

Suppose, for example, that you want replication traffic between Cluster A and Cluster B to be separated from replication traffic between Cluster A and Cluster C. To accomplish this, you can create two IPspaces on Cluster A.

One IPspace contains the intercluster LIFs that you use to communicate with Cluster B. The other contains the intercluster LIFs that you use to communicate with Cluster C, as shown in the following illustration.



For custom IPspace configuration, see the *Network Management Guide*.

Related tasks

Configuring intercluster LIFs in custom IPspaces on page 12
You can configure intercluster LIFs in custom IPspaces. Doing so allows you to isolate replication traffic in multitenant environments.

Configuring intercluster LIFs

You can use dedicated ports for intercluster communication, or share ports used by the data network. If you need to isolate replication traffic, you can configure intercluster LIFs in custom IPspaces.

Related tasks

Configuring intercluster LIFs on shared data ports on page 8
You can configure intercluster LIFs on ports shared with the data network. Doing so reduces the number of ports you need for intercluster networking.

Configuring intercluster LIFs on dedicated ports on page 9
You can configure intercluster LIFs on dedicated ports. Doing so typically increases the available bandwidth for replication traffic.

Configuring intercluster LIFs in custom IPspaces on page 12
You can configure intercluster LIFs in custom IPspaces. Doing so allows you to isolate replication traffic in multitenant environments.

Configuring intercluster LIFs on shared data ports

You can configure intercluster LIFs on ports shared with the data network. Doing so reduces the number of ports you need for intercluster networking.

Steps

1. List the ports in the cluster:

   `network port show`

   For complete command syntax, see the man page.

   The following example shows the network ports in **`cluster01`**:

```
cluster01::> network port show
                                                          Speed (Mbps)
Node   Port      IPspace      Broadcast Domain Link   MTU    Admin/Oper
------ --------- ------------ ---------------- ----- ------- ------------
cluster01-01
       e0a       Cluster      Cluster          up     1500   auto/1000
       e0b       Cluster      Cluster          up     1500   auto/1000
       e0c       Default      Default          up     1500   auto/1000
       e0d       Default      Default          up     1500   auto/1000
cluster01-02
       e0a       Cluster      Cluster          up     1500   auto/1000
       e0b       Cluster      Cluster          up     1500   auto/1000
       e0c       Default      Default          up     1500   auto/1000
       e0d       Default      Default          up     1500   auto/1000
```

2. Create intercluster LIFs on the system SVM:

Option	Description
In ONTAP 9.6 and later:	**`network interface create -vserver` *`system_SVM`* `-lif` *`LIF_name`* `-service-policy default-intercluster -home-node` *`node`* `-home-port` *`port`* `-address` *`port_IP`* `-netmask` *`netmask`***
In ONTAP 9.5 and earlier:	**`network interface create -vserver` *`system_SVM`* `-lif` *`LIF_name`* `-role intercluster -home-node` *`node`* `-home-port` *`port`* `-address` *`port_IP`* `-netmask` *`netmask`***

   For complete command syntax, see the man page.

   The following example creates intercluster LIFs **`cluster01_icl01`** and **`cluster01_icl02`**:

```
cluster01::> network interface create -vserver cluster01 -lif cluster01_icl01 -service-
```

```
policy default-intercluster -home-node cluster01-01 -home-port e0c -address 192.168.1.201
-netmask 255.255.255.0

cluster01::> network interface create -vserver cluster01 -lif cluster01_icl02 -service-
policy default-intercluster -home-node cluster01-02 -home-port e0c -address 192.168.1.202
-netmask 255.255.255.0
```

3. Verify that the intercluster LIFs were created:

Option	Description
In ONTAP 9.6 and later:	**`network interface show -service-policy default-intercluster`**
In ONTAP 9.5 and earlier:	**`network interface show -role intercluster`**

For complete command syntax, see the man page.

```
cluster01::> network interface show -service-policy default-intercluster
            Logical    Status     Network            Current       Current Is
Vserver     Interface  Admin/Oper Address/Mask       Node          Port    Home
----------- ---------- ---------- ------------------ ------------- ------- ----
cluster01
            cluster01_icl01
                       up/up      192.168.1.201/24   cluster01-01  e0c     true
            cluster01_icl02
                       up/up      192.168.1.202/24   cluster01-02  e0c     true
```

4. Verify that the intercluster LIFs are redundant:

Option	Description
In ONTAP 9.6 and later:	**`network interface show –service-policy default-intercluster -failover`**
In ONTAP 9.5 and earlier:	**`network interface show -role intercluster -failover`**

For complete command syntax, see the man page.

The following example shows that the intercluster LIFs **`cluster01_icl01`** and **`cluster01_icl02`** on the **`e0c`** port will fail over to the **`e0d`** port.

```
cluster01::> network interface show -service-policy default-intercluster –failover
         Logical         Home                  Failover        Failover
Vserver  Interface       Node:Port             Policy          Group
-------- --------------- --------------------- --------------- --------
cluster01
         cluster01_icl01 cluster01-01:e0c   local-only      192.168.1.201/24
                           Failover Targets: cluster01-01:e0c,
                                             cluster01-01:e0d
         cluster01_icl02 cluster01-02:e0c   local-only      192.168.1.201/24
                           Failover Targets: cluster01-02:e0c,
                                             cluster01-02:e0d
```

Related concepts

Using shared or dedicated ports on page 5

You can use dedicated ports for intercluster communication, or share ports used by the data network. In deciding whether to share ports, you need to consider network bandwidth, the replication interval, and port availability.

