Oracle® Fabric OS 1.0.2 Administration Guide

ORACLE®

Oracle Fabric OS 1.0.2 Administration Guide

Part No: E66324-03

Copyright © 2015, 2016, Oracle and/or its affiliates. All rights reserved.

Documentation Accessibility

For information about Oracle's commitment to accessibility, visit the Oracle Accessibility Program website at `http://www.oracle.com/pls/topic/lookup?ctx=acc&id=docacc`.

Access to Oracle Support

Oracle customers that have purchased support have access to electronic support through My Oracle Support. For information, visit `http://www.oracle.com/pls/topic/lookup?ctx=acc&id=info` or visit `http://www.oracle.com/pls/topic/lookup?ctx=acc&id=trs` if you are hearing impaired.

Contents

Using This Documentation

- **Overview** – Describes how to use the Oracle Fabric OS 1.0.2 to administer the Oracle InfiniBand Switch IS2-46, the Oracle EDR Infiniband Fabric, and the Oracle Fabric Interconnect F2-12 virtualization switch.
- **Audience** – Technicians, system administrators, and authorized service providers who have been instructed on the hazards within the equipment and are qualified to administer hardware.
- **Required knowledge** – Advanced experience administering similar hardware.

Product Documentation Library

Documentation and resources for this product and related products are available at `http://docs.oracle.com/cd/E64522_01`.

Feedback

Provide feedback about this documentation at `http://www.oracle.com/goto/docfeedback`.

Understanding Oracle Fabric OS

The Oracle Fabric OS 1.0.2 runs on the Oracle InfiniBand Switch IS2-46 (leaf switch) and the Oracle Fabric Interconnect F2-12 (virtualization switch). The Oracle Fabric OS manages the switches, the Oracle EDR InfiniBand Fabric devices, and virtual network and storage resources.

The leaf switch provides IB switching and Ethernet gateway functions for the Oracle EDR InfiniBand Fabric. The 100-Gb converged fabric helps you build and manage a secure cloud network infrastructure. The fabric provides I/O services for servers with one network interface that includes network, storage, and inter-process communication. Using the fabric helps to eliminate network bottlenecks and increase data transmission speed.

The virtualization switch supports several I/O modules that provide FC and Ethernet connectivity. Ethernet modules provide additional capacity and can adapt to various LAN speeds and media types. For details on the configuring the virtualization switch, refer to the *Oracle EDR InfiniBand Switch and Virtualized I/O Systems Administration Guide*. For details on the modules, refer to these documents:

- *Oracle F2 Quad Port 10GBASE-T Module User's Guide*
- *Oracle F2 10 Gb and 40 Gb Ethernet Module User's Guide*
- *Oracle F2 Dual Port 16 Gb Fibre Channel Module User's Guide*
- *Oracle F2 Long Range InfiniBand Module User's Guide*

This guide provides instructions on using the Oracle Fabric OS CLI to set up IB, configure Ethernet connectivity, monitor the Oracle Fabric OS, manage the I/O modules, and perform system management tasks. You can use either the CLI or the Oracle Fabric Manager GUI to manage the switches on the fabric. For instructions on using the GUI, refer to the *Oracle Fabric Manager 5.0.2 Administration Guide*.

Tip - The term *GUI* refers to the Oracle Fabric Manager GUI, while *CLI* refers to the Oracle Fabric OS CLI. Some procedures are performed in the GUI, and some procedures are performed in the CL.

These topics provide an introduction to using the Oracle Fabric OS.

- "Hardware Overview" on page 14
- "Oracle Fabric OS Overview" on page 17

- "Administration Task Overview" on page 18
- "Choosing a Login Method" on page 19

Related Information

- "Implementing User Authorization" on page 37
- "Configuring IB Switching" on page 45
- "Configuring the Virtualization Switch and I/O Modules" on page 57

Hardware Overview

The Oracle Fabric OS 1.0.2 runs on the Oracle InfiniBand Switch IS2-46 (leaf switch) and the Oracle Fabric Interconnect F2-12 (virtualization switch). The Oracle Fabric OS manages the switches, the Oracle EDR InfiniBand Fabric devices, and virtual network and storage resources.

Related Information

- "Leaf Switch Overview" on page 14
- "Virtualization Switch Overview" on page 15
- "Module Overview" on page 17

Leaf Switch Overview

The leaf switch is a complete access switching and I/O platform that consolidates and virtualizes the switching infrastructure for server and storage systems deployed in high-performance enterprise clouds.

The switch contains 24 4x IB ports, 4 12x IB ports, and 8 10-Gb gateway ports that support EDR speeds. Ports 25 and 26 are configurable ports, and can be 40-Gbit/sec gateway ports, 4 10-Gb gateway ports, or 12x IB ports. Additionally, 10-GbE ports and 24 1GBASE-T ports provide both network and gateway capabilities.

The leaf switch ships preconfigured for network management through DHCP, but the *Oracle InfiniBand Switch IS2-46 Installation Guide* provides instructions for serial management to configure static IP addresses.

Related Information

- "Virtualization Switch Overview" on page 15
- "Leaf Switch Front Panel Components" on page 25
- "Virtualization Switch Rear Panel Components" on page 28
- Oracle InfiniBand Switch IS2-46 Product Page
- Documentation for Oracle InfiniBand Switch IS2-46

Virtualization Switch Overview

The virtualization switch provides scalable I/O and on-demand network services for high-performance clouds. The virtualization switch supports up to 12 I/O modules per chassis. The virtualization switch supports the following I/O module hardware:

- Oracle F2 Dual Port 16 Gb Fibre Channel module
- Oracle F2 Quad Port 10GBase-T module

- Oracle F2 Long Range InfiniBand module (switching mode only)
- Oracle F2 10 Gb and 40 Gb Ethernet module
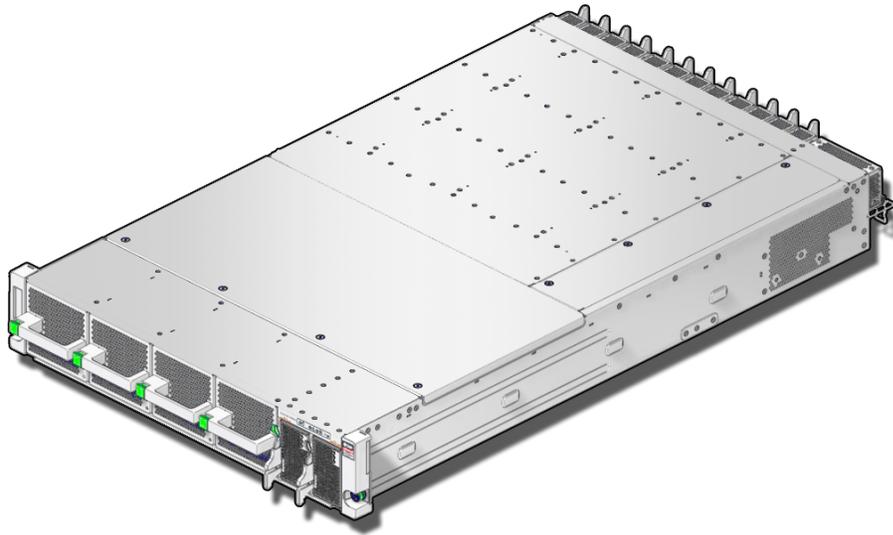
The virtualization switch can be configured many ways through I/O modules appropriate for your data center. Through I/O modules, the switch can support up to 48 4x IB ports, 24 16GbFC ports, 48 10GBASE-T ports, 48 40G Ethernet ports, or a mixture of these ports to provide network and gateway capabilities.

Additionally, the switch has a dedicated port block, which also supports limited customization. Through the port block, the switch supports 4 12x IB ports, 4 1GBASE-T ports, and 2 4x IB/40GbE combination ports provide both network and gateway capabilities:

- If you configure the 2 4x IB/40GbE ports for IB, the switch can support a maximum of 50 4x IB ports.
- If you configure the 2 4x IB/40GbE ports for GbE, the switch can support a maximum of 50 40GbE ports.

The virtualization switch ships preconfigured, but the *Oracle Fabric Interconnect F2-12 Installation Guide* provides additional information for installing and configuring the switch.

Related Information

- "Module Overview" on page 17
- "Virtualization Switch Front Panel Components" on page 27
- "Virtualization Switch Rear Panel Components" on page 28

- Oracle Fabric Interconnect F2-12 Product Page
- Documentation for Oracle Fabric Interconnect F2-12

Module Overview

Several types of I/O modules provide Ethernet connectivity to servers and storage systems that are connected to the fabric. This graphic shows the Oracle F2 Quad Port 10GBase-T I/O Module.
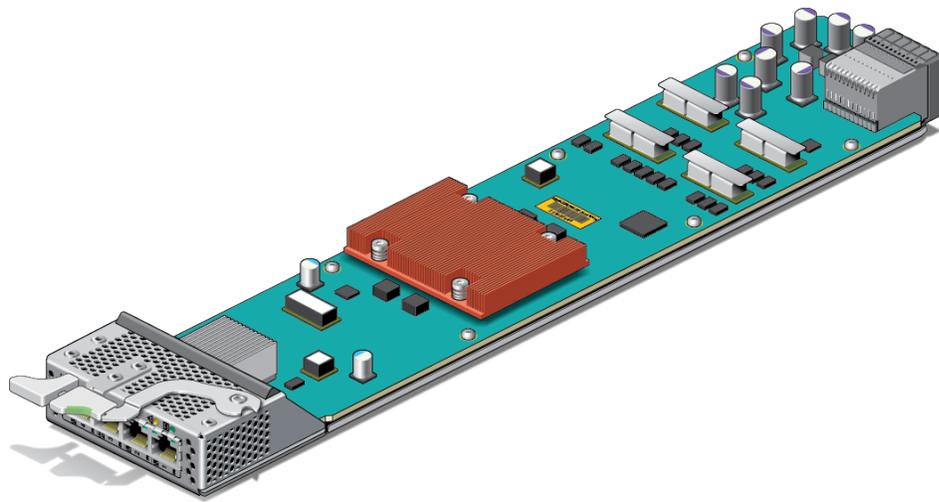
Related Information

- "Oracle Fabric OS Overview" on page 17
- "Module Front Panel Components" on page 29
- Oracle F2 I/O Modules Product Page
- Documentation for Oracle F2 I/O Modules

Oracle Fabric OS Overview

The Oracle Fabric OS uses network virtualization to enable flexible connections from servers to networks and storage. An Ethernet gateway can replace the need for vNICs. Applications and the OS view these virtual resources exactly as they would their physical counterparts.

Oracle Fabric OS supports the following versions of software.

Supported Software	Documentation
Oracle Fabric Manager, starting with version 5.0.1	*Oracle Fabric Manager 5.0.2 Administration Guide*
Oracle Linux OEL, starting with version 6.7 (UEK 4)	Oracle Linux 6 documentation (`http://docs.oracle.com/cd/E37670_01/index.html`)

Related Information

- "Administration Task Overview" on page 18

Administration Task Overview

After you install the leaf switch, the virtualization switch, and the I/O modules, use the Oracle Fabric OS CLI and the Oracle Fabric Manager GUI to manage the fabric, the switches, and the modules.

Step	Action	Link	Method
1. Plan how to use the switch.	Plan your network topology and determine how you will use the Oracle Fabric OS to manage the switch and the fabric.		
2. Add users.	Configure users and assign privileges.	"View Privileges for a User" on page 38	GUI and CLI
3. Configure IB switching	Optional: Enable an IB port.	"Enable an IB Port" on page 47	CLI
	Create and configure a subnet manager group.	"Manage SM Group Information" on page 49	GUI
4. Set up Ethernet connectivity.	Optional: Configure an additional IB or Ethernet port.	"Configure an Additional Port" on page 34	CLI
	Add a public network if you need access to an external Ethernet network.	"Create a Public Network" on page 95.	CLI
	Configure a PVI to connect the switch to the IB fabric.	"Configure a PVI" on page 97	CLI
	Assign connections and I/O configuration properties to a physical server.	"Create a Server Profile" on page 98	GUI and CLI
	Determine if you will implement a VLAN.	"Planning a VLAN" on page 41	
	Create a vNIC to virtualize Ethernet connectivity.	"Create a vNIC" on page 100	GUI and CLI
	Optional: Configure Ethernet ports in a LAG to increase bandwidth.	"Configure a Static LAG" on page 108	CLI

Step	Action	Link	Method
5. Modify the virtualization switch and I/O module configuration.	Optional: Change the default configuration for the virtualization switch or I/O modules.	"Managing the Virtualization Switch" on page 58 "Managing a Module" on page 60	GUI and CLI CLI
6. Monitor the switches and the fabric.	Monitor the OS.	"Monitoring Hardware and Software" on page 111	CLI
7. Manage the system.	Perform system management.	"Managing Oracle Fabric OS" on page 121	CLI

Related Information

- "Choosing a Login Method" on page 19
- *Oracle InfiniBand Switch IS2-46 Installation Guide*
- *Oracle Fabric Interconnect F2-12 Installation Guide*
- *Oracle Fabric Manager 5.0.2 Administration Guide*
- Documentation for Oracle InfiniBand Switch IS2-46
- Documentation for Oracle Fabric Interconnect F2-12
- Documentation for Oracle F2 I/O Modules

Choosing a Login Method

You can use either the console or SSH to log in to the Oracle Fabric OS. Telnet is not supported. You can establish up to 20 concurrent CLI sessions on the chassis. This number is limited by the number of instances available in the address object. After you use the default login to log in for the first time, change the password to a strong password. See "Set System Password Strength" on page 122.

