CHAPTER 4

Configuring IOA Using the CLI

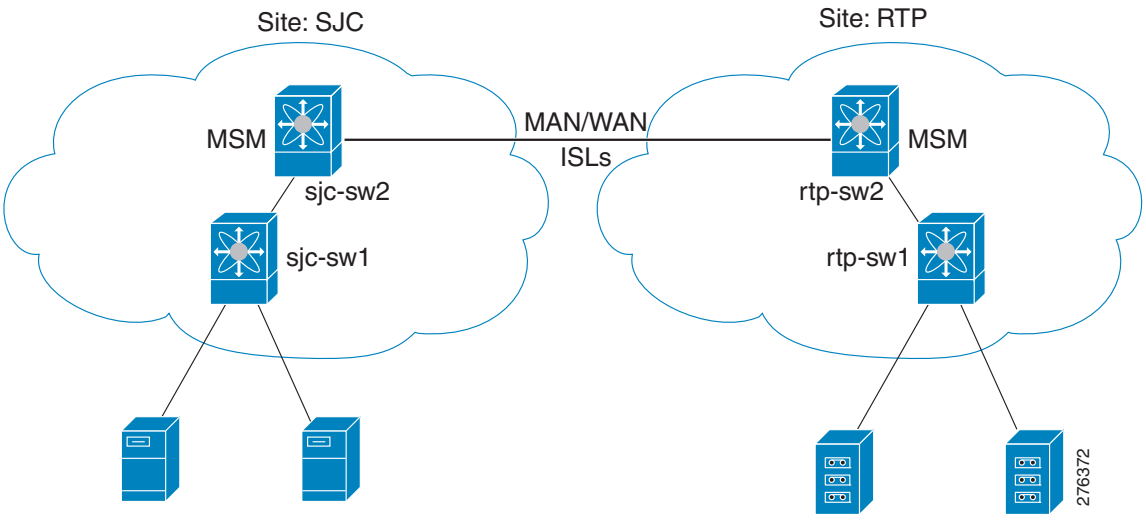
This chapter describes how to configure IOA using the command line interface (CLI).

This chapter describes these sections:

Configuring IOA

In this chapter, all configuration steps relate to a reference topology shown in Figure 4-1 where SJC and RTP represent two sites connected through the WAN or MAN ISLs. In this example, sjc-sw2 and rtp-sw2 represent the core switches where IOA is deployed. sjc-sw1 and rtp-sw1 are edge switches that has the hosts or targets connected to them.

Figure 4-1 IOA CLI Reference Topology



The process of configuring IOA involves a number of configuration tasks that should be completed in order:

On each IOA switch, complete the following configurations:

- Enabling Clustering, page 4-3
- Enabling the IOA Service, page 4-3
- Classifying the Switches to IOA Sites, page 4-3
- Configuring IOA Interfaces, page 4-4

On the master IOA switch, complete the following configurations:

- Configuring an IOA Cluster, page 4-5
- Adding Nodes to an IOA Cluster, page 4-6
- Adding Interfaces to an IOA Cluster, page 4-8
- Adding N Ports to an IOA Cluster, page 4-9
- Configuring the IOA Flows, page 4-10

Enabling Clustering

The first step in the process of configuring IOA is to enable clustering in all of the IOA switches.

To enable or disable the IOA cluster on sjc-sw2, perform this task:

	Command	Purpose
Step 1	`sjc-sw2# conf t` `sjc-sw2(config)#`	Enters configuration mode.
Step 2	`sjc-sw2(config)# feature cluster`	Enables clustering.
	`sjc-sw2(config)# no feature cluster`	Disables clustering.

To complete the configuration for the reference topology, enable clustering in rtp-sw2.

Enabling the IOA Service

After enabling the IOA cluster, the second step in the process of configuring IOA is to enable the IOA service on each of the IOA switches.

To enable the IOA service on sjc-sw2, perform this task:

	Command	Purpose
Step 1	`sjc-sw2# config t`	Enters configuration mode.
Step 2	`sjc-sw2(config)# feature ioa`	Enables IOA feature.
	`sjc-sw2(config)# no feature ioa`	Disables IOA feature.

To complete the configuration for the reference topology, enable the IOA service in rtp-sw2.

Classifying the Switches to IOA Sites

Each of the IOA switches need to be classified into a site. Make sure that you classify only the IOA switches within the physical site into an IOA site.

To classify an IOA switch into the SJC site, perform this task:

	Command	Purpose
Step 1	`sjc-sw2# config t` `sjc-sw2(config)#`	Enters configuration mode.
Step 2	`sjc-sw2(config)# ioa site-local SJC`	Configures the site to which the switch belongs to. The maximum name length is restricted to 31 alphabetical characters. **Note** This command configures the site to which the switch belongs to across all the IOA clusters that the switch participates in.

To complete the configuration for the reference topology, classify rtp-sw2 into RTP site.

Configuring IOA Interfaces

After enabling the cluster and enabling IOA, configure the IOA interfaces on the switch.

To provision an IOA interface, perform this task:

	Command	Purpose
Step 1	`sjc-sw2# config t` `sjc-sw2(config)#`	Enters configuration mode.
Step 2	`sjc-sw2(config)# interface ioa 2/1`	Configures IOA on service engine 1 in slot 2.
	`sjc-sw2(config)# interface ioa 2/2`	Configures IOA on service engine 2 in slot 2. **Note** Service engines 2, 3, and 4 are available only on the SSN-16 module. The appropriate IOA license is checked out as a part of the creation of the interface. A standard MDS notation is used to denote the IOA interfaces: ioa *slot*/*service engine*. For example, ioa2/1 refers to Slot 1, Service Engine 1. In the case of the MSM-18/4 Module and 9222i Switch, only one service engine exists and so only ioa2/1 is valid. In the case of the SSN-16 Module, four service engines exist and so ioa2/1, ioa2/2, ioa2/3, and ioa2/4 are valid interfaces.
	`sjc-sw2(config)# no interface ioa 2/2`	Deletes the IOA interface. **Note** Before deleting an IOA interface, you must remove the IOA interface from the cluster.
Step 3	`sjc-sw2(config-if)# no shutdown`	Enables the IOA interface.
	`sjc-sw2(config-if)# shutdown`	Disables the IOA interface.

Note FCIP and IOA are not supported on the same engine.

To complete the configuration for the reference topology, configure the interfaces in rtp-sw2.