Configuring intercluster LIFs on dedicated ports

You can configure intercluster LIFs on dedicated ports. Doing so typically increases the available bandwidth for replication traffic.

Steps

1. List the ports in the cluster:

   `network port show`

For complete command syntax, see the man page.

The following example shows the network ports in **cluster01**:

```
cluster01::> network port show
                                                            Speed (Mbps)
Node   Port      IPspace      Broadcast Domain Link   MTU    Admin/Oper
------ --------- ------------ ---------------- ----- ------- ------------
cluster01-01
       e0a       Cluster      Cluster          up     1500   auto/1000
       e0b       Cluster      Cluster          up     1500   auto/1000
       e0c       Default      Default          up     1500   auto/1000
       e0d       Default      Default          up     1500   auto/1000
       e0e       Default      Default          up     1500   auto/1000
       e0f       Default      Default          up     1500   auto/1000
cluster01-02
       e0a       Cluster      Cluster          up     1500   auto/1000
       e0b       Cluster      Cluster          up     1500   auto/1000
       e0c       Default      Default          up     1500   auto/1000
       e0d       Default      Default          up     1500   auto/1000
       e0e       Default      Default          up     1500   auto/1000
       e0f       Default      Default          up     1500   auto/1000
```

2. Determine which ports are available to dedicate to intercluster communication:

   network interface show -fields home-port,curr-port

   For complete command syntax, see the man page.

   The following example shows that ports **e0e** and **e0f** have not been assigned LIFs:

```
cluster01::> network interface show -fields home-port,curr-port
vserver lif                  home-port curr-port
------- -------------------- --------- ---------
Cluster cluster01-01_clus1   e0a       e0a
Cluster cluster01-01_clus2   e0b       e0b
Cluster cluster01-02_clus1   e0a       e0a
Cluster cluster01-02_clus2   e0b       e0b
cluster01
        cluster_mgmt         e0c       e0c
cluster01
        cluster01-01_mgmt1   e0c       e0c
cluster01
        cluster01-02_mgmt1   e0c       e0c
```

3. Create a failover group for the dedicated ports:

   network interface failover-groups create -vserver *system_SVM* -failover-group *failover_group* -targets *physical_or_logical_ports*

   The following example assigns ports **e0e** and **e0f** to the failover group **intercluster01** on the system SVM **cluster01**:

```
cluster01::> network interface failover-groups create -vserver cluster01 -failover-group
intercluster01 -targets
cluster01-01:e0e,cluster01-01:e0f,cluster01-02:e0e,cluster01-02:e0f
```

4. Verify that the failover group was created:

   network interface failover-groups show

   For complete command syntax, see the man page.

```
cluster01::> network interface failover-groups show
                                  Failover
Vserver          Group            Targets
---------------- ---------------- --------------------------------------------
Cluster
                 Cluster
                                  cluster01-01:e0a, cluster01-01:e0b,
                                  cluster01-02:e0a, cluster01-02:e0b
cluster01
                 Default
                                  cluster01-01:e0c, cluster01-01:e0d,
                                  cluster01-02:e0c, cluster01-02:e0d,
                                  cluster01-01:e0e, cluster01-01:e0f
                                  cluster01-02:e0e, cluster01-02:e0f
                 intercluster01
                                  cluster01-01:e0e, cluster01-01:e0f
                                  cluster01-02:e0e, cluster01-02:e0f
```

5. Create intercluster LIFs on the system SVM and assign them to the failover group.

Option	Description
In ONTAP 9.6 and later:	**network interface create -vserver *system_SVM* -lif *LIF_name* -service-policy default-intercluster -home-node *node* -home-port *port* -address *port_IP* -netmask *netmask* -failover-group *failover_group***
In ONTAP 9.5 and earlier:	**network interface create -vserver *system_SVM* -lif *LIF_name* -role intercluster -home-node *node* -home-port *port* -address *port_IP* -netmask *netmask* -failover-group *failover_group***

For complete command syntax, see the man page.