- "Log In to Oracle Fabric OS (Console)" on page 19
- "Log In to Oracle Fabric OS (SSH)" on page 20
- "Login Information" on page 21
- "Log In to Oracle Fabric Manager (GUI)" on page 22

▼ Log In to Oracle Fabric OS (Console)

The SER MGT port is used for switch administration. For more information, refer to "Connect a Serial Management Device to the SER MGT Port" in *Oracle InfiniBand Switch IS2-46 Installation Guide*.

1. **Locate the prompt for the serial port.**

2. **Log in to the switch.**

   The default user name is admin. The default password is admin.

   ```
   login: admin
   Password: ********
          Welcome to Oracle Fabric OS
     Copyright (c) 2012-2016 Oracle Corp.  All rights reserved.
        Enter "help" for information on available commands.
   Enter the command "show system copyright" for licensing information.

   [OFOS] pwd
   /home/admin

   [OFOS] show userss
   name          role              descr
   --------------------------------------
   admin         administrators
   JAnderson     storage
   2 records displayed
   ```

   The Oracle Fabric OS places you directly into a CLI session with full administrative privileges.

   ### Related Information

   -
   -
   -

▼ Log In to Oracle Fabric OS (SSH)

Use SSH to log in to the CLI remotely. Telnet is not supported.

1. **Log in as the admin user to the switch.**

   ```
   -> ssh admin@hostname-IP-address
   ```

2. **Type the password.**

   The default password is admin. The welcome screen is displayed.

   ```
       Welcome to Oracle Fabric OS Controller
    Copyright (c) 2012-2016 Oracle Corp.  All rights reserved.
        Enter "help" for information on available commands.
   Enter the command "show system copyright" for licensing information.
   ```

The Oracle Fabric OS prompt is now admin@*hostname*[OFOS], with your *hostname* inserted. The prompt is not customizable. In the remaining topics in this guide, the prompt is simply shown as [OFOS].

The default login home directory is /home/admin.

Note - To log off from the Oracle Fabric OS, type exit.

---

3.   **(Optional) Add users and assign them to roles.**

See "Implementing User Authorization" on page 37.

Related Information

- "Login Information" on page 21
- "Log In to Oracle Fabric Manager (GUI)" on page 22

Login Information

Use the show login and show users commands to display details about the active CLI sessions and configured local user accounts, which are user accounts that are configured directly on the IB fabric.

Use the set cli idle-timeout 0 command to configure an infinite CLI time-out (no time-out). For instructions on adding user accounts, see "View Privileges for a User" on page 38.

```
[OFOS] show login [session-ID]
show user
```

Related Information

- "Example: Display Login Details" on page 21
- "File System Structure" on page 22

Example: Display Login Details

```
[OFOS] show login
-----------------------------------
session        1
time           2016-02-20 21:28:20
name           admin
descr
```

```
roles          administrator
interface      cli
type           local
logged-in-from 172.16.48.120
--------------------------------------
1 record displayed

[OFOS] show users
name           role            descr
--------------------------------------
admin          administrators
JAnderson      storage
2 records displayed
```

Related Topics

-
-

File System Structure

The Oracle Fabric OS software creates these top-level directories.

Directory	Contains
bin	Binary files.
sbin	System binaries not available to users.
etc	Copyright and other files.
skins	Skin definitions for the CLI commands. The default skin is the "xsigo" skin. For example, /etc/skin and /etc/xsigorc.
home	Users' home directories.
log	Log files.
config	Contains current configuration files.

Related Information

-

▼ Log In to Oracle Fabric Manager (GUI)

The GUI is browser-based. Use the GUI for configuration tasks that you cannot do in the CLI.

1. **Go to `https://`*server-name*`:8443/xms.`**

   Type the IP address or host name of the Oracle Fabric Manager server for the *server-name*. Ensure that you add 8443 after the colon.

2. **Type your name and password.**

3. **(Optional) Add users and assign them to roles.**

   Refer to "Managing Users" in *Oracle Fabric Manager 5.0.2 Administration Guide*.

   Related Information

   - "Understanding the Hardware" on page 25
   - "Using I/O Ports" on page 33

Understanding the Hardware

These topics describe the hardware and software used with the Oracle Fabric OS.

- "Hardware Components" on page 25
- "Understanding Ports" on page 31
- "Using I/O Ports" on page 33
- "Hardware Status and Environmental Statistics" on page 35
- "Interfaces and Interface State" on page 36

Related Information

- "Leaf Switch Overview" on page 14
- "Virtualization Switch Overview" on page 15
- "Configuring Ethernet Connectivity" on page 93
- "Configuring IB Switching" on page 45

Hardware Components

These topics demonstrate the front and rear panels for the leaf switch, the virtualization switch, and a sample I/O module.

Related Information

- "Leaf Switch Front Panel Components" on page 25
- "Leaf Switch Rear Panel Components" on page 26
- "Virtualization Switch Front Panel Components" on page 27
- "Virtualization Switch Rear Panel Components" on page 28
- "Module Front Panel Components" on page 29

Leaf Switch Front Panel Components

The leaf switch contains these front panel components.
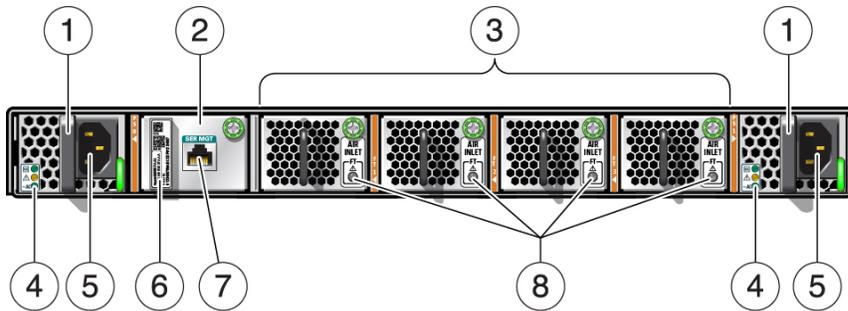
No.	Description
1	Power supplies
2	SMM, with battery inside
3	Fan modules
4	Power supply LEDs
5	Power cord receptacles
6	RFID module
7	SER MGT port
8	Fan module LEDs

Related Information

- "Leaf Switch Rear Panel Components" on page 26
- "Understanding Ports" on page 31

Leaf Switch Rear Panel Components

The leaf switch contains these rear panel components. The IB ports are on the left and the Ethernet ports are on the right.

No.	Description
1	PrizmMT connectors: ■ **Ports 1 to 24** – IB 4x ■ **Ports 25 and 26** – Either IB 4x or 10GbE ■ **Ports 27 to 30** – IB 12x
2	SFP+ connectors ■ **Ports 1 to 8 (left)** – 10GbE Ethernet overlay network (IB switch chip) ■ **Ports 1 and 2 (right)** – 10GbE network management uplinks (Ethernet switch chip) **Note -** The two right most connectors, labeled 1 and 2, can be used for network management.
3	RJ-45 connectors – Any one of these connectors can be used for network management.
4	Chassis status LEDs

Related Information

-
-
-

Virtualization Switch Front Panel Components

The virtualization switch's front panel is the fan and power supply end of the switch. This end of the switch is installed to the cold aisle.
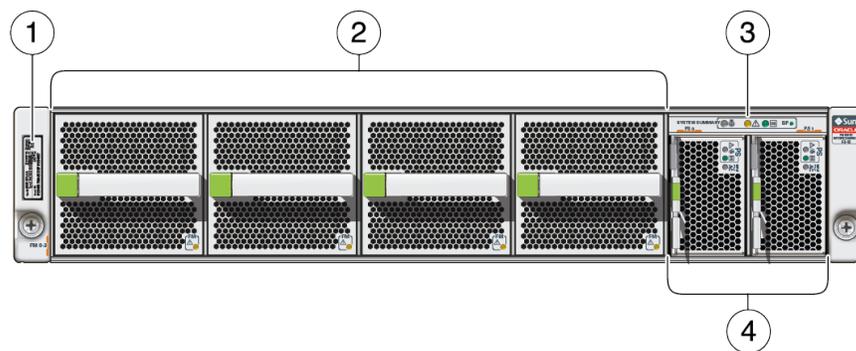
No.	Description
1	RFID tag

No.	Description
2	Fan modules
3	Chassis status LEDs
4	Power supplies

Related Information

- "Virtualization Switch Rear Panel Components" on page 28
- "Leaf Switch Front Panel Components" on page 25
- "Understanding Ports" on page 31

Virtualization Switch Rear Panel Components

The rear panel is the data cable connection end of the switch. This end of the switch is installed to the hot aisle.
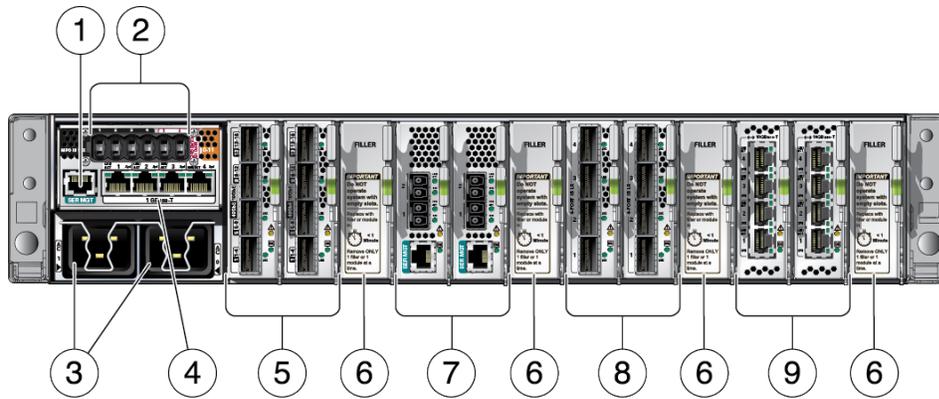
No.	Description
1	SER MGT connector
2	PrizmMT connectors:
	▪ **Ports 1 to 4** – 12x IB
	▪ **Ports 5 and 6** – Either 4x IB or 40 GbE
3	Power receptacles
4	1GBASE-T RJ-45 connectors – Any one of these connectors can be used for network management.