Displaying IOA Interface Status

After configuring the IOA interface, use the **show int** command to show whether the IOA interface is down. The interface is down until the interface is added to a cluster:

```
sjc-sw2# show interface ioa 2/1
ioa2/1 is down (Not in any Cluster)
    0 device packets in, 0 device packets out
    0 device bytes in, 0 device bytes out
    0 peer packets in, 0 peer packets out
    0 peer bytes in, 0 peer bytes out

    0 i-t create request, 0 i-t create destroy
```

```
0 i-t activate request, 0 i-t deactivate request
```

Possible reasons for the interface being down are as follows:

- Administratively down—The interface is shut down.
- Not in any cluster—The interface is not part of any IOA cluster.
- Port software failure—A software failure has occured causing a reset of the IOA service engine.
- No license—The interface does not have a valid IOA license. The license is either not installed or all the available licenses are in use.

Configuring an IOA Cluster

To configure a cluster, start with a switch and create a cluster and add the remaining IOA switches into the cluster. From this point on, all cluster parameters can be configured from this switch.

To create an IOA cluster, perform this task:

	Command	Purpose
Step 1	`sjc-sw2# config t` `sjc-sw2(config)#`	Enters configuration mode.
Step 2	`sjc-sw2(config)# ioa cluster tape_vault` `sjc-sw2(config-ioa-cl)#`	Assigns a user-specified name (tape_vault) to the IOA cluster. The maximum length of the name is 31 alphabetical characters. Enters the cluster configuration submode. The local switch is implicitly added to the cluster as part of this command.
	`sjc-sw2(config)# no ioa cluster tape_vault`	Deletes the specified IOA cluster.

Note You need to select a switch that you want to be the master switch as the seed switch when you create the IOA cluster. If you have multiple switches in a site, you may add all the switches in a site that you want to manage from to the cluster before adding the switches from the remote site.

This section inlcudes the following topics:

Displaying IOA Cluster Status

The following examples display the cluster information:

Note You must configure at least one IOA interface on each site for the cluster to be online.

```
sjc-sw2# show ioa cluster
```

```
IOA Cluster is tape_vault
  Cluster ID is 0x213a000dec3ee782
  Cluster status is online
  Is between sites SJC and RTP
  Total Nodes are 2
  Cluster Infra Status : Operational
  Cluster is Administratively Up
  Cluster Config Version : 26
  SSL for ICN : Not Configured

sjc-sw2# show ioa cluster tape_vault
IOA Cluster is tape_vault
  Cluster ID is 0x213a000dec3ee782
  Cluster status is online
  Is between sites SJC and RTP
  Total Nodes are 2
  Cluster Infra Status : Operational
  Cluster is Administratively Up
  Cluster Config Version : 26
  SSL for ICN : Not Configured
```

A cluster can have the following statuses:

- Pending—An IOA interface needs to be added to the cluster.
- Online—The cluster is online. IOA services can be run on the cluster.
- Offline—The cluster is offline. Check the infrastructure status for more information.

The infrastructure status has following values:

- Operational—The cluster infrastructure is operational on this switch. The IOA service will be able to use the cluster on this switch.
- Not Operational—The cluster infrastructure is not operational on this node. The IOA service will not run on this cluster on this switch.

The administrative status has following values:

- Administratively Up—If the cluster is not online, check this status to make sure that administratively the cluster is up.
- Administratively Shutdown—The cluster was shut down.

Adding Nodes to an IOA Cluster

To add nodes to an IOA cluster, perform this task:

	Command	Purpose
Step 1	`sjc-sw2# config t` `switch(config)#`	Enters configuration mode.
Step 2	`sjc-sw2(config)# ioa cluster tape_vault` `sjc-sw2(config-ioa-cl)#`	Enters the cluster configuration submode and adds the local switch where this command is executed into the IOA cluster.

Command	Purpose
Step 3 `sjc-sw2(config-ioa-cl)# node local`	Enters the node configuration submode for the local switch. The **local** keyword denotes the switch where the CLI command is executed. **Note** You may also specify the node name of the local switch to enter sub mode. The node name could be either the IP Address or the DNS name of the local switch.
`sjc-sw2(config-ioa-cl)# node sjc-sw2` `sjc-sw2(config-ioa-cl-node)# end`	Includes the switch as part of the cluster. Enters the node configuration submode.
`sjc-sw2(config-ioa-cl)# node rtp-sw2` `sjc-sw2(config-ioa-cl-node)# end`	Includes the remote switch as part of the cluster. Alternatively, use an IPv4 or IPv6 address. Enters the node configuration submode.
`sjc-sw2(config-ioa-cl)# no node rtp-sw2`	Removes the local or the remote node from the cluster.

The following examples display the nodes information:

```
sjc-sw2# show ioa cluster summary
--------------------------------------------------------------------------------
Cluster          Sites              Status    Master Switch
--------------------------------------------------------------------------------
tape_vault       SJC,               online    172.23.144.97
                 RTP

sjc-sw2# show ioa cluster tape_vault node summary
--------------------------------------------------------------------------------
Switch             Site            Status          Master
--------------------------------------------------------------------------------
172.23.144.97(L)   SJC             online          yes
172.23.144.98      RTP             online          no

sjc-sw2# show ioa cluster tape_vault node
Node 172.23.144.97 is local switch
  Node ID is 1
  Status is online
  Belongs to Site SJC
  Node is the master switch
Node 172.23.144.98 is remote switch
  Node ID is 2
  Status is online
  Belongs to Site RTP
  Node is not master switch
```

Adding Interfaces to an IOA Cluster

To add IOA interfaces to an IOA cluster, perform this task:

	Command	Purpose
Step 1	`sjc-sw2# config t` `switch(config)#`	Enters configuration mode.
Step 2	`sjc-sw2(config)# ioa cluster tape_vault` `sjc-sw2(config-ioa-cl)#`	Enters the cluster configuration submode.
Step 3	`sjc-sw2(config-ioa-cl)# node local`	Includes the local switch as part of the cluster. Enters the node configuration submode for the local switch. The **local** keyword denotes the switch where the CLI command is executed. **Note** You may also specify the node name of the local switch to enter sub mode. The node name could be either the IP address or the DNS name of the local switch.
	`sjc-sw2(config-ioa-cl-node)# interface ioa 2/1` `sjc-sw2(config-ioa-cl-node)# interface ioa 2/2`	Adds the interfaces to the IOA cluster.
	`sjc-sw2(config-ioa-cl-node)# no interface ioa 2/2`	Removes the interface from the IOA cluster.
Step 4	`sjc-sw2(config-ioa-cl)# node rtp-sw2`	Includes the remote switch as part of the cluster. Alternatively, use a IPv4 or IPv6 address. Enters the node configuration submode.
	`sjc-sw2(config-ioa-cl-node)# interface ioa 2/1` `sjc-sw2(config-ioa-cl-node)# interface ioa 2/2`	Adds the interfaces to the IOA cluster.
	`sjc-sw2(config-ioa-cl-node)# no interface ioa 2/2`	Removes the interface from the IOA cluster.