The following example creates intercluster LIFs **cluster01_icl01** and **cluster01_icl02** in the failover group **intercluster01**:

```
cluster01::> network interface create -vserver cluster01 -lif cluster01_icl01 -service-
policy default-intercluster -home-node cluster01-01 -home-port e0e -address 192.168.1.201
-netmask 255.255.255.0 -failover-group intercluster01

cluster01::> network interface create -vserver cluster01 -lif cluster01_icl02 -service-
policy default-intercluster -home-node cluster01-02 -home-port e0e -address 192.168.1.202
-netmask 255.255.255.0 -failover-group intercluster01
```

6. Verify that the intercluster LIFs were created:

Option	Description
In ONTAP 9.6 and later:	**network interface show -service-policy default-intercluster**
In ONTAP 9.5 and earlier:	**network interface show -role intercluster**

For complete command syntax, see the man page.

```
cluster01::> network interface show -service-policy default-intercluster
            Logical    Status     Network            Current       Current Is
Vserver     Interface  Admin/Oper Address/Mask       Node          Port    Home
----------- ---------- ---------- ------------------ ------------- ------- ----
cluster01
            cluster01_icl01
                       up/up      192.168.1.201/24   cluster01-01  e0e     true
            cluster01_icl02
                       up/up      192.168.1.202/24   cluster01-02  e0f     true
```

7. Verify that the intercluster LIFs are redundant:

Option	Description
In ONTAP 9.6 and later:	**network interface show -service-policy default-intercluster -failover**
In ONTAP 9.5 and earlier:	**network interface show -role intercluster -failover**

For complete command syntax, see the man page.

The following example shows that the intercluster LIFs **cluster01_icl01** and **cluster01_icl02** on the SVM **e0e** port will fail over to the **e0f** port.

```
cluster01::> network interface show -service-policy default-intercluster –failover
         Logical         Home                  Failover        Failover
Vserver  Interface       Node:Port             Policy          Group
-------- --------------- --------------------- --------------- --------
cluster01
         cluster01_icl01 cluster01-01:e0e   local-only      intercluster01
                            Failover Targets:  cluster01-01:e0e,
                                               cluster01-01:e0f
         cluster01_icl02 cluster01-02:e0e   local-only      intercluster01
                            Failover Targets:  cluster01-02:e0e,
                                               cluster01-02:e0f
```

Related concepts

Using shared or dedicated ports on page 5

You can use dedicated ports for intercluster communication, or share ports used by the data network. In deciding whether to share ports, you need to consider network bandwidth, the replication interval, and port availability.

Configuring intercluster LIFs in custom IPspaces

You can configure intercluster LIFs in custom IPspaces. Doing so allows you to isolate replication traffic in multitenant environments.

About this task

Note: When you create a custom IPspace, the system creates a system storage virtual machine (SVM) to serve as a container for the system objects in that IPspace. You can use the new SVM as the container for any intercluster LIFs in the new IPspace. The new SVM has the same name as the custom IPspace.

Steps

1. List the ports in the cluster:

   `network port show`

   For complete command syntax, see the man page.

   The following example shows the network ports in **`cluster01`**:

```
cluster01::> network port show
                                                          Speed (Mbps)
Node   Port      IPspace      Broadcast Domain Link   MTU    Admin/Oper
------ --------- ------------ ---------------- ----- ------- ------------
cluster01-01
       e0a       Cluster      Cluster          up     1500   auto/1000
       e0b       Cluster      Cluster          up     1500   auto/1000
       e0c       Default      Default          up     1500   auto/1000
       e0d       Default      Default          up     1500   auto/1000
       e0e       Default      Default          up     1500   auto/1000
       e0f       Default      Default          up     1500   auto/1000
cluster01-02
       e0a       Cluster      Cluster          up     1500   auto/1000
       e0b       Cluster      Cluster          up     1500   auto/1000
       e0c       Default      Default          up     1500   auto/1000
       e0d       Default      Default          up     1500   auto/1000
       e0e       Default      Default          up     1500   auto/1000
       e0f       Default      Default          up     1500   auto/1000
```

2. Create custom IPspaces on the cluster:

   `network ipspace create -ipspace *ipspace*`

   The following example creates the custom IPspace **`ipspace-IC1`**:

```
cluster01::> network ipspace create -ipspace ipspace-IC1
```

3. Determine which ports are available to dedicate to intercluster communication:

   `network interface show -fields home-port,curr-port`

   For complete command syntax, see the man page.

   The following example shows that ports **`e0e`** and **`e0f`** have not been assigned LIFs:

```
cluster01::> network interface show -fields home-port,curr-port
vserver lif                  home-port curr-port
------- -------------------- --------- ---------
Cluster cluster01_clus1   e0a       e0a
Cluster cluster01_clus2   e0b       e0b
Cluster cluster02_clus1   e0a       e0a
Cluster cluster02_clus2   e0b       e0b
cluster01
        cluster_mgmt         e0c       e0c
cluster01
        cluster01-01_mgmt1   e0c       e0c
```

```
cluster01
        cluster01-02_mgmt1   e0c       e0c
```

4. Remove the available ports from the default broadcast domain:

   network port broadcast-domain remove-ports -broadcast-domain Default -ports *ports*

   A port cannot be in more than one broadcast domain at a time. For complete command syntax, see the man page.

   The following example removes ports **e0e** and **e0f** from the default broadcast domain:

```
cluster01::> network port broadcast-domain remove-ports -broadcast-domain Default -ports
cluster01-01:e0e,cluster01-01:e0f,cluster01-02:e0e,cluster01-02:e0f
```

5. Verify that the ports have been removed from the default broadcast domain:

   network port show

   For complete command syntax, see the man page.