No.	Description
5	Oracle F2 10 Gb and 40 Gb Ethernet module
6	Filler panel
7	Oracle F2 Dual Port 16Gb Fibre Channel module
8	Oracle F2 Long Range InfiniBand module
9	Oracle F2 Quad Port 10GBASE-T module

Related Information

- "Module Front Panel Components" on page 29
- "Virtualization Switch Front Panel Components" on page 27
- Oracle Fabric Interconnect F2-12 Product Page
- Documentation for Oracle Fabric Interconnect F2-12

Module Front Panel Components

Each I/O module is slightly different. This is the front panel of the Oracle F2 Quad Port 10GBase-T I/O Module.
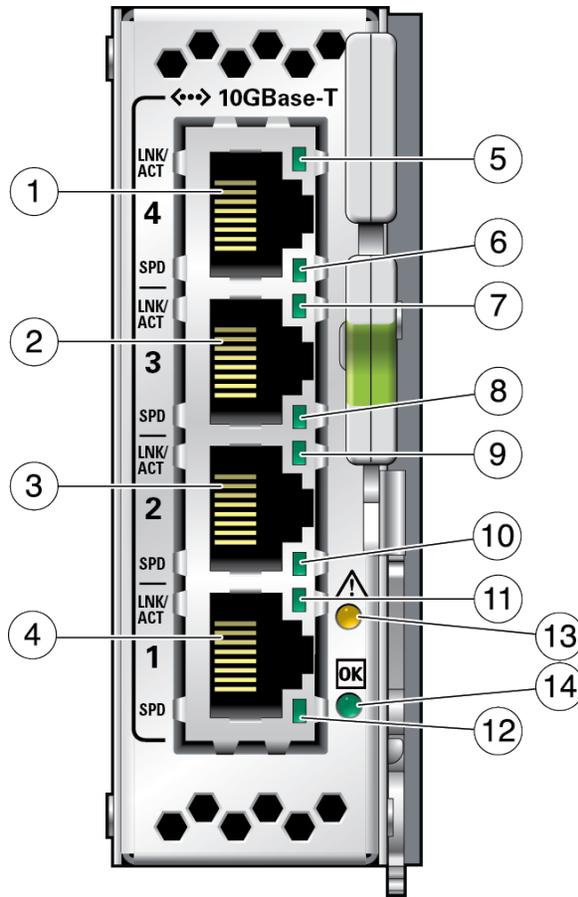
No.	Description
1	Port 4
2	Port 3
3	Port 2
4	Port 1
5,7,9,11	Link_up activity LEDs
6,8,10,12	Speed LEDs
	■ 10G: On ■ Others: Off
13	Amber LED (FAULT LED)
	■ On: Module attention ■ Blink: Initializing ■ Off: Module normal operation
14	Green (IOM_STATUS_OK LED)

No.	Description
	■ On: Module Powered and operational
	■ Blink: Power transition (Hot-plug is not allowed)
	■ Off: Module not operational

Related Information

- ■ "Understanding Ports" on page 31
- ■ "Managing a Module" on page 60
- ■ *Oracle F2 Dual Port 16 Gb Fibre Channel Module User's Guide*
- ■ *Oracle F2 10 Gb and 40 Gb Ethernet Module User's Guide*
- ■ *Oracle F2 Quad Port 10GBASE-T Module User's Guide*
- ■ *Oracle F2 Long Range InfiniBand Module User's Guide*
- ■ Oracle F2 I/O Modules Product Page

Understanding Ports

The IB technology is used for high performance computing. IB interconnects processor nodes and I/O nodes to a system area network. The architecture is independent of the host OS and processor platform. The leaf switch contains up to 38 4x IB ports that support EDR speeds and provides IB switching for the fabric. An IB port can be configured as a switch, a router, or a switch and router port.

The virtualization switch can be configured many ways, with up to 48 4x IB ports, 24 16Gb FC ports, 48 10GBASE-T ports, 48 40G Ethernet ports, or a mixture of these ports to provide network and gateway capabilities. For more information, see "Virtualization Switch Overview" on page 15.

Related Information

- ■ "Port Overview" on page 31
- ■ "Port Syntax" on page 32

Port Overview

One switch attaches to an internal HCA (IOC Port8). An external leaf switch connects to 12x IB ports 1 – 4. Embedded ports 5 and 6 can be set up as a 4x IB port connecting to an external leaf

switch or to a 40Gb Ethernet port. Each 40GbE port can be configured as one 40GbE port or 4x 10GbE ports.

A gateway port is a general term that includes both IB ports and Ethernet gateway ports. If your deployment requires additional ports, you can configure up to two more ports. These ports can be IB ports or 40-GbE Ethernet ports. See "Configure an Additional Port" on page 34.

The fabric contains an embedded SM group that manages the switching tables within the IB fabric. When there are multiple SM groups on a subnet, one SM group becomes the master SM group through an election algorithm. There is only one master SM group per subnet.

The master SM group is a key element in initializing and configuring an IB subnet. The master SM group is elected as part of the initialization process for the subnet. For more information, see "Configuring IB Switching" on page 45. Communication between the master SM group and the SM agents is performed through subnet management packets.

Related Information

- "Port Syntax" on page 32

Port Syntax

When referring to one of the switch's ports on the command line, use the syntax of `slot/port` to specify a specific slot and port. For example, **add vnic foo.bar embedded/1**. The slot number is always `embedded` for the leaf switch and the virtualization switch.

[OFOS] **show ioport ?**

Possible completions:

```
1/1         sanFc16GbPort in slot 1 port 1(up) unused
1/2         sanFc16GbPort in slot 1 port 2(up) used by 1 resource
2/1         gwEthernet40GbPort in slot 2 port 1(down) unused
2/2         gwEthernet40GbPort in slot 2 port 2(down) unused
2/3         gwEthernet40GbPort in slot 2 port 3(up) unused
2/4         gwEthernet40GbPort in slot 2 port 4(up) unused
3/1         gwEthernet10GbPort in slot 3 port 1(down) unused
3/2         gwEthernet10GbPort in slot 3 port 2(up) unused
3/3         gwEthernet10GbPort in slot 3 port 3(down) unused
3/4         gwEthernet10GbPort in slot 3 port 4(down) unused
4/1         gwEthernet10GbPort in slot 4 port 1(up) unused
4/2         gwEthernet10GbPort in slot 4 port 2(up) unused
4/3         gwEthernet10GbPort in slot 4 port 3(down) unused
4/4         gwEthernet10GbPort in slot 4 port 4(up) unused
<wildcard>  Wildcarded name
embedded/5  gwEthernet40GbPort in slot embedded port 5(up) unused
```

```
  embedded/6  gwEthernet40GbPort in slot embedded port 6(down) unused
Repeat '?' for detailed help.
```

In command output, the port consists of the following elements:

- Connection type – For example, network (gwEthernet) or FC SAN (sanFC).
- Port type – IB, Ethernet, or FC.
- Rate – For example, 1 Gbit/sec or 10 Gbit/sec.
- Slot or port – Physical slot number or port number. An example of a slot and port on an I/O module is 2/2. For the leaf switch and the virtualization switch, the slot number is always embedded.These leaf and virtualization switch ports use the syntax of embedded/x.

Related Information

- "Using I/O Ports" on page 33

Using I/O Ports

A single adapter provides all I/O services to servers and storage systems connected to the fabric. A gateway port can be an IB port or a 40-GbE Ethernet port.

- "Change a Gateway Port" on page 33
- "Configure an Additional Port" on page 34

▼ Change a Gateway Port

This procedure is for the CLI.

1. Determine which port you want to modify and what its state should be.

2. Change the state of the gateway port.

Change embedded slot, port 1 to the up/up state:

```
[OFOS] set gw-port embedded/1 up/up
```

3. Verify that the port was changed.

```
[OFOS] show gw-port
name         type                 state    desc   mode   lag   access-vlan
-------------------------------------------------------------------------------
```

```
embedded/1    gwEthernet40GbPort      up/up               trunk   1    1
embedded/2    gwEthernet40GbPort      up/down             trunk        1
embedded/3    gwEthernet40GbPort      up/up               trunk        1
embedded/4    gwEthernet40GbPort      up/up               trunk        1
```

Related Information

-

▼ Configure an Additional Port

If your deployment requires additional ports, you can configure up to two more ports. These ports can be IB ports or 40-GbE Ethernet ports. This procedure is for the CLI.

1. **Configure an additional port, specifying an IB port, or a 10-Gb or 40-Gb Ethernet port.**

    Note - The leaf switch does not support the 10-Gb Ethernet port.

    ```
    [OFOS] set multiconfig-port slot/port -port-type=gwEthernet40GbPort
    ```

2. **Verify that the port is working.**

    ```
    [OFOS] show multiconfig-port
    name         port-type
    2/1          ibPort
    embedded/2   gwEthernet40GbPort
    ```

    Related Information

    -

Using HCA Ports

A single adapter provides all I/O services to servers and storage systems connected to the fabric.

Related Information

-
-

Supported HCA Cards and Firmware Versions

For the most current list of IB HCA cards that are supported in the switch on a server, refer to "Software and Hardware Requirements" in *Oracle Fabric OS 1.0.2 Release Notes*.

Related Information

- "Determine HCA Port and Firmware Version" on page 35

▼ Determine HCA Port and Firmware Version

1. **Check the HCA card type and version.**

   On a Linux server:

   ```
   # cat /sys/class/infiniband/sif0/hca_type
   PSIF
   ```

2. **Check the firmware version.**

   For the firmware version, the value is the current revision level.

   ```
   [OFOS] show system version -all
   ```

   In this example, the HCA card has firmware version 0.55.0 installed.

   ### Related Information

   - "Hardware Status and Environmental Statistics" on page 35

Hardware Status and Environmental Statistics

Use the `show hardware` command to display hardware information and environmental statistics for the fabric.

Additional commands are available to show the hardware status of the fabric, such as "show config" in *Oracle Fabric OS 1.0.2 Command Reference*.

Related Information

- "Interfaces and Interface State" on page 36

Interfaces and Interface State

Each slot/port has its own interface (`if`) with state information (`if-state`):

```
[OFOS] show vnic
name        state   mac-addr          ipaddr      if        if-state  type    vlans
-------------------------------------------------------------------------------------
vn222.BBB   up/up   00:13:97:97:00:04  0.0.0.0/32  BBB(888)  up        static  none

[OFOS] show vhba
-------------------------------------
name          myvhba.myserver
state         up/up
fabric-state  up
if            4/1
if-state      up
wwnn          50:01:39:71:00:00:B1:25
wwpn          50:01:39:70:00:00:B1:25
map
local-id      0
```

Related Information

- "Implementing User Authorization" on page 37
- "Administration Task Overview" on page 18

Implementing User Authorization

Oracle's internal IMS service authenticates admin users and grants users a role. A role controls the access the fabric. The IMS service is the Oracle Fabric OS local system, which is always present. Adding admin users and roles is performed through the GUI.

The internal IMS ensures that you can always log in to the chassis using a local account if connections to an external service are lost. After you apply the configuration, the IMS service is completely transparent to the operators.

These topics describe how to manage users and roles.

- "Internal IMS" on page 37
- "Users and Roles" on page 38
- "View Privileges for a User" on page 38

Related Information

- "Configuring IB Switching" on page 45
- "Configuring the Virtualization Switch and I/O Modules" on page 57

Internal IMS

The Oracle Fabric OS IMS is installed with a predefined administrator (`admin`) account. Use the GUI to add additional `admin` users. For more information, refer to "Managing Users" in *Oracle Fabric Manager 5.0.2 Administration Guide*.

User accounts and roles are tied together:

- Create user accounts to control access to the chassis.
- Grant privileges with roles, to determine what the user can do.

Use the GUI to add, manage, and remove admin users for Oracle Fabric OS. Use the CLI to view admin users and set the administrator password.

Note - Microsoft's AD and RADIUS are not supported for Oracle Fabric OS.

Related Information

- "Users and Roles" on page 38
- "View Privileges for a User" on page 38

Users and Roles

A role defines a user's privileges. Use the GUI to add admin users and assign roles. You can use the GUI or the CLI to view admin users and roles. This table lists the predefined roles in Oracle Fabric OS and what each role can do.

Role	Access
administrators	Creates, edits, and manages the Oracle Fabric OS. Superuser.
network	Creates, edits, and deletes server profiles, vNICs, Ethernet cards and ports, and virtual networks.
operators	Allows read-only access, including all show commands.
server	Creates, edits, and deletes server profiles, and operates the physical server.
storage	Creates, edits, and deletes server profiles, vHBAs, and FC I/O cards and ports.

If you do not specify a role for an admin user, the user is assigned to the operators role (read-only privileges).

Related Information

- "View Privileges for a User" on page 38
- "Set System Password Strength" on page 122

▼ View Privileges for a User

You can perform this task using either the CLI and the GUI. To use the GUI procedure, refer to "Assign a Role to a User" in *Oracle Fabric Manager 5.0.2 Administration Guide*. This procedure uses both the GUI and the CLI.

1. **Log in to the GUI.**

See "Log In to Oracle Fabric Manager (GUI)" on page 22.

2. **In the GUI, add an admin user and assign a role to the user.**

Refer to "Assign a Role to a User" in *Oracle Fabric Manager 5.0.2 Administration Guide*. See role descriptions in "Internal IMS" on page 37.