The following examples display IOA interfaces information:

```
sjc-sw2# show interface ioa2/1
ioa2/1 is up
    Member of cluster tape_vault
    0 device packets in, 0 device packets out
    0 device bytes in, 0 device bytes out
    0 peer packets in, 0 peer packets out
    0 peer bytes in, 0 peer bytes out

    303 i-t create request, 300 i-t create destroy
    300 i-t activate request, 0 i-t deactivate request
```

```
sjc-sw2# show ioa cluster tape_vault interface summary
--------------------------------------------------------------------------------
Switch             Interface         Status       Flows
--------------------------------------------------------------------------------
```

```
172.23.144.97(L)   ioa2/1            up           --
172.23.144.97(L)   ioa2/2            up           --
172.23.144.98      ioa2/1            up           --
172.23.144.98      ioa2/2            up           --

sjc-sw2# show ioa cluster tape_vault interface
Interface ioa2/1 belongs to 172.23.144.97(L)(M)
  Status is up
Interface ioa2/2 belongs to 172.23.144.97(L)(M)
  Status is up
Interface ioa2/1 belongs to 172.23.144.98
  Status is up
Interface ioa2/2 belongs to 172.23.144.98
  Status is up
```

Note (L) indicates the Local switch.
(M) indicates the Master switch.

Adding N Ports to an IOA Cluster

To add N ports to the IOA cluster, perform this task:

	Command	Purpose
Step 1	`sjc-sw2# config t` `sjc-sw2(config)#`	Enters configuration mode.
Step 2	`sjc-sw2(config)# ioa cluster tape_vault`	Enters the cluster configuration submode.

Step 3	`sjc-sw2(config-ioa-cl)# nport pwwn 10:0:0:0:0:0:0:1 site SJC vsan 100`
	`sjc-sw2(config-ioa-cl)# nport pwwn 11:0:0:0:0:0:0:1 site RTP vsan 100`
	`sjc-sw2(config-ioa-cl)# nport pwwn 10:0:0:0:0:0:0:2 site SJC vsan 100`
	`sjc-sw2(config-ioa-cl)# nport pwwn 11:0:0:0:0:0:0:2 site RTP vsan 100`
	`sjc-sw2(config-ioa-cl)# end`
		Configures the site and VSAN ID of the N ports that will be a part of accelerated flows.

	`sjc-sw2(config-ioa-cl)# no nport pwwn 10:0:0:0:0:0:0:1`	Removes the N port from the IOA cluster.

This example shows how to display N ports configuration:

```
sjc-sw2# show ioa cluster tape_vault nports
--------------------------------------------------------------------------------
P-WWN                          Site                           Vsan
--------------------------------------------------------------------------------
10:00:00:00:00:00:00:01        SJC                            100
11:00:00:00:00:00:00:01        RTP                            100
10:00:00:00:00:00:00:02        SJC                            100
11:00:00:00:00:00:00:02        RTP                            100
```

Configuring the IOA Flows

Before configuring the IOA flows, flow groups must be created.

To create a new IOA flow group and add flows, perform this task:

	Command	Purpose
Step 1	`switch# config t` `switch(config)#`	Enters configuration mode.
Step 2	`switch(config)# ioa cluster tape_vault`	Enters the cluster configuration submode.
Step 3	`switch(config-ioa-cl)# flowgroup tsm`	Creates an IOA flow group.
	`switch(config-ioa-cl)# no flowgroup tsm`	Deletes an IOA flow group.
Step 4	`sjc-sw2(config-ioa-cl-flgrp)# host 10:0:0:0:0:0:0:1 target 11:0:0:0:0:0:0:1`	Creates a flow with write acceleration.
	`sjc-sw2(config-ioa-cl-flgrp)# host 10:0:0:0:0:0:0:2 target 11:0:0:0:0:0:0:2 tape`	Creates a flow with tape acceleration.
	`sjc-sw2(config-ioa-cl-flgrp)# host 10:0:0:0:0:0:0:3 target 11:0:0:0:0:0:0:3 compression`	Creates a flow with write acceleration and compression.
	`sjc-sw2(config-ioa-cl-flgrp)# host 10:0:0:0:0:0:0:4 target 11:0:0:0:0:0:0:4 tape compression`	Creates a flow with tape acceleration, and compression.
	`sjc-sw2(config-ioa-cl-flgrp)# no host 10:0:0:0:0:0:0:1 target 11:0:0:0:0:0:0:1`	Removes the configured flow.

Note We recommend that you suspend the traffic while enabling IOA for a given flow.

The following examples display the configured flow information:

```
sjc-sw2# show ioa cluster tape_vault flows
--------------------------------------------------------------------------------
Host WWN,                 VSAN     WA  TA  Comp  Status    Switch,Interface
Target WWN                                                 Pair
--------------------------------------------------------------------------------

10:00:00:00:00:00:00:01, 100      Y    Y    N   online    172.23.144.97, ioa2/1
11:00:00:00:00:00:00:01                                    172.23.144.98, ioa2/1
10:00:00:00:00:00:00:02, 100      Y    Y    Y   online    172.23.144.97, ioa2/2
11:00:00:00:00:00:00:02                                    172.23.144.98, ioa2/2


sjc-sw2# show ioa cluster tape_vault flows detail
Host 10:00:00:00:00:00:00:01, Target 11:00:00:00:00:00:00:01, VSAN 100
  Is online
  Belongs to flowgroup tsm
```

```
  Is enabled for WA, TA
  Is assigned to
    Switch 172.23.144.97    Interface ioa2/1 (Host Site)
    Switch 172.23.144.98    Interface ioa2/1 (Target Site)
Host 10:00:00:00:00:00:00:02, Target 11:00:00:00:00:00:00:02, VSAN 100
  Is online
  Belongs to flowgroup tsm
  Is enabled for WA, TA, Compression
  Is assigned to
    Switch 172.23.144.97    Interface ioa2/2 (Host Site)
    Switch 172.23.144.98    Interface ioa2/2 (Target Site)
```

IOA Flow Setup Wizard

You can use the IOA Flow Setup Wizard to simplify the provisioning of flows especially when there are many flows to provision, and when you add, remove, or replace host HBAs, tape drives or storage controllers.

This section includes the following topics:

Prerequisites for IOA Flow Setup Wizard

The following prerequisites must be met before you can invoke the IOA Flow Setup Wizard:

- All of the N ports of both initiators and targets that need to be accelerated must be online.
- The zoning configuration must already be in place to permit the flows that need to communicate with each other. If you are replacing a host HBA, you must update the zoning configuration to remove the faulty HBA and to add the new HBA before you invoke the IOA Flow Setup Wizard.