   The following example shows that ports **e0e** and **e0f** have been removed from the default broadcast domain:

```
cluster01::> network port show
                                                          Speed (Mbps)
Node   Port    IPspace   Broadcast Domain Link   MTU    Admin/Oper
------ ------- --------- --------------- ----- ------- ------------
cluster01-01
       e0a     Cluster    Cluster          up    9000  auto/1000
       e0b     Cluster    Cluster          up    9000  auto/1000
       e0c     Default    Default          up    1500  auto/1000
       e0d     Default    Default          up    1500  auto/1000
       e0e     Default    -                up    1500  auto/1000
       e0f     Default    -                up    1500  auto/1000
       e0g     Default    Default          up    1500  auto/1000
cluster01-02
       e0a     Cluster    Cluster          up    9000  auto/1000
       e0b     Cluster    Cluster          up    9000  auto/1000
       e0c     Default    Default          up    1500  auto/1000
       e0d     Default    Default          up    1500  auto/1000
       e0e     Default    -                up    1500  auto/1000
       e0f     Default    -                up    1500  auto/1000
       e0g     Default    Default          up    1500  auto/1000
```

6. Create a broadcast domain in the custom IPspace:

   network port broadcast-domain create -ipspace *ipspace* -broadcast-domain *broadcast_domain* -mtu *MTU* -ports *ports*

   The following example creates the broadcast domain **ipspace-IC1-bd** in the IPspace **ipspace-IC1**:

```
cluster01::> network port broadcast-domain create -ipspace ipspace-IC1 -broadcast-domain
ipspace-IC1-bd -mtu 1500 -ports cluster01-01:e0e,cluster01-01:e0f,
cluster01-02:e0e,cluster01-02:e0f
```

7. Verify that the broadcast domain was created:

   network port broadcast-domain show

   For complete command syntax, see the man page.

```
cluster01::> network port broadcast-domain show
IPspace Broadcast                                       Update
Name    Domain Name    MTU  Port List                   Status Details
------- ----------- ------  --------------------------- --------------
Cluster Cluster       9000
                            cluster01-01:e0a            complete
                            cluster01-01:e0b            complete
                            cluster01-02:e0a            complete
                            cluster01-02:e0b            complete
Default Default       1500
                            cluster01-01:e0c            complete
                            cluster01-01:e0d            complete
                            cluster01-01:e0f            complete
                            cluster01-01:e0g            complete
                            cluster01-02:e0c            complete
                            cluster01-02:e0d            complete
                            cluster01-02:e0f            complete
                            cluster01-02:e0g            complete
ipspace-IC1
       ipspace-IC1-bd
                      1500
```

```
                            cluster01-01:e0e             complete
                            cluster01-01:e0f             complete
                            cluster01-02:e0e             complete
                            cluster01-02:e0f             complete
```

8. Create intercluster LIFs on the system SVM and assign them to the broadcast domain:

Option	Description
In ONTAP 9.6 and later:	**network interface create -vserver *system_SVM* -lif *LIF_name* -service-policy default-intercluster -home-node *node* -home-port *port* -address *port_IP* -netmask *netmask***
In ONTAP 9.5 and earlier:	**network interface create -vserver *system_SVM* -lif *LIF_name* -role intercluster -home-node *node* -home-port *port* -address *port_IP* -netmask *netmask***

The LIF is created in the broadcast domain that the home port is assigned to. The broadcast domain has a default failover group with the same name as the broadcast domain. For complete command syntax, see the man page.

The following example creates intercluster LIFs **cluster01_icl01** and **cluster01_icl02** in the broadcast domain **ipspace-IC1-bd**:

```
cluster01::> network interface create -vserver ipspace-IC1 -lif cluster01_icl01 -service-
policy default-intercluster -home-node cluster01-01 -home-port e0e -address 192.168.1.201
-netmask 255.255.255.0

cluster01::> network interface create -vserver ipspace-IC1 -lif cluster01_icl02 -service-
policy default-intercluster -home-node cluster01-02 -home-port e0e -address 192.168.1.202
-netmask 255.255.255.0
```

9. Verify that the intercluster LIFs were created:

Option	Description
In ONTAP 9.6 and later:	**network interface show -service-policy default-intercluster**
In ONTAP 9.5 and earlier:	**network interface show -role intercluster**

For complete command syntax, see the man page.

```
cluster01::> network interface show -service-policy default-intercluster
            Logical    Status     Network            Current       Current Is
Vserver     Interface  Admin/Oper Address/Mask       Node          Port    Home
----------- ---------- ---------- ------------------ ------------- ------- ----
ipspace-IC1
            cluster01_icl01
                       up/up      192.168.1.201/24   cluster01-01  e0e     true
            cluster01_icl02
                       up/up      192.168.1.202/24   cluster01-02  e0f     true
```

10. Verify that the intercluster LIFs are redundant:

Option	Description
In ONTAP 9.6 and later:	**network interface show -service-policy default-intercluster -failover**
In ONTAP 9.5 and earlier:	**network interface show -role intercluster -failover**

For complete command syntax, see the man page.