3. **In the GUI or the CLI, verify that the admin user was configured correctly.**

```
[OFOS] show user macki
name          role              descr
----------------------------------
macki        administrators
1 record displayed
```

4. **In the CLI, test the new user account.**

```
[OFOS] quit
Connection to 192.168.8.133 closed.
$ ssh macki@192.168.8.133
Password:
[OFOS] pwd
/home/macki
```

5. **(Optional) Determine if you will implement a VLAN or configure an IB switch.**

See "Planning a VLAN" on page 41 or "Configuring IB Switching" on page 45.

Related Information

- "Planning a VLAN" on page 41
- "Set System Password Strength" on page 122

Planning a VLAN

A VLAN is a private, independent, logical network that is created within a physical network. A VLAN behaves like an ordinary LAN, but connected devices do not have to be physically connected to the same network segment.

These topics explain how to plan your VLAN configuration and modify vNIC information for host-managed VLANs that were configured for the fabric. Use the GUI to create and manage a VLAN. For more information, refer to the *Oracle Fabric Manager 5.0.2 Administration Guide*.

- "VLAN Overview" on page 41
- "VLAN Configuration" on page 43
- "Prepare to Add a VLAN" on page 44
- "Properties of a vNIC's VLAN" on page 44

Related Information

- "Configuring Ethernet Connectivity With vNICs and vHBAs" on page 99
- "Working with a LAG" on page 105

VLAN Overview

A VLAN enables you to isolate and secure the network by creating a smaller, more focused virtual LAN within the overall network. The gateway uses the ports of the Oracle IB switch.

Use the following information to plan your VLAN:

- Each gateway can only have one untagged public-network, which has a default of `vlan 1`.
- Each gateway can have multiple tagged public networks.
- Each tagged public network can have a range of VLANs.
- The ports on each gateway share a VLAN. Therefore, the VLAN range of the public networks that terminate on the same gateway ports cannot overlap. For example, if you want all ports to have a 2-4096 vlan range, create one public network terminated on a LAG with

all four ports. The Oracle Fabric OS software automatically checks and blocks incorrect overlapping operations.

In this figure, no isolation exists and all hosts (s1, s2, s3, and s4) are visible to each other on the network. This scenario might not be useful in situations where you want some hosts to be isolated from others. You can use VLANs to achieve this isolation.
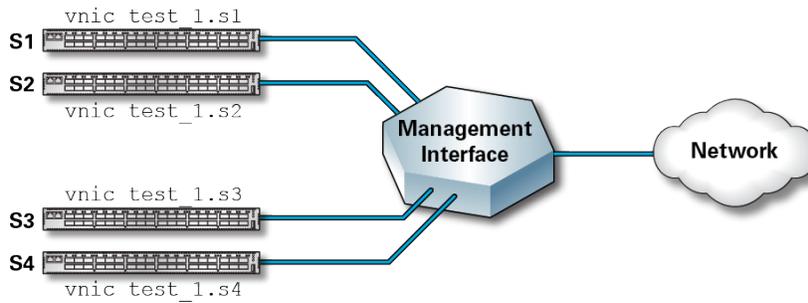
In this figure, configured VLAN packets are tagged with unique VLAN IDs and are transmitted and received on specific vNICs to support communication between specified servers. For example, the packets that are supported on vNICs in VLAN 5 are transmitted and received on interfaces that support VLAN 5. As a result, only hosts s1 and s2 know about each other, and traffic to and from those hosts is kept isolated from hosts s3 and s4 in VLAN 10. Servers s3 and s4 know only about each other and traffic for hosts s3 and s4 is also kept isolated from traffic related to VLAN 5.
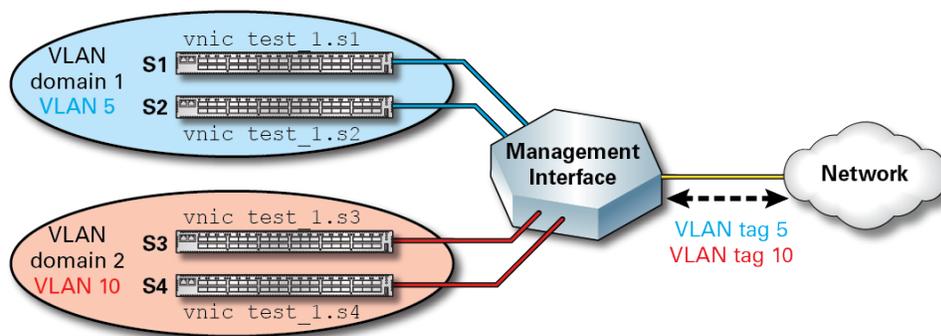
Related Information

- "VLAN Configuration" on page 43

■ "Configuring Ethernet Connectivity With vNICs and vHBAs" on page 99

VLAN Configuration

To support host-managed VLANs, the vNIC must be created in `trunk` mode. All vNICs are created and configured using the GUI.

This mode informs the vNIC configuration software on the chassis that the VLANs are configured from the host side and the fabric should honor VLAN configuration requests coming from the host. The fabric can thus allow tagged packets to go across this vNIC which otherwise would get dropped when the vNIC is in the `access` mode of operation.

Host-managed VLANs are configured and managed from the host server using the native OS tools. This method can help administrators by allowing them to use traditional administrative tools and methods to configure the vNIC accordingly.

A successful VLAN configuration requires you to configure the following parameters:

1. Ethernet port parameters – Ethernet port parameters are set first.
2. VNIC parameters – The vNIC parameters are set after the port parameters.

Configuring VLANs requires you to set VLAN properties on an Ethernet port and on any vNICs terminating on that port. The names and definitions of VLAN properties for an Ethernet port and a vNIC are identical. For the syntax, refer to "lag" in *Oracle Fabric OS 1.0.2 Command Reference*.

These properties collectively define rules that govern how the fabric operates and handles VLAN tagged and untagged frames.

When you originally configured a VLAN, you set VLAN properties on the Ethernet port before any vNICs are assigned to it. Any mismatch in configuration results in improper handling of data traffic.

Note - A VLAN can be configured for a LAG as well as an Ethernet port. Any VLAN properties configured for the LAG are set on all Ethernet ports in the LAG group, the same as a single Ethernet port in a VLAN. There are no special commands or configuration steps for configuring VLANs on a LAG.

Related Information

■ "Prepare to Add a VLAN" on page 44

▼ Prepare to Add a VLAN

1. **Determine if vNIC tags must be preserved between the fabric and a peer Ethernet device.**

   If tags must be preserved, the `port` mode must be set to `trunk` mode. If tags do not need to be preserved, the `port` mode must be set to `access` mode.

   Note - The fabric's `port` mode and the Ethernet switch's port mode must be set to the same operational mode (either `trunk` or `access`) to transmit or receive tagged or untagged packets between hosts.

   ---

2. **Determine if the host will be VLAN aware.**

   If the host will not be VLAN aware, set the vNIC to `access` mode.

   The mode you configure (`trunk` or `access`) affects both vNICs and Ethernet ports that are members of the VLAN. Whichever configuration method you choose, use the GUI to create the VLAN. Refer to the *Oracle Fabric Manager 5.0.2 Administration Guide*.

3. **Create the vNICs that will be members of the VLANs.**

   See "Create a vNIC" on page 100.

   Related Information

   - "Properties of a vNIC's VLAN" on page 44
   - "Configuring Ethernet Connectivity With vNICs and vHBAs" on page 99

Properties of a vNIC's VLAN

A vNIC uses the `access` mode of operation by default, and belongs to the same VLAN domain as its terminating port. Depending on the configuration method you choose, the VLAN properties might be set differently. For more information, refer to "Configuring vNICs" in *Oracle Fabric OS 1.0.2 Command Reference*.

The vNICs are created and terminated on the port with appropriate VLAN properties.

Related Information

- "Configuring IB Switching" on page 45
- "Configuring Ethernet Connectivity With vNICs and vHBAs" on page 99

Configuring IB Switching

IB is a high-bandwidth messaging technology that is used for high-performance computing. IB interconnects processor nodes and I/O nodes to a system area network. The leaf switch contains up to 38 4x IB ports to provide switching for the fabric, while the virtualization switch has up to 100 12x IB ports that support EDR speeds.

SM groups manage the switching on an IB subnet. Use the GUI to create SM groups that contain the switches where OpenSM will run. Using the GUI ensures that the configuration changes for an SM group are applied to all the affected devices.

These topics explain how IB works and demonstrates how to configure IB.

- "IB Features" on page 45
- "Configuring IB" on page 46
- "Understanding SM Groups" on page 48
- "Troubleshooting End-to-End IB Path Continuity" on page 50

Related Information

- "Configuring the Virtualization Switch and I/O Modules" on page 57
- "Configuring vHBAs" on page 71

IB Features

The IB interconnect is controlled by the following features:

- **IB ports** – IB ports provide switching for the fabric. See "Understanding Ports" on page 31.
- **IB nodes** – The three types of IB nodes include channel adapters, switches, or routers.
- **SM, Trusted MKey, and Untrusted MKey tables** – These SM management key tables initialize and configure network switches. All SM groups in the fabric must be configured with the same readable `M_KEY` value.
- **Jumbo frames** – Increases the throughput for Oracle FCAs. Set the jumbo frames before you create a public network. Up to 10,000 jumbo frames are supported for an Ethernet

gateway. For the syntax, refer to "set system" in *Oracle Fabric OS 1.0.2 Command Reference*.

- **Subnet and subnet partitions** – You can create a subnet or a subnet partition. A change to a subnet partition affects the whole subnet.
- **SM group** – The SM group manages the switching tables within the IB fabric. When there are multiple SM groups on a subnet, an election algorithm determines which SM group will be the master group. The SM group is responsible for the following actions:
  - Discovering the physical topology of the subnet.
  - Assigning a priority.
  - Assigning group members.
  - Assigning LIDs (to the end nodes, switches, or routers).
  - Establishing possible paths among the end nodes.
  - Sweeping the subnet, discovering topology changes and managing changes as switches are added and deleted.

Related Information

- "Configuring IB" on page 46

Configuring IB

Configure IB in the order described in the IB Configuration Task Overview.

Related Information

- "IB Configuration Task Overview" on page 46
- "Enable an IB Port" on page 47

IB Configuration Task Overview

IB Configuration Task	Link	Method
1. Enable an IB port.	"Enable an IB Port" on page 47	CLI
2. Create and configure an SM group.	"Create an SM Group" in *Oracle Fabric Manager 5.0.2 Administration Guide*	GUI
4. Verify SM information.	"Manage SM Group Information" on page 49	GUI
5. Troubleshooting.	"Troubleshooting End-to-End IB Path Continuity" on page 50	CLI

Related Information

- "Enable an IB Port" on page 47
- "Configuring Ethernet Connectivity" on page 93

▼ Enable an IB Port

This procedure is for the CLI.

1. **Determine which IB port you want to enable.**

2. **Enable the IB port.**

   For example:

   ```
   [OFOS] set infiniband-port embedded/1 up
   ```

3. **Verify that the IB port is enabled.**

   ```
   [OFOS] show infiniband-port
   name            state            mode_state       guid
   -------------------------------------------------------------
   embedded/1      up/down          switching        0
   embedded/2      up/down          switching        0
   embedded/3      up/down          switching        0
   embedded/4      up/down          switching        0
   embedded/5      up/down          switching        0
   embedded/6      up/down          switching        0
   embedded/7      up/down          switching        0
   embedded/8      up/down          switching        0
   embedded/9      up/down          switching        0
   embedded/10     up/down          switching        0
   embedded/11     up/down          switching        0
   embedded/12     up/down          switching        0
   embedded/13     up/down          switching        0
   embedded/14     up/down          switching        0
   embedded/15     up/down          switching        0
   embedded/16     up/down          switching        0
   embedded/17     up/down          switching        0
   embedded/18     up/down          switching        0
   embedded/19     up/down          switching        0
   embedded/20     up/down          switching        0
   embedded/21     up/down          switching        0
   embedded/22     up/down          switching        0
   embedded/23     up/down          switching        0
   embedded/24     up/down          switching        0
   embedded/25     up/down          switching        0
   embedded/26     up/down          switching        0
   ```

```
embedded/27      up/down            switching           0
embedded/28      up/down            switching           0
embedded/29      up/down            switching           0
embedded/30      up/down            switching           0
30 records displayed
```

4. **(Optional) If you plan to use SM groups, create and configure them now.**

    See "Manage SM Group Information" on page 49.