Using the IOA Flow Setup Wizard

To configure flows using the Flow Setup Wizard, follow these steps:

Step 1 Invoke the Flow Setup Wizard on a specific VSAN.

```
sjc-sw1# ioa flow-setup cluster tape_vault flowgroup repln-fg vsan 100
```

In the case of an IVR deployment, you can enter the following CLI command on an IVR border switch where IOA is deployed:

```
sjc-sw1# ioa ivr flow-setup cluster tape_vault flowgroup repln-fg
```

The wizard processes the active zone set for the VSAN and creates a set of candidate flows. When you use the **ivr flow-setup** command, the active IVR zone set is considered. The zone set may have local flows as well as flows that traverse across sites. The IOA Flow Setup Wizard runs through a series of steps as listed in this procedure to prune the list to capture only the flows that traverse across the sites that need to be accelerated.

Step 2 Classify the switches in the candidate switch list into appropriate sites.

This step is only for those switches where none of the hosts or targets have been configured yet for acceleration. From the flows in the active zone set, a candidate switch list is prepared based on where the hosts and targets are logged into.

```
The following switches need to be classified into appropriate sites
--------------------------------------------------------------------------------
Do you want to classify sjc-sw1 into site sjc or rtp [sjc]
Do you want to classify 172.23.144.96 into site sjc or rtp [sjc] rtp
```

The candidate flow list is now pruned to contain only the inter-site flows that need to be accelerated.

Step 3 The wizard displays all of the N ports that need to be classified into sites. Enter **yes** to classify the N ports into sites.

```
The following nport to site mapping needs to be configured
--------------------------------------------------------------------------------
N-Port PWWN: 10:00:00:00:00:00:00:00 Site: sjc
N-Port PWWN: 10:00:00:00:00:00:01:00 Site: sjc
N-Port PWWN: 10:00:00:00:00:00:02:00 Site: sjc
N-Port PWWN: 10:00:00:00:00:00:03:00 Site: sjc
N-Port PWWN: 10:00:00:00:00:00:04:00 Site: sjc
N-Port PWWN: 11:00:00:00:00:00:00:00 Site: rtp
N-Port PWWN: 11:00:00:00:00:00:01:00 Site: rtp
N-Port PWWN: 11:00:00:00:00:00:02:00 Site: rtp
N-Port PWWN: 11:00:00:00:00:00:03:00 Site: rtp
N-Port PWWN: 11:00:00:00:00:00:04:00 Site: rtp
Do you want to configure the n-port to site mappings? (yes/no) [yes] yes
```

Step 4 (Optional) Use this step only when some of the N ports such as those used in remote replication are represented as **scsi-fcp(both)** in the FCNS database. Enter the primary direction of the traffic that will be used by IOA to decide on what should be configured as host and target in IOA.

Replication traffic can flow in either direction.

```
Certain N-ports in this VSAN can act as both initiator and targets
Is the traffic flow primarily from sjc to rtp? (yes/no) [yes] yes
```

Step 5 The wizard configures the list of flows that are not already configured in IOA and attempts to delete the IOA flows that are not part of the zone set. This operation specifically handles removing HBAs or storage controllers. Enter **yes** to accept the flows that need to be accelerated. New flows that need to be accelerated are displayed.

```
The following flows will be configured
--------------------------------------------------------------------------------
Host: 10:00:00:00:00:00:00:00 VSAN: 100 Target: 11:00:00:00:00:00:00:00 VSAN:100
Host: 10:00:00:00:00:00:00:00 VSAN: 100 Target: 11:00:00:00:00:00:01:00 VSAN:100
Host: 10:00:00:00:00:00:00:00 VSAN: 100 Target: 11:00:00:00:00:00:02:00 VSAN:100
Host: 10:00:00:00:00:00:00:00 VSAN: 100 Target: 11:00:00:00:00:00:03:00 VSAN:100
Host: 10:00:00:00:00:00:01:00 VSAN: 100 Target: 11:00:00:00:00:00:00:00 VSAN:100
Host: 10:00:00:00:00:00:01:00 VSAN: 100 Target: 11:00:00:00:00:00:01:00 VSAN:100
Host: 10:00:00:00:00:00:01:00 VSAN: 100 Target: 11:00:00:00:00:00:02:00 VSAN:100
Host: 10:00:00:00:00:00:01:00 VSAN: 100 Target: 11:00:00:00:00:00:03:00 VSAN:100
Host: 10:00:00:00:00:00:02:00 VSAN: 100 Target: 11:00:00:00:00:00:00:00 VSAN:100
Host: 10:00:00:00:00:00:02:00 VSAN: 100 Target: 11:00:00:00:00:00:01:00 VSAN:100
Host: 10:00:00:00:00:00:02:00 VSAN: 100 Target: 11:00:00:00:00:00:02:00 VSAN:100
Host: 10:00:00:00:00:00:02:00 VSAN: 100 Target: 11:00:00:00:00:00:03:00 VSAN:100
Host: 10:00:00:00:00:00:03:00 VSAN: 100 Target: 11:00:00:00:00:00:00:00 VSAN:100
Host: 10:00:00:00:00:00:03:00 VSAN: 100 Target: 11:00:00:00:00:00:01:00 VSAN:100
Host: 10:00:00:00:00:00:03:00 VSAN: 100 Target: 11:00:00:00:00:00:02:00 VSAN:100
Host: 10:00:00:00:00:00:03:00 VSAN: 100 Target: 11:00:00:00:00:00:03:00 VSAN:100
Host: 10:00:00:00:00:00:04:00 VSAN: 100 Target: 11:00:00:00:00:00:04:00 VSAN:100
Do you want to configure these flows? (yes/no) [yes] yes
```