The following example shows that the intercluster LIFs **cluster01_icl01** and **cluster01_icl02** on the SVM **e0e** port fail over to the **e0f** port:

```
cluster01::> network interface show -service-policy default-intercluster –failover
         Logical         Home                  Failover        Failover
Vserver  Interface       Node:Port             Policy          Group
```

```
-------- --------------- --------------------- --------------- --------
ipspace-IC1
         cluster01_icl01 cluster01-01:e0e   local-only      intercluster01
                           Failover Targets:  cluster01-01:e0e,
                                              cluster01-01:e0f
         cluster01_icl02 cluster01-02:e0e   local-only      intercluster01
                           Failover Targets:  cluster01-02:e0e,
                                              cluster01-02:e0f
```

Related concepts

Using custom IPspaces to isolate replication traffic on page 6

You can use custom IPspaces to separate the interactions that a cluster has with its peers. Called *designated intercluster connectivity*, this configuration allows service providers to isolate replication traffic in multitenant environments.

Configuring peer relationships (starting with ONTAP 9.3)

A peer relationship defines the network connections that enable clusters and SVMs to exchange data securely. ONTAP 9.3 simplifies the way that you configure peer relationships between clusters and between SVMs.

Creating a cluster peer relationship (ONTAP 9.3 and later)

You can use the `cluster peer create` command to create a peer relationship between a local and remote cluster. After the peer relationship has been created, you can run `cluster peer create` on the remote cluster to authenticate it to the local cluster.

Before you begin

- You must have created intercluster LIFs on every node in the clusters that are being peered.
- The clusters must be running ONTAP 9.3.

Steps

1. On the destination cluster, create a peer relationship with the source cluster:

   `cluster peer create -generate-passphrase -offer-expiration` *`MM/DD/YYYY HH:MM:SS`*`|1...7days|1...168hours -peer-addrs` *`peer_LIF_IPs`* `-initial-allowed-vserver-peers` *`svm_name`*`,..|* -ipspace` *`ipspace`*

   If you specify both `-generate-passphrase` and `-peer-addrs`, only the cluster whose intercluster LIFs are specified in `-peer-addrs` can use the generated password.

   You can ignore the `-ipspace` option if you are not using a custom IPspace. For complete command syntax, see the man page.

   If you are creating the peering relationship in ONTAP 9.6 or later and you do not want cross-cluster peering communications to be encrypted, you must use the `-encryption-protocol-proposed none` option to disable encryption.

   The following example creates a cluster peer relationship with an unspecified remote cluster, and pre-authorizes peer relationships with SVMs **`vs1`** and **`vs2`** on the local cluster:

   ```
   cluster02::> cluster peer create -generate-passphrase -offer-expiration 2days -initial-
   allowed-vserver-peers vs1,vs2

                        Passphrase: UCa+6lRVICXeL/gq1WrK7ShR
                  Expiration Time: 6/7/2017 08:16:10 EST
     Initial Allowed Vserver Peers: vs1,vs2
               Intercluster LIF IP: 192.140.112.101
                 Peer Cluster Name: Clus_7ShR (temporary generated)

   Warning: make a note of the passphrase - it cannot be displayed again.
   ```

   The following example creates a cluster peer relationship with the remote cluster at intercluster LIF IP addresses 192.140.112.103 and 192.140.112.104, and pre-authorizes a peer relationship with any SVM on the local cluster:

   ```
   cluster02::> cluster peer create -generate-passphrase -peer-addrs
   192.140.112.103,192.140.112.104 -offer-expiration 2days -initial-allowed-vserver-peers
   *

                        Passphrase: UCa+6lRVICXeL/gq1WrK7ShR
                  Expiration Time: 6/7/2017 08:16:10 EST
   ```

```
  Initial Allowed Vserver Peers: vs1,vs2
            Intercluster LIF IP: 192.140.112.101,192.140.112.102
              Peer Cluster Name: Clus_7ShR (temporary generated)

Warning: make a note of the passphrase - it cannot be displayed again.
```

The following example creates a cluster peer relationship with an unspecified remote cluster, and pre-authorizes peer relationships with SVMs **vs1** and **vs2** on the local cluster:

```
cluster02::> cluster peer create -generate-passphrase -offer-expiration 2days -initial-
allowed-vserver-peers vs1,vs2

                    Passphrase: UCa+6lRVICXeL/gq1WrK7ShR
              Expiration Time: 6/7/2017 08:16:10 EST
  Initial Allowed Vserver Peers: vs1,vs2
            Intercluster LIF IP: 192.140.112.101
              Peer Cluster Name: Clus_7ShR (temporary generated)

Warning: make a note of the passphrase - it cannot be displayed again.
```

2. On source cluster, authenticate the source cluster to the destination cluster:

   cluster peer create -peer-addrs *peer_LIF_IPs* -ipspace *ipspace*

   For complete command syntax, see the man page.

   The following example authenticates the local cluster to the remote cluster at intercluster LIF IP addresses 192.140.112.101 and 192.140.112.102:

```
cluster01::> cluster peer create -peer-addrs 192.140.112.101,192.140.112.102

Notice: Use a generated passphrase or choose a passphrase of 8 or more characters.
        To ensure the authenticity of the peering relationship, use a phrase or
sequence of characters that would be hard to guess.

Enter the passphrase:
Confirm the passphrase:

Clusters cluster02 and cluster01 are peered.
```

   Enter the passphrase for the peer relationship when prompted.