    Related Information

    ■ "Understanding SM Groups" on page 48

Understanding SM Groups

The fabric can support thousands of servers in a single IB subnet, and the fabric can support up to 64,000 subnets. Use the GUI to create, configure, and view an SM group. You can also use the CLI to view a configured SM group.

Related Information

■ "SM Group Configuration Overview" on page 48
■ "Manage SM Group Information" on page 49

SM Group Configuration Overview

The IB SM group provides address lookup service for end nodes. When you create an SM group, you can assign multiple SM devices to that group to provide redundancy for your IB subnets.

An SM group should contain the switches where OpenSM will run. Using the GUI to set this up ensures that the configuration changes for an SM group are applied to all the affected devices.

The SM group performs the following configuration tasks on the IB fabric:

■ Assigns LIDs to all HCAs and switch ports in the fabric.
■ Programs switch forwarding tables based upon selected routing algorithm.
■ Programs P_KEY tables on HCAs and switches.

Related Information

■ "Manage SM Group Information" on page 49

▼ Manage SM Group Information

Use the GUI to create, configure, and view a configured IB SM group. You can also use the CLI to view a configured SM group.

1. **Log in to the GUI.**

   See "Log In to Oracle Fabric Manager (GUI)" on page 22.

2. **In the GUI, create an SM group that will contain the switches where OpenSM will run.**

   Refer to "Create an SM Group" in *Oracle Fabric Manager 5.0.2 Administration Guide*.

3. **In the GUI, configure the SM properties, including prefix and priority as well as group members and key sets.**

   By default, the SM is disabled. Refer to "Managing SM Group Details" in *Oracle Fabric Manager 5.0.2 Administration Guide*.

4. **In the GUI or the CLI, verify the configured properties.**

   a. **Verify the general properties.**

   ```
   [OFOS] show ib sm
   subnet-name              leaf_01
   subnet-id                10e08b53a80005
   subnet-prefix-id         0
   chassis-id               10e08b53a80005
   state                    up/master
   priority                 10
   handover-enabled         true
   log-level                3
   subnet-lid-range-start   0
   subnet-lid-range-end     bfff
   router-lid-range-start   0
   router-lid-range-end
   routing-engine           ftree
   ```

   b. **Verify the SM group named ABC.**

   ```
   [OFOS] show ib sm-group ABC
   name
   ABC
   ```

   c. **Verify the group members.**

   ```
   [OFOS] show ib sm-group group-name group-member
   chassis-name     chassis-ipaddr          chassis-guid
   delaware         x.x.x.x                 0x2c9020023f4c1
   ```

d. Verify the key sets.

```
[OFOS] show ib sm-keyset
sm-key      trusted-key     untrusted-key       isActive
333         3331234         333abcd             true
777         7771234         777abcd             false
```

e. Verify the SM partition.

```
[OFOS] show ib partition
name     pkey      type       oper-pkey     isIPoIB     useGRH      adminPartition
JJJ      777       subnet     8777          true        false       false
```

f. Verify the ports on the SM partition named JJJ.

```
[OFOS] show ib partition JJJ ports
port-guid             pkey     oper-pkey     membership     subnet-prefix
0x2c9020023f4c1       777      8777          limit          1234314
0x2c9020023f4c2       777      8777          full           4323333
```

g. Verify the groups on the SM partition named JJJ.

```
[OFOS] show ib partition JJJ groups
type      membership     oper-pkey
all       both           8777
self      limit          8777
```

5. (Optional) Determine how you will configure Ethernet connectivity.

See "Configuring Ethernet Connectivity" on page 93.

Related Information

- "Troubleshooting End-to-End IB Path Continuity" on page 50
- "Enable an IB Port" on page 47

Troubleshooting End-to-End IB Path Continuity

The show ib-path diagnostic command traces the IB path from the host server through the IB fabric. Use this functionality to troubleshoot virtual resources that are encountering a problem, or if you suspect a problem with the IB path between the hosts and the fabric.

Related Information

- "IB Path Overview" on page 51

-
-

IB Path Overview

The `show ib-path` command displays the entire IB path, including the individual links that comprise the overall IB path. A typical IB path might contain the following items:

- A link from a host server's HCA to an IB switch that is located between the host and the fabric.
- A link from the IB switch to the fabric.
- One or more links within each fabric that correspond to links between the hardware on the fabric board.

At each of these individual links, performance statistics and error counters are tracked and displayed in a table so that you can check the functionality of the IB path at different points. In the CLI, use the following syntax for the `show ib-path stats` command:

show ib-path stats *physical-server1 physical-server2*

Note - Virtual resources must be deployed to the I/O card where you want to display the IB path. If you issue this command and nothing is displayed, there are no vNICs or vHBAs configured on the server.

Additional information about the statistics includes the following:

- Statistics are not polled or refreshed at regular intervals, so you must explicitly issue the command every time you want to display an updated set of statistics.
- You can reset statistics to zero to allow them to accumulate by using the optional `-clear` option.
- Statistics are reset if the fabric board is reset. For example, the fabric is power cycled.

Related Information

-

▼ Determine the IB Path Continuity

If you have `root` access to the fabric, you can log in as the `root` user and use the `ibclear errors` command and then the `ibcheckerrors` command to reset all the IB error counters. This action starts a fresh statistics-gathering session. This step is not mandatory, but if you decide

to perform it, log out and log back in to the fabric as the `admin` user to run the `show ib-path stats` command.

This procedure is for the CLI.

1. **Determine which server is experiencing problems.**

2. **Log in to the fabric as the `admin` user.**

3. **Verify that the server appears in the resulting list.**

   Type the `show ib path-stats` command without any qualifiers and press Tab or a question mark (?). For example:

   ```
   [OFOS] show ib path-stats ?
   Possible completions:
       10e08508ac0005  Port Guid of host nsn178-42
       10e085095a0005  Port Guid of host nsn178-76
       10e08b53a80005  Port Guid of host leaf_01
       10e09a86500005  Port Guid of host hca-10e09a86500004
       2c9030057b4de   Port Guid of host nsn178-32
   ```

4. **Clear the counters on the server to get a fresh batch of statistics.**

   For example:

   ```
   show ib path brick -clear
   ```

5. **Display the IB path and counters.**

   See the example in "Determine the IB Path Continuity" on page 51.

   ### Related Information

   -

Example: IB Path and Counters

The output of the `show diagnostics ib-path` command is displayed in a top-down manner, which represents the IB path's flow from the server to where it terminates the IB path on the fabric.

```
[OFOS] show ib path-stats 10e0000186a7f1 10e09a863c0005
--------------------------------------------------------
name                      ibpath
link-id                   0
from-node-id              10e0000186a7f1
to-node-id                d03480e0100003ff
from-node-symbol-errs     0
from-node-link-downed     1
```

```
from-node-rcv-errs              0
from-node-rcv-switch-relay-errs  0
from-node-rcv-pkt               149059286
from-node-trans-disc            17
from-node-trans-pkt             66244051
to-node-symbol-errs             0
to-node-link-downed             0
to-node-rcv-errs                0
to-node-rcv-switch-relay-errs   0
to-node-rcv-pkt                 0
to-node-trans-disc              0
to-node-trans-pkt               0
--------------------------------------------------------
name                            ibpath
link-id                         1
from-node-id                    d03480e0100003ff
to-node-id                      685580e0100003ff
from-node-symbol-errs           0
from-node-link-downed           0
from-node-rcv-errs              0
from-node-rcv-switch-relay-errs  0
from-node-rcv-pkt               0
from-node-trans-disc            0
from-node-trans-pkt             0
to-node-symbol-errs             0
to-node-link-downed             0
to-node-rcv-errs                0
to-node-rcv-switch-relay-errs   0
to-node-rcv-pkt                 2512
to-node-trans-disc              0
to-node-trans-pkt               2536
--------------------------------------------------------
name                            ibpath
link-id                         2
from-node-id                    685580e0100003ff
to-node-id                      10e09a863c0001
from-node-symbol-errs           0
from-node-link-downed           0
from-node-rcv-errs              0
from-node-rcv-switch-relay-errs  0
from-node-rcv-pkt               2512
from-node-trans-disc            0
from-node-trans-pkt             2536
to-node-symbol-errs             0
to-node-link-downed             0
to-node-rcv-errs                0
to-node-rcv-switch-relay-errs   0
to-node-rcv-pkt                 631
to-node-trans-disc              0
to-node-trans-pkt               658
--------------------------------------------------------
```

```
name                          ibpath
link-id                       3
from-node-id                  10e09a863c0001
to-node-id                    10e09a863c0005
from-node-symbol-errs         0
from-node-link-downed         0
from-node-rcv-errs            0
from-node-rcv-switch-relay-errs  0
from-node-rcv-pkt             631
from-node-trans-disc          0
from-node-trans-pkt           658
to-node-symbol-errs           0
to-node-link-downed           0
to-node-rcv-errs              0
to-node-rcv-switch-relay-errs 0
to-node-rcv-pkt               0
to-node-trans-disc            0
to-node-trans-pkt             0
```

The fields in the command output show information about performance and any errors on the links in the overall IB path. This table provides a brief description of the fields. For documentation, refer to the *InfiniBand Architecture Release 1.2.1, July 2007, Final Release*.

Field	Description
lid/port	The LID and port that the IB path is using.
width/speed	The link width and speed.
SymErrors	The Symbol Error Counter, which shows the total number of minor link errors detected on one or more IB lanes.
LnkRcov	The Link Error Recovery Counter, which shows the total number of times the port training state machine has successfully completed a link-error recovery.
LnkDwnd	The Link Downed Counter, which shows the total number of times the port training state machine has not successfully completed a link-error recovery, and as a result, has put the link into down state.
RxErrs	The Port Receive Errors Counter, which shows the total number of packets received on the port, but the packets contained errors.
RxSwErr	The Port Receive Switch Relay Errors Counter, which shows the total number of packets received on the port that were discarded because they could not be forwarded by the switch relay.
TxDisc	The Port Transmit Discard Errors Counter, which shows the total number of outbound packets discarded by the port because the port is down or congested.
TxPkts	The Port Transmit Packets Counter, which shows the total number of packets transmitted on all virtual lanes from the port.
RxPkts	The Port Receive Packets Counter, which shows the total number of packets received on all virtual lanes on the port, including packets containing errors. Link packets are excluded.

Related Information

- "Configuring the Virtualization Switch and I/O Modules" on page 57
- "Configuring Ethernet Connectivity" on page 93

-

Configuring the Virtualization Switch and I/O Modules

The virtualization switch supports I/O modules, which provide Ethernet connectivity to servers and storage systems that are connected to the fabric. The virtualization switch and modules you requested were assembled to order and arrive at your site fully configured.

Note - I/O modules are not supported on the leaf switch.

The virtualization switch supports the following modules:

- Oracle F2 Dual Port 16 Gb Fibre Channel module
- Oracle F2 Quad Port 10GBase-T module
- Oracle F2 Long Range InfiniBand module
- Oracle F2 10 Gb and 40 Gb Ethernet module

Tip - If you have installed the Oracle F2 40 Gb Ethernet module, the 10 Gb module is also supported. You can also split each 40 Gb port into four 10 Gb ports. For more information on this module, refer to the *Oracle F2 10 Gb and 40 Gb Ethernet Module User's Guide*.

You might want to add a SAN or storage network to a virtualization switch. You can also add an additional module to the switch, remove a module, move a module, change a module's configuration, upgrade a module, or restart a module. The procedures are the same for all types of modules.

These topics explain how to configure the virtualization switch and the modules.

- "Managing the Virtualization Switch" on page 58
- "Managing a Module" on page 60

Related Information

- Oracle Fabric Interconnect F2-12 Product Page
- "Configuring vHBAs" on page 71

■ "Configuring Ethernet Connectivity" on page 93

Managing the Virtualization Switch

You can perform these actions on the virtualization switch:

■ Add users – See "View Privileges for a User" on page 38.
■ Configure IB switching – See "Configuring IB Switching" on page 45.
■ Set up Ethernet connectivity – See "Configuring Ethernet Connectivity" on page 93.
■ Configure a SAN or storage network – See "Configure a SAN or Storage Network" on page 58.
■ View virtualization switch details – See "Display Information for the Virtualization Switch" on page 59.

Related Information

■ "Configure a SAN or Storage Network" on page 58
■ "Display Information for the Virtualization Switch" on page 59
■ "Managing a Module" on page 60

▼ Configure a SAN or Storage Network

If you want to have the virtualization switch access a SAN or storage network, you must create and configure a vHBA.