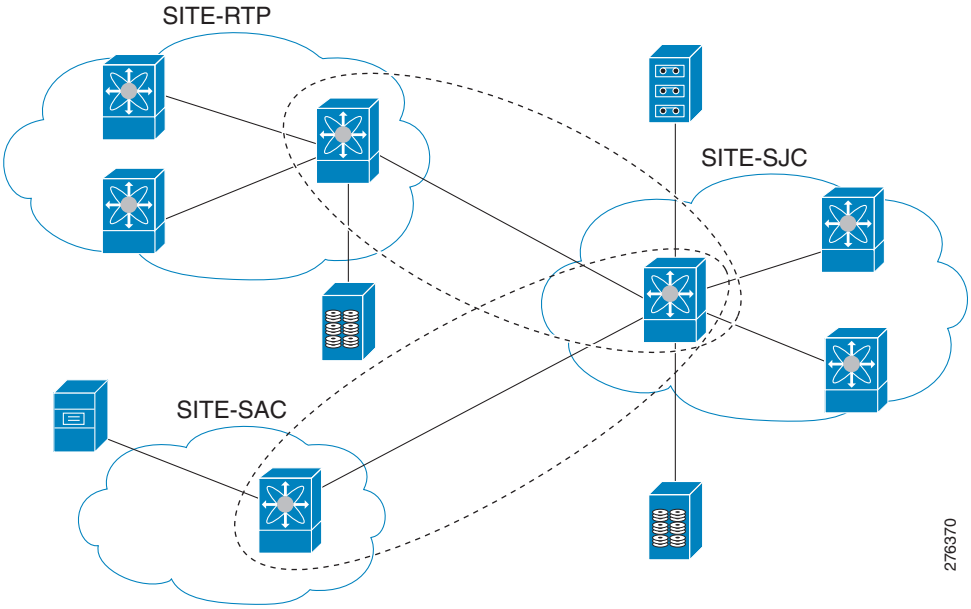
You can display the configured flow information by using the following commands:

```
sjc-sw1# show ioa cluster tape_vault nports
--------------------------------------------------------------------------------
P-WWN                          Site                           Vsan
--------------------------------------------------------------------------------
10:00:00:00:00:00:00:00        sjc                            100
10:00:00:00:00:00:01:00        sjc                            100
10:00:00:00:00:00:02:00        sjc                            100
10:00:00:00:00:00:03:00        sjc                            100
10:00:00:00:00:00:04:00        sjc                            100
11:00:00:00:00:00:00:00        rtp                            100
11:00:00:00:00:00:01:00        rtp                            100
11:00:00:00:00:00:02:00        rtp                            100
11:00:00:00:00:00:03:00        rtp                            100
11:00:00:00:00:00:04:00        rtp                            100

sjc-sw1# show ioa cluster tape_vault flows
--------------------------------------------------------------------------------
Host WWN,                VSAN     WA  TA  Comp  Status    Switch,Interface
Target WWN                                                 Pair
--------------------------------------------------------------------------------

10:00:00:00:00:00:00:00, 100      Y    N    N   offline   --, --
11:00:00:00:00:00:00:00                                    --, --
10:00:00:00:00:00:01:00, 100      Y    N    N   offline   --, --
11:00:00:00:00:00:00:00                                    --, --
10:00:00:00:00:00:02:00, 100      Y    N    N   offline   --, --
11:00:00:00:00:00:00:00                                    --, --
10:00:00:00:00:00:03:00, 100      Y    N    N   offline   --, --
11:00:00:00:00:00:00:00                                    --, --
10:00:00:00:00:00:00:00, 100      Y    N    N   offline   --, --
11:00:00:00:00:00:01:00                                    --, --
10:00:00:00:00:00:01:00, 100      Y    N    N   offline   --, --
11:00:00:00:00:00:01:00                                    --, --
10:00:00:00:00:00:02:00, 100      Y    N    N   offline   --, --
11:00:00:00:00:00:01:00                                    --, --
10:00:00:00:00:00:03:00, 100      Y    N    N   offline   --, --
11:00:00:00:00:00:01:00                                    --, --
10:00:00:00:00:00:00:00, 100      Y    N    N   offline   --, --
11:00:00:00:00:00:02:00                                    --, --
10:00:00:00:00:00:01:00, 100      Y    N    N   offline   --, --
11:00:00:00:00:00:02:00                                    --, --
10:00:00:00:00:00:02:00, 100      Y    N    N   offline   --, --
11:00:00:00:00:00:02:00                                    --, --
10:00:00:00:00:00:03:00, 100      Y    N    N   offline   --, --
11:00:00:00:00:00:02:00                                    --, --
10:00:00:00:00:00:00:00, 100      Y    N    N   offline   --, --
11:00:00:00:00:00:03:00                                    --, --
10:00:00:00:00:00:01:00, 100      Y    N    N   offline   --, --
11:00:00:00:00:00:03:00                                    --, --
10:00:00:00:00:00:02:00, 100      Y    N    N   offline   --, --
11:00:00:00:00:00:03:00                                    --, --
10:00:00:00:00:00:03:00, 100      Y    N    N   offline   --, --
11:00:00:00:00:00:03:00                                    --, --
10:00:00:00:00:00:04:00, 100      Y    N    N   offline   --, --
11:00:00:00:00:00:04:00                                    --, --
```

Creating Multiple IOA Clusters on a Single Switch

Figure 4-2 illustrates the IOA implementation where the IOA service is extended across multiple sites. In the illustration, Site-SJC consolidates the tape backup from Site-RTP and Site-SAC. Each IOA cluster represents a site pair, which means there are two unique clusters. This topology provides segregation and scalability of the IOA service across multiple sites. In the Site-SJC, a single switch can participate in multiple IOA clusters.

Figure 4-2 Extended Across Multiple Sites



Note Before creating another cluster on sjc-sw2, create a third site SAC with the sac-sw2 switch. Clustering and IOA service must be enabled, and IOA interfaces must have been provisioned on the sac-sw2 switch.

To create another IOA cluster on sjc-sw2 with SAC, follow these steps:

	Command	Purpose
Step 1	`sjc-sw2# config t`	Enters configuration mode.
Step 2	`sjc-sw2(config)# ioa cluster tape_vault_site2`	Specifies the cluster name and enters IOA cluster configuration submode. A cluster name can include a maximum of 31 alphabetical characters.
Step 3	`sjc-sw2(config-ioa-cl)# node local`	Adds the local switch to the cluster. Enters the node configuration mode.
	`sjc-sw2(config-ioa-cl-node)# interface ioa2/3`	Adds the IOA interface to the cluster.
Step 4	`sjc-sw2(config-ioa-cl)# node sac-sw2`	Adds the remote node to the cluster and enters the node configuration mode.
	`sjc-sw2(config-ioa-cl-node)# interface ioa2/3`	Adds the IOA interface to the cluster.

The following example displays the multiple clusters created using the SJC site:

```
sjc-sw2# show ioa cluster summary
--------------------------------------------------------------------------------
Cluster          Sites              Status    Master Switch
--------------------------------------------------------------------------------
tape_vault       SJC,               online    172.23.144.97
                 RTP
tape_vault_site2 SAC,               online    172.23.144.97
                 SJC
```

Note You need to select a switch that you want to be the master switch as the seed switch when you create the IOA cluster. If you have multiple switches in a site, you may add all the switches in a site that you want to manage from to the cluster before adding the switches from the remote site.

Note In this example, the SJC site may be a natural consolidation point for management, and you may choose a switch from this site as the preferred master switch.

Additional Configurations

This section inlcudes the following topics:

Shutting Down a Cluster

To shut down a cluster, perform this task:

	Command	Purpose
Step 1	`sjc-sw2# config t`	Enters configuration mode.
Step 2	`sjc-sw2(config)# ioa cluster tape_vault`	Specifies the cluster name and enters IOA cluster configuration submode. A cluster name can include a maximum of 31 alphabetical characters.
Step 3	`sjc-sw2(config-ioa-cl)# shut`	Shuts down the cluster. This command must be used to recover a cluster when it is partitioned. The change can be disruptive. For more information, see "Cluster Recovery Scenarios, page B-5.