3. Verify that the cluster peer relationship was created:

   cluster peer show -instance

```
cluster01::> cluster peer show -instance

                                Peer Cluster Name: cluster02
                    Remote Intercluster Addresses: 192.140.112.101, 192.140.112.102
              Availability of the Remote Cluster: Available
                               Remote Cluster Name: cluster2
                               Active IP Addresses: 192.140.112.101, 192.140.112.102
                             Cluster Serial Number: 1-80-123456
                    Address Family of Relationship: ipv4
            Authentication Status Administrative: no-authentication
               Authentication Status Operational: absent
                                 Last Update Time: 02/05 21:05:41
                     IPspace for the Relationship: Default
```

4. Check the connectivity and status of the nodes in the peer relationship:

cluster peer health show

```
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
```

Related tasks

Enabling cluster peering encryption on an existing peer relationship on page 24

Beginning with ONTAP 9.6, cluster peering encryption is enabled by default on all newly created cluster peering relationships. Cluster peering encryption uses a pre-shared key (PSK) and the Transport Security Layer (TLS) to secure cross-cluster peering communications. This adds an additional layer of security between the peered clusters.

Creating an intercluster SVM peer relationship (ONTAP 9.3 and later)

You can use the `vserver peer create` command to create a peer relationship between SVMs on local and remote clusters.

Before you begin

- The source and destination clusters must be peered.
- The clusters must be running ONTAP 9.3.
- You must have "pre-authorized" peer relationships for the SVMs on the remote cluster.
  For more information, see *Creating a cluster peer relationship (ONTAP 9.3 and later)* on page 16.

About this task

Previous releases of ONTAP let you authorize a peer relationship for only one SVM at a time. You needed to run the `vserver peer accept` command each time you authorized a pending SVM peer relationship.

Starting in ONTAP 9.3, you can "pre-authorize" peer relationships for multiple SVMs by listing the SVMs in the `-initial-allowed-vserver` option when you create a cluster peer relationship. For more information, see *Creating a cluster peer relationship (ONTAP 9.3 and later)* on page 16.

Steps

1. On the data protection destination cluster, display the SVMs that are pre-authorized for peering:

   vserver peer permission show

```
cluster02::> vserver peer permission show
Peer Cluster         Vserver              Applications
```

```
------------------  --------------------  --------------------
cluster02           vs1,vs2               snapmirror
```

2. On the data protection source cluster, create a peer relationship to a pre-authorized SVM on the data protection destination cluster:

   vserver peer create -vserver *local_SVM* -peer-vserver *remote_SVM*

   For complete command syntax, see the man page.

   The following example creates a peer relationship between the local SVM **pvs1** and the pre-authorized remote SVM **vs1**:

```
cluster01::> vserver peer create -vserver pvs1 -peer-vserver vs1
```

3. Verify the SVM peer relationship:

   vserver peer show

```
cluster01::> vserver peer show
            Peer        Peer                           Peering        Remote
Vserver     Vserver     State        Peer Cluster      Applications   Vserver
----------- ----------- ------------ ----------------- -------------- ---------
pvs1        vs1         peered       cluster02         snapmirror     vs1
```

Adding an intercluster SVM peer relationship (ONTAP 9.3 and later)

If you create an SVM after configuring a cluster peer relationship, you will need to add a peer relationship for the SVM manually. You can use the `vserver peer create` command to create a peer relationship between SVMs. After the peer relationship has been created, you can run `vserver peer accept` on the remote cluster to authorize the peer relationship.

Before you begin

The source and destination clusters must be peered.

About this task

You can create a peer relationships between SVMs in the same cluster for local data backup. For more information, see the `vserver peer create` man page.

Administrators occasionally use the `vserver peer reject` command to reject a proposed SVM peer relationship. If the relationship between SVMs is in the `rejected` state, you must delete the relationship before you can create a new one. For more information, see the `vserver peer delete` man page.

Steps

1. On the data protection source cluster, create a peer relationship with an SVM on the data protection destination cluster:

   vserver peer create -vserver *local_SVM* -peer-vserver *remote_SVM* -applications snapmirror|file-copy|lun-copy -peer-cluster *remote_cluster*
   The following example creates a peer relationship between the local SVM **pvs1** and the remote SVM **vs1**

```
cluster01::> vserver peer create -vserver pvs1 -peer-vserver vs1 -applications snapmirror -peer-
cluster cluster02
```

   If the local and remote SVMs have the same names, you must use a *local name* to create the SVM peer relationship:

```
cluster01::> vserver peer create -vserver vs1 -peer-vserver
vs1 -applications snapmirror -peer-cluster cluster01
-local-name cluster1vs1LocallyUniqueName
```

2. On the data protection source cluster, verify that the peer relationship has been initiated:

`vserver peer show-all`

For complete command syntax, see the man page.