1.   Create a vHBA.

See "Configure a vHBA" on page 74.

2.   Change the SAN or FC card attributes.

See the instructions in "Set FC Card Attributes" on page 81 and "Set FC Port Attributes" on page 81.

3.   After you configure the SAN or storage network, begin monitoring.

See "Monitoring Hardware and Software" on page 111.

Related Information

■ "Display Information for the Virtualization Switch" on page 59
■ "Managing a Module" on page 60

▼ Display Information for the Virtualization Switch

1.   Display the modules installed on the virtualization switch.

```
[OFOS] show iocard
slot        state     descr    type                    v-resources
-----------------------------------------------------------------------------
1           up/up              sanFc2Port16GbCard       1
2           up/up              gwEthernet4Port40GbCard  0
4           up/up              gwEthernet4Port10GbCard  0
5           up/up              ibSlm8Port100GbCard      0
7           up/up              sanFc2Port16GbCard       0
embedded    up/up              spineIb4Gw2PortCard      0
6 records displayed
```

You can also use the `show iocard` subcommands to view additional information:

- alarms

- cpu

- dmesg

- errors

- ioport

- ioports

- stats

- vhbas

- vnics

- warnings

Note - VHBAs are supported only for the virtualization switch. VHBAs are not supported for the leaf switch.

For more information on these commands, refer to the *Oracle Fabric OS 1.0.2 Command Reference*.

2.   Display the port status for all I/O ports on the virtualization switch.

```
[OFOS] show ioport
name           type                 state     descr    v-resources
-----------------------------------------------------------------------------
embedded/5     gwEthernet40GbPort   up/up               0
embedded/6     gwEthernet40GbPort   up/down             0
1/1            sanFc16GbPort        up/down             2
1/2            sanFc16GbPort        up/down             2
2/1            gwEthernet40GbPort   up/down             0
2/2            gwEthernet40GbPort   up/down             0
2/3            gwEthernet40GbPort   up/up               0
```

```
2/4              gwEthernet40GbPort      up/up                0
4/1              gwEthernet10GbPort      up/up                0
4/2              gwEthernet10GbPort      up/up                0
4/3              gwEthernet10GbPort      up/up                0
4/4              gwEthernet10GbPort      up/up                0
7/1              sanFc16GbPort           up/down              0
7/2              sanFc16GbPort           up/up                1
14 records displayed

[OFOS] show infiniband-port
name            state         mode_state      guid
----------------------------------------------------------------
embedded/1      up/up         switching       10e080510303ff
embedded/2      up/up         switching       10e080510303ff
embedded/3      up/down       switching       10e080510303ff
embedded/4      up/down       switching       10e080510303ff
5/1             up/down       switching       90f597e0100003ff
5/2             up/down       switching       90f597e0100003ff
5/3             up/down       switching       90f597e0100003ff
5/4             up/down       switching       90f597e0100003ff
5/5             up/down       switching       90f597e0100003ff
5/6             up/down       switching       90f597e0100003ff
5/7             up/down       switching       90f597e0100003ff
5/8             up/down       switching       90f597e0100003ff
12 records displayed

[OFOS] show multiconfig-port
name            port_type
----------------------------------
embedded/5      gwEthernet40GbPort
embedded/6      gwEthernet40GbPort
2/1             gwEthernet40GbPort
2/2             gwEthernet40GbPort
2/3             gwEthernet40GbPort
2/4             gwEthernet40GbPort
6 records displayed
```

Related Information

-
-

Managing a Module

When you order an additional module, it arrives fully configured according to your specifications. All of the module's I/O ports that are used for gateways, IB ports, or FC ports are automatically activated. The F2-12 virtualization switch supports the multi-type port. For

example, for the Oracle F2 4x40 Gb Ethernet module, each 40Gb port can be split into four 10G ports.

The configuration changes you can make include changing the module's port or connection information. You can also add, restart, remove, or upgrade a module. The procedures are the same for all types of modules.

If you want to back up the configuration of a module, use the system export command, which is also used to back up the Oracle Fabric OS. Use the system import command to restore a configuration. Refer to "system" in *Oracle Fabric OS 1.0.2 Command Reference*.

Related Information

- "Add a Module" on page 61
- "Change a Module's Configuration" on page 63
- "Restart a Module" on page 65
- "Move a Module" on page 66
- "Remove a Module" on page 67
- "Upgrade a Module" on page 68

▼ Add a Module

When you order an additional module, it arrives fully configured according to your specifications. Plug the new module into the virtualization switch and the software will recognize the module. This procedure uses the CLI.

1. Display the modules installed on the virtualization switch.

```
[OFOS] show iocard
slot          state     descr     type                       v-resources
-----------------------------------------------------------------------
1             up/up               sanFc2Port16GbCard         1
2             up/up               gwEthernet4Port40GbCard    0
4             up/up               gwEthernet4Port10GbCard    0
5             up/up               ibSlm8Port100GbCard        0
embedded      up/up               spineIb4Gw2PortCard        0
5 records displayed
```

2. Plug the new module into the appropriate slot in the virtualization switch.

> **Tip -** VHBAs are supported only for the virtualization switch. VHBAs are not supported for the leaf switch. If you want to add vHBAs or vNICs to a module, you must create them with the add vnic or add vhba command and associate them with a server profile. A vNIC can be bound only to network Ethernet cards, and up to 128 vNICs per I/O card are supported. A vHBA is bound only to SAN FC cards. For instructions, refer to "vnic" in *Oracle Fabric OS 1.0.2 Command Reference* and "vhba" in *Oracle Fabric OS 1.0.2 Command Reference*.

3.   Verify that the new module was recognized.

For example, the FC module was inserted into slot 7:

```
[OFOS] show iocard 7
---------------------------
slot     7
state    up/up
descr
type     sanFc2Port16GbCard
vhbas    0
qos
enables  -
---------------------------
1 record displayed

[OFOS] show iocard
slot         state     descr     type                      v-resources
-------------------------------------------------------------------------
1            up/up               sanFc2Port16GbCard         1
2            up/up               gwEthernet4Port40GbCard    0
4            up/up               gwEthernet4Port10GbCard    0
5            up/up               ibSlm8Port100GbCard        0
7            up/up               sanFc2Port16GbCard         0
embedded     up/up               spineIb4Gw2PortCard        0
6 records displayed
```

> **Tip -** If you are installing a module in a slot that previously held a different type of module, the show iocard command will show a mismatch and you might experience connectivity problems. To fix this problem, remove the I/O card information from the database by typing remove iocard *slot-number*. See "Remove a Module" on page 67.

Related Information

- "Change a Module's Configuration" on page 63
- Oracle F2 I/O Modules Product Page

▼ Change a Module's Configuration

To change the configuration or properties of a module that is in use, use this procedure. This procedure uses the CLI.

1. **Display the installed modules and the I/O card slots.**

```
[OFOS] show iocard
slot         state     descr    type                     v-resources
--------------------------------------------------------------------------
1            up/up              sanFc2Port16GbCard        1
2            up/up              gwEthernet4Port40GbCard   0
4            up/up              gwEthernet4Port10GbCard   0
5            up/up              ibSlm8Port100GbCard       0
7            up/up              sanFc2Port16GbCard        0
embedded     up/up              spineIb4Gw2PortCard       0
6 records displayed
```

2. **Display the properties for the card you want to change.**

```
[OFOS] show iocard 7
--------------------------
slot    7
state   up/up
descr
type    sanFc2Port16GbCard
vhbas   1
qos
enables -
--------------------------
1 record displayed
```

> **Note -** The FC card requires a vHBA, while other cards use a vNIC.

3. **Change the properties for the card, or the port information on an FC card.**

Use this command to change the length of the timeout for the FC link on an FC card. The default timeout is 30 seconds. Enter a value between 0 and 60 seconds. For example, enter a timeout value of 25 seconds for port 7/1:

```
[OFOS] set fc-port 7/1 -fc-link-down-timeout=25
```

For example, to change the description for any type of card:

```
[OFOS] set fc-card 7 -desc=West
```

4. **Verify the changes to the module.**

Verify the description that you entered in Step 3:

```
[OFOS] show iocard 7
----------------------------
slot    7
state   up/up
descr   West
type    sanFc2Port16GbCard
vhbas   1
qos
enables -
----------------------------
1 record displayed
```

Verify the new fc-link-down-timeout value that you entered in Step 3:

```
[OFOS] show fc-port 7/1 -detail
-----------------------------------------------------
name                     7/1
type                     sanFc16GbPort
state                    up/up
descr
wwnn                     50:01:39:71:00:56:70:0B
wwpn                     50:01:39:70:00:56:70:0B
rate                     auto/8Gbps
frame-size               2048/2048
exec-throttle            65535
int-delay                1000
fc-link-down-timeout     25
login-retry              8
login-timeout            4
fc-target-port-down-timeout 30
topo                     F
loop-delay               5
tape-support             true
sfp-type                 8G
vhbas_2Mb_mtu_size       0
vhbas                    0
guid                     10e09a864c0005
-----------------------------------------------------
1 record displayed
```

Tip - You can also use the `set fc-port` command to change the topology of a FC port:

- `f-port` – Specifies a point-to-point connection to the storage device through a FC switch. This type of connection supports NPIV. This is the default configuration for a FC module.
- `l-port` – Specifies a loop connection to the storage device without using a FC switch. this type of connection does not support NPIV. A port configured this way can support only a single vHBA.
- `n-port` – Specifies a point-to-point connection to the storage device without using a FC switch. This type of connection supports NPIV.

For instructions, see the *Oracle Fabric OS 1.0.1 Command Reference*.

Related Information

- "Restart a Module" on page 65

▼ Restart a Module

This procedure uses the CLI.

1. Determine which module you wish to restart.

```
[OFOS] show iocard
slot          state                 descr    type                      v-resources
--------------------------------------------------------------------------------
1             up/up                          sanFc2Port16GbCard         1
2             up/indeterminate               gwEthernet4Port40GbCard    0
4             up/up                          gwEthernet4Port10GbCard    0
5             up/up                          ibSlm8Port100GbCard        0
7             up/up                          sanFc2Port16GbCard in slot 0
5 records displayed
```

2. Restart the module and type y to confirm.

For example, restart the module in slot 2:

```
[OFOS] set iocard 2 reset
Resetting I/O cards will adversely affect any virtual I/O resource connected to them and
thus cut I/O to the physical servers.  Are you sure you want to reset the I/O card in
slot 2 (y/n)?
```

3. Verify that the module was restarted and is now in the up/up state.

Related Information

-
-

▼ Move a Module

To increase performance, you might want to move a module to another slot, to redistribute the modules on the virtualization switch. This procedure uses the CLI.

1. Display all installed modules.

```
[OFOS] show iocard
slot          state     descr     type                      v-resources
-----------------------------------------------------------------------
1             up/up               sanFc2Port16GbCard        1
4             up/up               gwEthernet4Port10GbCard   0
5             up/up               ibSlm8Port100GbCard       0
7             up/up               sanFc2Port16GbCard        0
11            up/up               gwEthernet4Port40GbCard   0
embedded      up/up               spineIb4Gw2PortCard       0
6 records displayed
```

2. Unplug the module you want to move.

For example, remove the module from slot 7.

3. Delete the I/O card information for that slot.

For example, remove the information for the FC module in slot 7 and confirm the removal by typing **y**.

```
[OFOS] remove iocard 7
This may disrupt traffic on all physical server that happen to be using the I/O card.
Remove iocard in slot 7 (y/n)?
```

4. Plug the module into the desired slot.

The module is automatically recognized and the I/O card reports the change.

Tip - If the new module is not recognized, run this command: add iocard *slot-number module-name*.

---

5. Verify that the FC module appears in the new slot.

For example, the FC module was plugged into slot 2.

```
[OFOS] show iocard
```

```
slot          state      descr     type                        v-resources
---------------------------------------------------------------------------
1             up/up                 sanFc2Port16GbCard          1
2             up/up                 sanFc2Port16GbCard          0
4             up/up                 gwEthernet4Port10GbCard     0
5             up/up                 ibSlm8Port100GbCard         0
11            up/up                 gwEthernet4Port40GbCard     0
embedded      up/up                 spineIb4Gw2PortCard         0
6 records displayed
```

Related Information

- "Remove a Module" on page 67
- "Upgrade a Module" on page 68

▼ Remove a Module

1. **Display all installed modules.**

```
[OFOS] show iocard
slot          state              descr     type                        v-resources
------------------------------------------------------------------------------------
1             up/up                         sanFc2Port16GbCard          1
2             up/up                         gwEthernet4Port40GbCard     0
4             up/up                         gwEthernet4Port10GbCard     0
5             up/up                         ibSlm8Port100GbCard         0
7             up/up                         sanFc2Port16GbCard in slot  0
5 records displayed
```

2. **Determine which module you want to remove.**

   Tip - The `v-resources` field contains the number of connected vNICs and vHBAs and the port status. If you want to remove the vHBAs or the vNICs that exist on a specific module, you must use the `remove vnic` or `remove vhba` command. For more information, refer to "vnic" in *Oracle Fabric OS 1.0.2 Command Reference* and "vhba" in *Oracle Fabric OS 1.0.2 Command Reference*.