Load Balancing the Flows

To load balance the flows, perform this task:

	Command	Purpose
Step 1	`sjc-sw2# config t`	Enters configuration mode.
Step 2	`sjc-sw2(config)# ioa cluster tape_vault`	Enters the cluster configuration mode.
Step 3	`sjc-sw2(config-ioa-cl)# load-balancing`	Load balances all the IOA flows. This process is disruptive and causes the hosts to relogin into targets. The **load-balancing** command will take some time to execute depending on the number of flows. You should not abort the command in the middle of its execution.
	`sjc-sw2(config-ioa-cl)# load-balancing enable`	The **load-balancing enable** command turns on the load-balancing attribute for the new flows. You may enter the **load-balancing enable** command only when you abort the **load-balancing** command process.
	`sjc-sw2(config-ioa-cl)# load-balancing 11:22:33:44:55:66:77:88`	Load balances specified targets in the IOA flows. This process is disruptive and causes the hosts to re-login into targets. The **load-balancing** command will take some time to execute depending on the number of flows. You should not abort the command in the middle of its execution.

Setting the Tunable Parameters

To set the the following tunable parameters based on your deployment requirements, perform this task:

Command	Purpose
`sjc-sw2(config-ioa-cl)# tune round-trip-time` *ms*	Specifies the round-trip time in milliseconds. It is the time taken by the IOA data packet to traverse between two sites. The value can vary from 1 to 100 ms. 15 ms is the default.
`sjc-sw2(config-ioa-cl)# tune lrtp-retx-timeout` *msec*	Specifies the LRTP retransmit timeout in milli-seconds. It is the time to wait before LRTP starts retransmitting packets. The value can vary from 500 to 5000 msec. 2500 msec is the default. For more information, refer to **Tuning for E_D_TOV** under "Resiliency Considerations" section on page 3-8.

Caution The following are advanced tunable parameters, and you must consult the Cisco Services and Support team before tuning these parameters.

To set the the following advanced tunable parameters based on your deployment requirements, perform this task:

	Command	Purpose
Step 1	`sjc-sw2# config t`	Enters configuration mode.
Step 2	`sjc-sw2(config)# ioa cluster tape_vault`	Enters the cluster configuration mode.
Step 3	`sjc-sw2(config-ioa-cl)# tune timer rscn-suppression` *seconds*	Specifies the IOA RSCN suppression timer value. It is the amount of time the IOA process waits before it queries FCNS (name server) after learning about changes in the network. This helps alleviate the amount of duplicate or repeating query in case of rapid network changes. The value can vary from 1 to 10 seconds. 5 seconds is the default.
Step 4	`sjc-sw2(config-ioa-cl)# tune timer load-balance target` *seconds*	Specifies a IOA target load-balance timer value. It is the amount of time the IOA process waits before it attempts to load balance all IT Nexuses of a certain target port after a change in connectivity has been detected. The value can vary from 2 to 30 seconds. 2 seconds is the default.
Step 5	`sjc-sw2(config-ioa-cl)# tune timer load-balance global` *seconds*	Specifies a global IOA load-balance timer value. It is the amount of time the IOA process waits before it attempts to load balance all IT Nexuses configured in a cluster after a change in connectivity has been detected. The value can vary from 5 to 30 seconds. 5 seconds is the default.
Step 6	`sjc-sw2(config-ioa-cl)# tune ta-buffer-size` *KB*	Specifies the tape acceleration buffer size in KB. It is the amount of buffering allowed for flow control during tape acceleration. The value can vary from 64 to 12288 KB or Auto. Auto is the default. Auto option takes WAN latencies and speed of the tape device into account to provide optimum performance.
Step 7	`sjc-sw2(config-ioa-cl)# tune wa-buffer-size` *MB*	Specifies the write acceleration buffer size in MB. It is the amount of buffering allowed for flow control during write acceleration. The value can vary from 50 to 100 MB. 70 MB is the default.
Step 8	`sjc-sw2(config-ioa-cl)# tune wa-max-table-size` *KB*	Specifies the Write Max Table size in KB. It is the maximum number of active exchanges supported on an IOA flow. The value can vary from 4 to 64 KB. 4 KB is the default.

Changing the Node Description and IP Address of an IOA Cluster

To perform any of the following tasks, follow the steps defined in the Guidelines for Changing the Node Description and IP Address of an IOA Cluster, page 4-18.

- Change the node-description (IP address) and node IP-address of a cluster.
- Change node-description(DNS name) of a cluster.
- Change the node-description from IP address to DNS name and vice versa.

Guidelines for Changing the Node Description and IP Address of an IOA Cluster

Follow these steps to change the node description and IP address of an IOA node in the existing IOA cluster.

Step 1 Shut down the IOA cluster on the switch1.

Step 2 Shut down the IOA cluster on the switch2.

Step 3 Remove the IOA cluster on the switch2.

Step 4 Remove the node of switch2 in the switch1.

Step 5 Do one of the following based on what you want to perfom on the switch:

- Change the management interface IP Address.
- Change the IP address and the switch name.
- Enable or disable DNS configuration.

Step 6 Change node description using "**node id** *id*, **node-description ip-address** *ip address*" command on switch1.

This step may vary depending on when the node description (DNS name) needs to be changed or node description and node IP address to be changed.

Step 7 Shut down the IOA cluster on the switch1.

Step 8 Add switch2 node with new description and the IP address .

Step 9 Add IOA interfaces on switch2.

Configuration Example for Changing the Node Description and Node IP Address of an IOA Cluster

This example shows the following configuration procedures used to change the description and IP address:

Shut Down the IOA Cluster on switch1

To shut down the IOA cluster on switch1 follow these steps:

```
sw-231-19(config)# show ioa cluster  c1 node summary
--------------------------------------------------------------------------------
Switch             Site            Status           Master     Node ID
--------------------------------------------------------------------------------
172.25.231.14      site3           online           no         2
172.25.231.19(L)   site2           online           yes        1
sw-231-19(config)# ioa cluster  c1
sw-231-19(config-ioa-c1)# sh
This change can be disruptive. Please ensure you have read the "IOA Cluster Recovery
Procedure" in the configuration guide. -- Are you sure you want to continue? (y/n) [n] y
2011 Apr 12 07:02:21 sw-231-19 %CLUSTER-2-CLUSTER_LOCAL_NODE_EXIT: Local Node 0x1 has left
the Cluster 0x5000530019f08076
```