The following example shows that the peer relationship between SVM **`pvs1`** and SVM **`vs1`** has been initiated:

```
cluster01::> vserver peer show-all
                    Peer              Peer                           Peering
Vserver             Vserver           State       Peer Cluster       Applications
-----------         -----------       ----------  --------------     ------------
pvs1                vs1               initiated   Cluster02          snapmirror
```

3. On the data protection destination cluster, display the pending SVM peer relationship:

   `vserver peer show`

   For complete command syntax, see the man page.

   The following example lists the pending peer relationships for **`cluster02`**:

```
cluster02::> vserver peer show

                    Peer              Peer
Vserver             Vserver           State
-----------         -----------       ------------
vs1                 pvs1              pending
```

4. On the data protection destination cluster, authorize the pending peer relationship:

   `vserver peer accept -vserver` ***`local_SVM`*** **`-peer-vserver`** ***`remote_SVM`***

   For complete command syntax, see the man page.

   The following example authorizes the peer relationship between the local SVM **`vs1`** and the remote SVM **`pvs1`**:

```
cluster02::> vserver peer accept -vserver vs1 -peer-vserver pvs1
```

5. Verify the SVM peer relationship:

   `vserver peer show`

```
cluster01::> vserver peer show
            Peer        Peer                           Peering        Remote
Vserver     Vserver     State        Peer Cluster      Applications   Vserver
----------- ----------- ------------ ----------------- -------------- ---------
pvs1        vs1         peered       cluster02         snapmirror     vs1
```

Configuring peer relationships (ONTAP 9.2 and earlier)

A peer relationship defines network connections that enable clusters and SVMs to exchange data securely. You must create a cluster peer relationship before you can create an SVM peer relationship.

Creating a cluster peer relationship (ONTAP 9.2 and earlier)

You can use the `cluster peer create` command to initiate a request for a peering relationship between a local and remote cluster. After the peer relationship has been requested by the local cluster, you can run `cluster peer create` on the remote cluster to accept the relationship.

Before you begin

- You must have created intercluster LIFs on every node in the clusters being peered.
- The cluster administrators must have agreed on the passphrase each cluster will use to authenticate itself to the other.

Steps

1. On the data protection destination cluster, create a peer relationship with the data protection source cluster:

   `cluster peer create -peer-addrs` *`peer_LIF_IPs`* `-ipspace` *`ipspace`*

   You can ignore the `-ipspace` option if you are not using a custom IPspace. For complete command syntax, see the man page.

   The following example creates a cluster peer relationship with the remote cluster at intercluster LIF IP addresses 192.168.2.201 and 192.168.2.202:

   ```
   cluster02::> cluster peer create -peer-addrs 192.168.2.201,192.168.2.202
   Enter the passphrase:
   Please enter the passphrase again:
   ```

   Enter the passphrase for the peer relationship when prompted.

2. On the data protection source cluster, authenticate the source cluster to the destination cluster:

   `cluster peer create -peer-addrs` *`peer_LIF_IPs`* `-ipspace` *`ipspace`*

   For complete command syntax, see the man page.

   The following example authenticates the local cluster to the remote cluster at intercluster LIF IP addresses 192.140.112.203 and 192.140.112.204:

   ```
   cluster01::> cluster peer create -peer-addrs 192.168.2.203,192.168.2.204
   Please confirm the passphrase:
   Please confirm the passphrase again:
   ```

   Enter the passphrase for the peer relationship when prompted.

3. Verify that the cluster peer relationship was created:

   `cluster peer show –instance`

   For complete command syntax, see the man page.

   ```
   cluster01::> cluster peer show –instance
   Peer Cluster Name: cluster01
   Remote Intercluster Addresses: 192.168.2.201,192.168.2.202
   Availability: Available
   Remote Cluster Name: cluster02
   Active IP Addresses: 192.168.2.201,192.168.2.202
   Cluster Serial Number: 1-80-000013
   ```

4. Check the connectivity and status of the nodes in the peer relationship:

   `cluster peer health show`

   For complete command syntax, see the man page.

```
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
```

Creating an intercluster SVM peer relationship (ONTAP 9.2 and earlier)

You can use the `vserver peer create` command to create a peer relationship between SVMs on local and remote clusters. After the peer relationship has been created, you can run `vserver peer accept` on the remote cluster to authorize the peer relationship.

Before you begin

The source and destination clusters must be peered.

About this task

You can create a peer relationships between SVMs in the same cluster for local data backup. For more information, see the `vserver peer create` man page.

Administrators occasionally use the `vserver peer reject` command to reject a proposed SVM peer relationship. If the relationship between SVMs is in the `rejected` state, you must delete the relationship before you can create a new one. For more information, see the `vserver peer delete` man page.