3. **Unplug the module from the slot in the virtualization switch.**

   For example, unplug the module from slot 7. Removing the module can disrupt the traffic on the physical server that is using this I/O card.

4. **If you plan to add a module of a different type, delete the I/O card information from the database.**

If the slot will be occupied by a different type of module, you must delete the card information. For example, to delete all information for the FC module in slot 7 from the database, type this command and then **y** to confirm:

```
[OFOS] remove iocard 7
This may disrupt traffic on all physical server that happen to be using the I/O card.
Remove iocard in slot 7 (y/n)?
```

Tip - If you do not remove the I/O card information from the database, and you later install a different type of module, you might experience connectivity problems.

5. **Verify that the module was removed.**

```
[OFOS] show iocard
slot         state     descr     type                      v-resources
----------------------------------------------------------------------
1            up/up               sanFc2Port16GbCard        1
2            up/up               gwEthernet4Port40GbCard   0
4            up/up               gwEthernet4Port10GbCard   0
5            up/up               ibSlm8Port100GbCard       0
4 records displayed
```

Related Information

- "Upgrade a Module" on page 68

▼ Upgrade a Module

This procedure uses the CLI.

Tip - I/O modules are supported only on a virtualization switch. Modules are not supported on a leaf switch.

1. **Determine which module you want to upgrade.**

```
[OFOS] show iocard
slot         state     descr     type                      v-resources
----------------------------------------------------------------------
2            up/up               gwEthernet4Port40GbCard   0
3            up/up               sanFc2Port16GbCard        0
4            up/up               gwEthernet4Port10GbCard   0
embedded     up/up               sanFc2Port16GbCard        0
4 records displayed
```

2. **Upgrade the module.**

a. To upgrade the Oracle F2 Dual Port 16 Gb Fibre Channel Module, type this command and then type y to confirm.

```
[OFOS] system upgrade-io -slot=3
Are you sure you want to update the I/O Module software (y/n)?
```

The FC module is the only CPUM-based module.

b. To upgrade any other module that uses a Saturn chip, type this command and then type y to confirm.

```
[OFOS] system upgrade-saturn -slot=4
Are you sure you want to update the I/O Module software (y/n)?
```

You can also use the `system upgrade-saturn` command to upgrade a Saturn chip on an embedded slot on a management board:

```
[OFOS] system upgrade-saturn -slot=embedded
Are you sure you want to update the I/O Module software (y/n)?
```

3. Verify that the module was upgraded.

For example:

```
[OFOS] show iocard 4
```

Note - For information on upgrading the leaf switch or the virtualization switch, refer to "Updating the Firmware" in *Oracle EDR InfiniBand Switch and Virtualized I/O Systems Administration Guide*.

Related Information

- "Configuring vHBAs" on page 71
- "Managing a Module" on page 60

Configuring vHBAs

The Oracle vHBA virtualizes HBA connectivity. It appears to the OS as a physical HBA and enables a server to have an FC SAN attachment without having a physical HBA present. Instead of the host server using an HBA, an IB HCA is used, which then virtualizes the HBA and allows SAN connectivity.

Note - VHBAs are supported only for the virtualization switch. VHBAs are not supported for the leaf switch.

These topics explain how to plan and configure vHBAs.

Related Information

vHBA Topology

The following figure displays a typical vHBA topology.
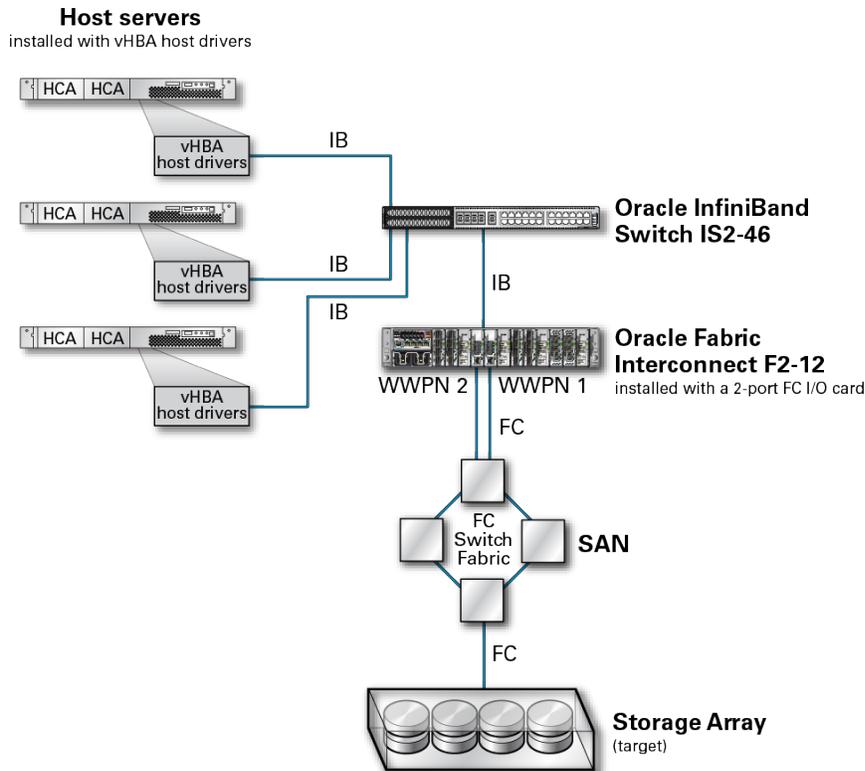
An IB connection exists between the Oracle Fabric Interconnect and host servers supporting the Oracle Virtual Networking vHBA host software stack. Up to 24 IB ports are supported. A 2-port FC I/O card connects to a SAN FC switch fabric. All the host server vHBAs multiplex through the FC ports on the I/O card. A storage array is attached to the switch fabric. Initiators are host servers that request I/O processing and actively seek out and interact with target devices on the SAN. Targets are passive storage devices (arrays, JBODs, RAIDs, and so on) that respond to requests sent by initiators. The fabric interconnect itself is an I/O initiator that provides a conduit for host-server initiators to send commands to the fabric.

Note - Some target devices also function as data replicators. In this case, these targets function as I/O initiators replicating data (syncing) to other locations.

The vHBA host software defines how the FC protocol is transported over IB. Without this software and the details of the transport, the vHBA will not function and the payload cannot be sent over IB.

Both initiators and targets have a WWNN and a WWPN. A 2-port FC card has one WWNN, and each port has its own WWPN. These IDs register with one another to establish communication.

NPIV enables multiple FC initiators (WWNs) to log in and occupy a single physical port. The switch (between the Oracle Fabric Interconnect and the storage device) must support NPIV and NPIV must be turned on. Some switches might require a software upgrade to support NPIV.

Without NPIV, a vHBA cannot log into the fabric. Some switches require you to configure the maximum number of NPIV logins.

Note - Reset the Oracle fabric interconnect's FC I/O module whenever the firmware is changed on the upstream FC switch. The I/O module rediscovers the updated FC settings with the `set iocard` *slot* `reset` command.

Related Information

- "Determining the Number of LUNs Supported on a Single Host" on page 73

Determining the Number of LUNs Supported on a Single Host

Each host server supports up to 256 LUNs. However, on some hosts, it might be possible to exceed the guideline of 256 LUNs per host by changing host hardware or software settings.

When you configure vHBAs on individual host servers, use the following formula to verify that your deployment is in compliance with the general guideline of less than or equal to 256 LUNs per host:

(Number of vHBAs) * (Number of Targets per vHBA) * (Number of LUNs per target) <= 256

where:

- Maximum number of vHBAs for a host is 16
- Maximum number of targets for an vHBA is 64
- Maximum number of LUNs per targets for a target is 256

Some examples of the formula and individual limits:

- (2 vHBAs) * (64 targets) * (2 LUNs) = 256, which complies with the rule of 256 total LUNs per host, and the maximum of 64 targets per vHBA
- (4 vHBAs) * (16 targets) * (4 LUNs) = 256, which complies with the rule of 256 total LUNs per host
- (16 vHBAs) * (4 targets) * (4 LUNs) = 256, which complies with the rule of 256 total LUNs per host, and the maximum of 16 vHBAs per host

- (4 vHBAs) * (4 targets) * (2 LUNs) = 32, which complies with the rule of 256 total LUNs per host. This example shows that less than 256 LUNs per host are supported.
- (1 vHBA) * (1 target) * (256 LUNs) = 256, which complies with the rule of 256 total LUNs per host, and the maximum of 256 LUNs per target

Related Information

- "vHBA Configuration" on page 74

vHBA Configuration

For syntax and examples of basic vHBA configuration, refer to the "Configuring a VHBA" in *Oracle Fabric OS 1.0.2 Command Reference*.

The procedure you use to remove a vHBA depends on the environment where it operates. See "Removing VHBAs" on page 84.

Related Information

- "Configure a vHBA" on page 74
- "vHBA Attributes and State" on page 76

▼ Configure a vHBA

Use this procedure to enable a minimum vHBA configuration.

Note - VHBAs are supported only for the virtualization switch. VHBAs are not supported for the leaf switch.

---

1. **Create a named server profile and bind it to a physical-server connection.**

   ```
   add server-profile myserver ceasar@iowa:ServerPort24
   ```

2. **Find an FC card on which you can terminate a vHBA.**

   For example, `sanFc2Port16GbCard`.

   ```
   show iocard
   slot        state    descr    type                v-resources
   ```

```
-----------------------------------------------------------------
1          up/up          sanFc2Port16GbCard   0
2          up/up          sanFc2Port16GbCard   0
3          up/up          sanFc2Port16GbCard   0
4          up/up          sanFc2Port16GbCard   0
4 records displayed
```

3.   Find an FC slot/port to which you will assign a vHBA.

In this example, 2/1 is used:

```
show ioport
name       type            state       descr       v-resources
-----------------------------------------------------------------
1/1        sanFc16GbPort   up/up                    0
1/2        sanFc16GbPort   up/up                    0
2/1        sanFc16GbPort   up/up                    0
2/2        sanFc16GbPort   up/up                    0
3/1        sanFc16GbPort   up/up                    0
3/2        sanFc16GbPort   up/up                    0
4/1        sanFc16GbPort   up/up                    0
4/2        sanFc16GbPort   up/up                    0
8 records displayed
```

The FC port (sanFc16GbPort) must be connected to an FC switch. In this case, the `show ioport` state will be `up/up`. If you see `up/down`, the cable might be disconnected from the port or the port could be disabled on the remote switch.

An FC port can auto negotiate its speed up to the following speeds:

- 4, 8, and 16 Gbps
- 8 and 16 Gbps

4.   Create a vHBA, bind it to the server profile, and specify a slot /port on which to terminate the vHBA.

`add vhba vhba1.myserver 2/1`

In this example, the vHBA is `vhba1` and the server profile is `myserver`. The FC slot is 2, and the FC port is 1. When you add a vHBA and specify a termination point, a vHBA is automatically created on the server (assuming the correct host software is installed). If devices connect through that port, the hosts will begin to discover the targets.

5.   To create another vHBA, repeat Step 3 and Step 4.

Note - vHBAs must be distinct on each chassis. For example, a vHBA named `VH1.SP1` cannot exist on two different chassis that connect to one or more common servers.

6.   Verify that the vHBA was created and its state is `up`.

```
show -list vhba vhba1.myserver
------------------------------------------------------------------
name            vhba1.myserver
state           up/up
fabric-state    initialized
if              2/1
if-state
wwnn            50:01:39:71:00:02:D1:1E
wwpn            50:01:39:70:00:02:D1:1E
map
local-id        0
------------------------------------------------------------------
1 record displayed
```

The state is up when the FC port is connected to a reachable FC switch.