Shut Down the IOA Cluster on switch2

To shut down the IOA cluster on switch2 follow these steps:

```
sw-231-14(config)# ioa cluster  c1
sw-231-14(config-ioa-c1)# sh
This change can be disruptive. Please ensure you have read the "IOA Cluster Recovery
Procedure" in the configuration guide. -- Are you sure you want to continue? (y/n) [n] y
2011 Apr 12 07:02:30 sw-231-14 %CLUSTER-2-CLUSTER_LOCAL_NODE_EXIT: Local Node 0x2 has left
the Cluster 0x5000530019f08076

sw-231-14(config-ioa-c1)# sh ioa cluster  c1 node sum
--------------------------------------------------------------------------------
Switch             Site            Status           Master     Node ID
--------------------------------------------------------------------------------
192.125.231.14(L)   --              unknown (cluster is offline)            2

192.125.231.19      --              unknown (cluster is offline)            1
```

Remove the IOA Cluster on switch2

To remove the IOA cluster on switch2, follow these steps:

```
sw-231-14(config-ioa-c1)# no ioa cluster  c1
sw-231-14(config)#
```

Remove the Node of switch2 in switch1

To remove the node of switch 2 in switch1, follow these steps:

```
sw-231-19(config-ioa-c1)# no node 192.125.231.14
sw-231-19(config-ioa-c1)# sh ioa cluster  c1 node sum
--------------------------------------------------------------------------------
Switch             Site            Status           Master     Node ID
--------------------------------------------------------------------------------
192.125.231.19(L)   --              unknown (cluster is offline)            1

sw-231-19(config-ioa-c1)#
```

Change the Management Interface IP Address on Switches

```
sw-231-19(config)# int mgmt0
sw-231-10(config-if)# ip address 172.25.231.19 255.255.255.0
sw-231-19(config)# int mgmt0
sw-231-10(config-if)# ip address 172.25.231.25 255.255.255.0
```

Change the Node Description and IP Address on switch1

Change the node description and IP address on the switch1 using the command **node id** *id new-description* **ip-address** *new-ip address*

```
sw-231-19(config-ioa-cl)# node id 1 192.125.231.72 ip-address 192.125.231.72
```

No Shut Down IOA Cluster on switch1

To shut down the IOA cluster on a switch, follow these steps:

```
sw-231-19(config-ioa-cl-node)# no sh
This change can be disruptive. Please ensure you have read the "IOA Cluster Recovery
Procedure" in the configuration guide. -- Are you sure you want to continue? (y/n) [n] y
sw-231-19(config-ioa-cl)# 2011 Apr 12 07:04:54 sw-231-19
%CLUSTER-2-CLUSTER_LEADER_ANNOUNCE: Node 0x1 is the new Master of cluster
0x5000530019f08076 of 1 nodes
2011 Apr 12 07:04:54 sw-231-19 %CLUSTER-2-CLUSTER_QUORUM_GAIN: Cluster 0x5000530019f08076
now has quorum with 1 nodes

sw-231-19(config-ioa-cl)# show ioa cluster  c1 node summary
--------------------------------------------------------------------------------
Switch             Site            Status           Master     Node ID
--------------------------------------------------------------------------------
192.125.231.72(L)   site2           online           yes        1
```

Add switch2 Node with New Description and the IP Address

To add switch2 node with new description and IP address, follow these steps

```
sw-231-19(config-ioa-cl)# node 172.25.231.25
2011 Apr 12 07:05:30 sw-231-19 %CLUSTER-2-CLUSTER_QUORUM_GAIN: Cluster 0x5000530019f08076
now has quorum with 1 nodes
2011 Apr 12 07:05:30 sw-231-19 %CLUSTER-2-CLUSTER_QUORUM_GAIN: Cluster 0x5000530019f08076
now has quorum with 2 nodes
```

Add IOA Interfaces on switch2

To add IOA interfaces on the switch, follow these steps:

```
sw-231-19(config-ioa-cl-node)# int ioa 1/1
sw-231-19(config-ioa-cl-node)# int ioa 1/2
sw-231-19(config-ioa-cl-node)#
```

Verify the Node Description and IP Address and Flows

Use the following **show** commands to confirm the functioning of the cluster with the new IP address:

```
sw-231-19(config)# show ioa cluster  c1 node summary
--------------------------------------------------------------------------------
Switch             Site            Status           Master     Node ID
--------------------------------------------------------------------------------
172.25.231.25      site3           online           no         2
172.25.231.72(L)   site2           online           yes        1

sw-231-19(config)# show ioa cluster  c1 int summary
--------------------------------------------------------------------------------
Switch             Interface         Status       Flows
--------------------------------------------------------------------------------
172.25.231.25      ioa1/1            up           20
172.25.231.25      ioa1/2            up           16
172.25.231.72(L)   ioa4/1            up           20
172.25.231.72(L)   ioa4/2            up           16

sw-231-19(config)# show ioa cluster  c1 node
Node 172.25.231.25 is remote switch
  Node ID is 2
  IP address is 172.25.231.25
  Status is online
  Belongs to Site site3
  Node is not master switch
Node 172.25.231.72 is local switch
  Node ID is 1
  IP address is 172.25.231.72
  Status is online
  Belongs to Site site2
  Node is the master switch
sw-231-19(config)#
```