Steps

1. On the data protection source cluster, create a peer relationship with an SVM on the data protection destination cluster:

   vserver peer create -vserver *local_SVM* -peer-vserver *remote_SVM* -applications snapmirror|file-copy|lun-copy -peer-cluster *remote_cluster*
   The following example creates a peer relationship between the local SVM **pvs1** and the remote SVM **vs1**

   ```
   cluster01::> vserver peer create -vserver pvs1 -peer-vserver vs1 -applications snapmirror -peer-
   cluster cluster02
   ```

   If the local and remote SVMs have the same names, you must use a *local name* to create the SVM peer relationship:

   ```
   cluster01::> vserver peer create -vserver vs1 -peer-vserver
   vs1 -applications snapmirror -peer-cluster cluster01
   -local-name cluster1vs1LocallyUniqueName
   ```

2. On the data protection source cluster, verify that the peer relationship has been initiated:

   vserver peer show-all

   For complete command syntax, see the man page.

   The following example shows that the peer relationship between SVM **pvs1** and SVM **vs1** has been initiated:

   ```
   cluster01::> vserver peer show-all
                    Peer              Peer                           Peering
   Vserver          Vserver           State       Peer Cluster       Applications
   ```

```
-----------        -----------       ----------  --------------  ------------
pvs1               vs1               initiated   Cluster02       snapmirror
```

3. On the data protection destination cluster, display the pending SVM peer relationship:

   vserver peer show

   For complete command syntax, see the man page.

   The following example lists the pending peer relationships for **cluster02**:

```
cluster02::> vserver peer show

                    Peer               Peer
Vserver             Vserver            State
-----------         -----------        ------------
vs1                 pvs1               pending
```

4. On the data protection destination cluster, authorize the pending peer relationship:

   vserver peer accept -vserver *local_SVM* -peer-vserver *remote_SVM*

   For complete command syntax, see the man page.

   The following example authorizes the peer relationship between the local SVM **vs1** and the remote SVM **pvs1**:

```
cluster02::> vserver peer accept -vserver vs1 -peer-vserver pvs1
```

5. Verify the SVM peer relationship:

   vserver peer show

```
cluster01::> vserver peer show
            Peer        Peer                           Peering        Remote
Vserver     Vserver     State        Peer Cluster      Applications   Vserver
----------- ----------- ------------ ----------------- -------------- ---------
pvs1        vs1         peered       cluster02         snapmirror     vs1
```

Enabling cluster peering encryption on an existing peer relationship

Beginning with ONTAP 9.6, cluster peering encryption is enabled by default on all newly created cluster peering relationships. Cluster peering encryption uses a pre-shared key (PSK) and the Transport Security Layer (TLS) to secure cross-cluster peering communications. This adds an additional layer of security between the peered clusters.

About this task

Cluster peering encryption must be enabled manually for peering relationship created prior to upgrading to ONTAP 9.6. Cluster peering encryption is not available for clusters running ONTAP 9.5 or earlier. Therefore, both clusters in the peering relationship must be running ONTAP 9.6 in order to enable cluster peering encryption.

Steps

1. On the destination cluster, enable encryption for communications with the source cluster:

   `cluster peer modify source_cluster -auth-status-admin use-authentication -encryption tls-psk`

2. When prompted enter a passphrase.
3. On the data protection source cluster, enable encryption for communication with the data protection destination cluster:

   `cluster peer modify data_protection_destination_cluster -auth-status-admin use-authentication -encryption tls-psk`

4. When prompted, enter the same passphrase entered on the destination cluster.

Removing cluster peering encryption from an existing peer relationship

By default, cluster peering encryption is enabled on all peer relationships created in ONTAP 9.6 or later. If you do not want to use encryption for cross-cluster peering communications, you can disable it.

Steps

1. On the destination cluster, modify communications with the source cluster to discontinue use of cluster peering encryption :
   - To remove encryption, but maintain authentication enter:

     cluster peer modify *source_cluster* -auth-status-admin use-authentication -encryption none
   - To remove encryption and authentication, enter:

     cluster peer modify *source_cluster* -auth-status no-authentication
2. When prompted enter a passphrase.
3. On the source cluster, disable encryption for communication with the destination cluster:
   - To remove encryption, but maintain authentication enter:

     cluster peer modify *destination_cluster* -auth-status-admin use-authentication -encrypt none
   - To remove encryption and authentication, enter:

     cluster peer modify *destination_cluster* -auth-status no-authentication
4. When prompted, enter the same passphrase entered on the destination cluster.

Where to find additional information

You can learn more about tasks related to cluster and SVM peering in NetApp's extensive documentation library.

- *ONTAP concepts*
  Describes the concepts that inform ONTAP data management software, including data protection and transfer.
- *Data protection*
  Describes how to use the ONTAP CLI to perform SnapMirror replication.
- *Cluster management using System Manager*
  Describes how to use ONTAP System Managerto perform SnapMirror replication.
- *Volume disaster recovery express preparation*
  Describes how to use ONTAP System Managerto quickly configure a destination volume for disaster recovery.
- *Volume disaster recovery express preparation*
  Describes how to use ONTAP System Managerto quickly recover a destination volume after a disaster.
- *Volume express backup using SnapVault*
  Describes how to use ONTAP System Managerto quickly configure a SnapVault relationship between volumes.
- *Volume restore express management using SnapVault*
  Describes how to use ONTAP System Managerto quickly restore files from a destination volume in a SnapVault relationship.
- *Archive and compliance using SnapLock technology*
  Describes how to replicate WORM files in a SnapLock volume.

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