Displaying Interface Statistics

The following examples display interface statistics:

```
sjc-sw2# show int ioa 2/1 counters
ioa1/1
    4454232796 device packets in, 375748229 device packets out
    8948409208760 device bytes in, 24047886946 device bytes out
    526563297 peer packets in, 2471396408 peer packets out
    45198770258 peer bytes in, 4697995629324 peer bytes out

    8 i-t create request, 4 i-t create destroy
    8 i-t activate request, 0 i-t deactivate request

sjc-sw2# show int ioa 2/1 counters  brief

--------------------------------------------------------------------------------
Interface          To Device  (rate is 5 min avg) To Peer  (rate is 5 min avg)
                   ----------------------------  ----------------------------
                   Rate     Total                 Rate     Total
                   MB/s     Bytes                 MB/s     Bytes
--------------------------------------------------------------------------------
ioa1/1             0.56     24049257618           109.66   4698262901274

sjc-sw2# show ioa int int ioa 2/1 summary

---- ---------------------- ---- ------------- ---- ---
FLOW HOST                    VSAN STATUS        COMP ACC
```

```
     TARGET
---- ----------------------- ---- ------------- ---- ---
1    10:00:00:00:00:00:03:00 200  ACTIVE        YES WA
     11:00:00:00:00:00:03:00
2    10:00:00:00:00:00:02:00 200  ACTIVE        NO  WA
     11:00:00:00:00:00:02:00
3    10:00:00:00:00:00:01:00 100  ACTIVE        YES TA
     11:00:00:00:00:00:01:00
4    10:00:00:00:00:00:00:00 100  ACTIVE        NO  TA
     11:00:00:00:00:00:00:00

sjc-sw2# show ioa int int ioa 2/1 stats
  Adapter Layer Stats
    4457312829 device packets in, 376008035 device packets out
    8954596919462 device bytes in, 24064514554 device bytes out
    526927441 peer packets in, 2473105321 peer packets out
    45230025550 peer bytes in, 4701244024682 peer bytes out

    8 i-t create request, 4 i-t create destroy
    8 i-t activate request, 0 i-t deactivate request
    0 i-t create error, 0 i-t destroy error
    0 i-t activate error, 0 i-t deactivate error
    48 i-t-n  not found, 0 i-t-n stale logo timer expiry
    4 logo sent, 8 logo timer started
    4 logo timer fired, 4 logo timer cancelled
    4 plogi 4 plogi-acc 4 logo-acc 4 prli 4 prli-acc 0 els-q-err
    to-device 214279940 orig pkts 12743547488 orig bytes
    to-peer 8748538 orig pkts 682386268 orig bytes
    0 queued 0 flushed 0 discarded
  LRTP Stats
    0 retransmitted pkts, 0 flow control
    2464072014 app sent 2464072014 frags sent 0 tx wait
    0 rexmt bulk attempts  0 rexmt bulk pkts  2 delayed acks
    376008013 in-order 0 reass-order 0 reass-wait  0 dup-drop
    376008013 app deliver 376008013 frags rcvd
    150919428 pure acks rx  376008013 data pkts rx 0 old data pkts
    0 remove reass node, 0 cleanup reass table
   Tape Accelerator statistics
      2 Host Tape Sessions
      0 Target Tape Sessions
     Host End statistics
      Received 26275926 writes, 26275920 good status, 2 bad status
      Sent 26275914 proxy status, 10 not proxied
      Estimated Write buffer 4 writes 524288 bytes
      Received 0 reads, 0 status
      Sent 0 cached reads
      Read buffer 0 reads, 0 bytes
     Host End error recovery statistics
      Sent REC 0, received 0 ACCs, 0 Rejects
      Sent ABTS 0, received 0 ACCs
      Received 0 RECs, sent 0 ACCs, 0 Rejects
      Received 0 SRRs, sent 0 ACCs, 0 Rejects
      Received 0 TMF commands
     Target End statistics
      Received 0 writes, 0 good status, 0 bad status
      Write Buffer 0 writes, 0 bytes
      Received 0 reads, 0 good status, 0 bad status
      Sent 0 reads, received 0 good status, 0 bad status
      Sent 0 rewinds, received 0 good status, 0 bad status
      Estimated Read buffer 0 reads, 0 bytes
      Target End error recovery statistics
      Sent REC 0, received 0 ACCs, 0 Rejects
      Sent SRR 0, received 0 ACCs
      Sent ABTS 0, received 0 ACCs
```

```
      Received 0 TMF commands
  Write Accelerator statistics
   Received 726357548 frames, Sent 529605035 frames
   0 frames dropped, 0 CRC errors
   0 rejected due to table full, 0 scsi busy
   0 ABTS sent, 0 ABTS received
   0 tunnel synchronization errors
   Host End statistics
     Received 188004026 writes, 188004000 XFER_RDY
     Sent 188004026 proxy XFER_RDY, 0 not proxied
     Estimated Write buffer 1146880 bytes
     Timed out 0 exchanges, 0 writes
   Target End statistics
     Received 0 writes, 0 XFER_RDY
     Write buffer 0 bytes
     TCP flow control 0 times, 0 bytes current
     Timed out 0 exchanges, 0 writes
  Compression Statistics
    Pre Comp Batch size 131072
    Post Comp Batch size 2048
    4375494911078 input bytes, 50140348947 output compressed bytes
    0 non-compressed bytes, 0 incompressible bytes
    0 compression errors
    0 Compression Ratio
  De-Compression Statistics
    0 input bytes, 0 output decompressed bytes
    11883488326 non-compressed bytes
    0 de-compression errors

sjc-sw2# show ioa int int ioa 2/1 init-pwwn 10:00:00:00:00:00:03:00 targ-pwwn
11:00:00:00:00:00:03:00 vsan 200 counters
  Adapter Layer Stats
    1366529601 device packets in, 160768174 device packets out
    2699458644986 device bytes in, 10289163140 device bytes out
    160844041 peer packets in, 165188790 peer packets out
    18652597246 peer bytes in, 47736122724 peer bytes out

    0 i-t create request, 0 i-t create destroy
    0 i-t activate request, 0 i-t deactivate request
    0 i-t create error, 0 i-t destroy error
    0 i-t activate error, 0 i-t deactivate error
    0 i-t-n  not found, 0 i-t-n stale logo timer expiry
    1 logo sent, 2 logo timer started
    1 logo timer fired, 1 logo timer cancelled
    1 plogi 1 plogi-acc 1 logo-acc 1 prli 1 prli-acc 0 els-q-err
    to-device 80384094 orig pkts 4662277452 orig bytes
    to-peer 0 orig pkts 0 orig bytes
    0 queued 0 flushed 0 discarded
  LRTP Stats
    0 retransmitted pkts, 0 flow control
    160768190 app sent 160768190 frags sent 0 tx wait
    0 rexmt bulk attempts  0 rexmt bulk pkts  1 delayed acks
    160768162 in-order 0 reass-order 0 reass-wait  0 dup-drop
    160768162 app deliver 160768162 frags rcvd
    75879 pure acks rx  160768162 data pkts rx 0 old data pkts
    0 remove reass node, 0 cleanup reass table
  Write Accelerator statistics
   Received 1607681842 frames, Sent 1527297774 frames
   0 frames dropped, 0 CRC errors
   0 rejected due to table full, 0 scsi busy
   0 ABTS sent, 0 ABTS received
   0 tunnel synchronization errors
   Host End statistics
     Received 80384094 writes, 80384082 XFER_RDY
```

```
    Sent 80384094 proxy XFER_RDY, 0 not proxied
    Estimated Write buffer 524288 bytes
    Timed out 0 exchanges, 0 writes
  Target End statistics
    Received 0 writes, 0 XFER_RDY
    Write buffer 0 bytes
    TCP flow control 0 times, 0 bytes current
    Timed out 0 exchanges, 0 writes

sjc-sw2# show ioa int int ioa 2/1 init-pwwn 10:00:00:00:00:00:03:00 targ-pwwn
11:00:00:00:00:00:03:00 vsan 200 counters brief

--------------------------------------------------------------------------------
Interface          Input (rate is 5 min avg)      Output (rate is 5 min avg)
                   ----------------------------   ----------------------------
                   Rate     Total                 Rate     Total
                   MB/s     Frames                MB/s     Frames
--------------------------------------------------------------------------------
ioa1/1
Device             60       9573683               0        1126308
Peer               0        1126833               1        1157161
sjc-sw2#
```