If the state is *resourceUnavailable,* there is no FC connection. This field also displays *resourceUnavailable* when the server profile is not bound to a physical host resource, or the host cannot communicate.

There are three-levels of `oper-status` on the Oracle Fabric Interconnect: `card`, `port`, and `vhba`.

The access-control zoning on the switch must be set up properly in advance. Go to the switch and verify that the WWNs have logged in properly. Otherwise, you not see the appropriate devices through the vHBA in the CLI. When you perform the setup correctly, the prescan feature enables an unbound vHBA to display the discovered targets and LUNs in the network environment. At this point, an unbound vHBA can be bound to a server profile. For more information, see "Target Prescan and Rescan" on page 77.

The Oracle fabric interconnect supports both port zoning and soft zoning. In most cases, port zoning is preferred, but the method of zoning you use in your SAN is matter of choice based on how the SAN is connected.

Related Information

- "vHBA Attributes and State" on page 76

vHBA Attributes and State

Additional vHBA attributes are available through the `set vhba` command. These options allow for more customization of the vHBA than the basic configuration documented in the previous section. You can also control vHBA state through the `set vhba` command to set the vHBA to either up, down, or clear. For instructions, see "vhba" in *Oracle Fabric OS 1.0.2 Command Reference*.

When you bring a vHBA online it attempts to discover all the attached targets that are available to it. You can also have the vHBA relearn attached targets without bringing the vHBA down and then up. For more information, see "Target Prescan and Rescan" on page 77.

Related Information

- "Target Prescan and Rescan" on page 77
- "Set FC Card Attributes" on page 81

Target Prescan and Rescan

Target `prescan` and `rescan` enables you to discover the available target and LUN information on the network without requiring a host server to be bound to the Oracle Fabric Interconnect. Use this feature to determine if the list of targets and LUNs is satisfactory, or require any removals or additions, before committing them (binding) to a host-server profile. Oracle Fabric OS then supports binding the server profile with the `phys-con` after a prescan is complete.

The Oracle fabric interconnect relies on FC's RSCN to send target-state updates from the remote switch to the fabric interconnect. The fabric interconnect's FC module accepts the update and notifies the host server of any changes. By default, RSCN is turned off on some FC switches.

RSCN does not support reporting LUN state changes (add or remove). To compensate for this RSCN limitation, you must manually run `rescan` for a vHBA to detect any LUN level changes.

Related Information

- "Enable Prescan for an Unbound VHBA" on page 77
- Documentation for Oracle Fabric Interconnect F2-12

▼ Enable Prescan for an Unbound VHBA

Note - VHBAs are supported only for the virtualization switch. VHBAs are not supported for the leaf switch.

---

1. **Create an unbound server profile, where the state is `unassigned`.**

```
add server-profile III
show server-profile III
-------------------------------------------------------------
name       III
state      up/unassigned
...
```

2. **Create a vHBA under this unbound server.**

add vhba vhbaiii.III 4/1

At this point, the `show vhba` *vhba-name.server-profile* command reports the state as `resourceUnavailable`, which is expected. The vHBA is not bound to a server.

3. **Set this vHBA to the `prescan` state, which propagates target discovery to the FC I/O module (`sanFc2Port4GbLrCard`) on the Oracle Fabric Interconnect.**

   set vhba vhbaiii.III prescan

4. **Display the discovered targets and LUNs in the network environment.**

   If you add or remove a target on the array side, those changes are reflected on the fabric interconnect through RSCN.

```
show vhba vhbaiii.III targets
vhba name       wwnn                    wwpn                    lun-ids with values
 of 3,2,1,0
------------------------------------------------------------------------------------------------
vhbaiii.III    2F:9F:00:06:2B:10:C3:BA  2F:9F:00:06:2B:10:C3:BA
vhbaiii.III    2F:BF:00:06:2B:10:C3:BA  2F:BF:00:06:2B:10:C3:BA
vhbaiii.III    2F:DF:00:06:2B:10:C3:BA  2F:DF:00:06:2B:10:C3:BA
vhbaiii.III    2F:FF:00:06:2B:10:C3:BA  2F:FF:00:06:2B:10:C3:BA
4 records displayed

show vhba vhbaiii.III
------------------------------------------------------------------------------------------------
name          vhbaiii.III
state         resourceUnavailable
fabric-state  uninitialized
if            4/1
if-state      down
wwnn          50:01:39:71:00:00:F1:02
wwpn          50:01:39:70:00:00:F1:02
map
local-id      0
----------------------------------------------------------------------
1 record displayed
```

Related Information

- "Bind After a Prescan" on page 78

▼ Bind After a Prescan

You should bind the prescan-discovery results to a host server. Oracle Fabric OS supports binding the server profile with the `phys-con` after a prescan is complete, as long as you follow the correct configuration order.

Use this procedure to perform a prescan and then bind the server profile.

1. **Create an unbound server profile.**

   ```
   add server-profile III
   ```

2. **Create a vHBA under this unbound server.**

   ```
   add vhba vhbaiii.III 4/1
   ```

3. **Set this vHBA to prescan state.**

   ```
   set vhba vhbaiii.III prescan
   ```

4. **Display the targets.**

   ```
   show vhba vhbaiii.III targets
   ```

   If there are RSCN changes, the targets are updated.

5. **When you are satisfied with the results, bind the `server-profile`.**

   ```
   set server-profile III connect titan@ServerPort23
   ```

   This vHBA has now become a normal vHBA, and you can run rescan against it:

   ```
   set vhba vhbaiii.III rescan
   ```

   Note - You can no longer run prescan against this vHBA.

Related Information

- "Example: Remove Prior Prescan State" on page 79

Example: Remove Prior Prescan State

You can issue prescan several times. However, to detect LUN changes, the prior prescan state must be removed (remove-prescan) from the vHBA before you can re-issue prescan again.

```
set vhba vhbaiii.III remove-prescan
set vhba vhbaiii.III prescan
show vhba vhbaiii.III targets
```

Related Information

- "Detect LUN Changes" on page 80

▼ Detect LUN Changes

RSCN does not support reporting LUN state changes. For the Oracle Fabric Interconnect to detect LUN changes, you must manually run rescan for a vHBA. The rescan process runs to completion, then displays information for all vHBAs in down state.

Note - VHBAs are supported only for the virtualization switch. VHBAs are not supported for the leaf switch.

To detect LUN changes for a bound (normal) vHBA:

1. Create a bound server profile.

`add server-profile titan titan@ServerPort23`

2. Create a vHBA under this bound server.

`add vhba vhba888.titan 4/1`

3. Display the targets.

`show vhba vhba888.titan targets`

4. Configure this vHBA to rediscover (rescan state) the available LUN information.

If there are any LUN changes, they are reflected after this rescan operation:

`set vhba vhba888.titan rescan`

5. Display any new target and LUN information.

`show vhba vhba888.titan targets`

Related Information

- "Configuring FC Cards and Ports" on page 80

Configuring FC Cards and Ports

The FC card and FC port are controlled by different commands.

Related Information

- "Set FC Card Attributes" on page 81

-

Set FC Card Attributes

You can control the operational state of the FC card through the `set iocard` command. Commands that affect card state also affect the FC ports on the cards, and in turn, the vHBAs that are supported on the port.

Related Information

-

Example: Display FC Cards

This example shows how to display the properties of all FC cards.

```
show fc-card
slot    state    descr   type            vhbas   qos   enables
-----------------------------------------------------------------------
1       up/up            sanFc16GbPort   9               -
8       up/up            sanFc16GbPort   4       10    q
2 records displayed
```

Related Information

-

Set FC Port Attributes

Each FC port is controlled by a back-end logic chip, and a set of attributes and properties can be controlled from the command line. Some of the attributes are displayed only when using the `-detail` option for the `show fc-port` command.

```
show fc-port -detail
-----------------------------------------------------
name                    4/2
type                    sanFcPort
state                   up/down
descr
wwnn                    50:01:39:71:00:00:B0:21
```

```
wwpn                        50:01:39:70:00:00:B0:21
rate                        auto/0
frame-size                  2048/2048
exec-throttle               65535
int-delay                   1000
fc-link-down-timeout        30
login-retry                 8
login-timeout               4
fc-target-port-down-timeout 30
topo                        F
loop-delay                  5
tape-support                true
sfp-type                    8G
vhbas_2Mb_mtu_size          0
vhbas                       1
guid                        10e09a864c0005
--------------------------------------------------
1 record displayed
```

Note - The set fc-port commands have been implemented with defaults that are useful for most deployments. As a result, typically you do not need to change the FC port parameters. However, the set fc-port commands do support setting custom values. Oracle recommends that you use the default values for FC port parameters, and change them only if absolutely required.

The most commonly used fibre-channel controls are rate, topology (topo), frame-size, and execution-throttle. However, note that modified attributes do not take effect until you reset the I/O card. Refer to "fc-port" in *Oracle Fabric OS 1.0.2 Command Reference*.

Related Information

-

Example: Set the Link Down Time-Out

This example shows how to change the fc-port option. The new settings do not become effective until you reset the I/O card. To adopt new settings, the card must be reset using the set iocard command.

```
show ioport
name          type            state      descr    v-resources
-------------------------------------------------------------
embedded/1    sanFc16GbPort    up/up               0
embedded/2    sanFc16GbPort    up/up               0
```

```
embedded/3     sanFc16GbPort     up/up                    0
embedded/4     sanFc16GbPort     up/up                    0
embedded/5     sanFc16GbPort     up/up                    0
embedded/6     sanFc16GbPort     up/up                    0
4/1            sanFc16GbPort     up/up                    0
4/2            sanFc16GbPort     up/up                    4
8 records displayed
```
set fc-port 4/2 -fc-link-down-timeout=10
set iocard 4 reset
```
Resetting IO cards will adversely affect any virtual IO resource connected to them
and thus cut IO to the physical servers.
Are you sure you want to reset the IO card in slot 4 (y/n)?
```
y
show ioport 4/2 -detail
```
-----------------------------------------------------
name                          4/2
type                          sanFc16GbPort
state                         up/up
descr
wwnn                          50:01:39:71:00:00:B0:1F
wwpn                          50:01:39:70:00:00:B0:1F
rate                          auto/8Gbps
frame-size                    2048/2048
exec-throttle                 65535
int-delay                     1000
fc-link-down-timeout          10
login-retry                   8
login-timeout                 4
fc-target-port-down-timeout   30
topo                          F
loop-delay                    5
tape-support                  true
sfp-type                      8G
vhbas_2Mb_mtu_size            0
vhbas                         4
guid                          10e09a864c0005
-----------------------------------------------------
1 record displayed
```

Related Information

-

▼ Configure a Port for Direct-Attached Storage

The Oracle Fabric Interconnect supports direct-attached storage. Use this procedure to configure a port for this type of storage.

1. **Set the desired port type.**

   For example, to configure port 1 on I/O module 3 as an l port:

   ```
   set fc-port 3/1 -topology=n-port
   ```

2. **Reset the I/O card to make your change take effect.**

   For example:

   ```
   set iocard 3 reset
   ```

   You can configure each port on a card differently. Issue the reset command after making all port configuration changes.

   If you are reconfiguring a port, remove all but one vHBA from that port. Then follow the steps above to configure the port for direct-attached storage.

   Note - When you configure a LUN on this direct-attached device, you will see the WWPN of the port, not of the vHBA.

   ### Related Information

   - "Removing VHBAs" on page 84

Removing VHBAs

For each of these situations, use the same general procedure to remove a vHBA:

1. On the host server, stop I/O that uses the vHBA that you want to delete.
2. On the Oracle Fabric Interconnect, remove the vHBA.

For example, to delete the vHBA named news_storage:

```
remove vhba news_storage
```

Tip - Follow these procedures to remove vHBAs. Failure to follow the procedures can cause instability on the host server.

Related Information

- "Environments Where the General Procedure Applies" on page 85
- "vHBA Removal Procedure in Special Environments" on page 85

■ "Remove vHBAs Connected to Servers Using Direct Disk Access" on page 86

Environments Where the General Procedure Applies

Use the general procedure to remove a vHBA in one of these situations:

■ Connected to a native Linux server (not a VMware virtual machine) with no file system mounted and no other special circumstances (see the specialized instructions below for deleting a vHBA).
■ Connected to a non-multipath Linux server.
■ When you are migrating a server-profile.
■ Changing a server-profile configuration deletes all the vNICs and vHBAs contained in the profile.

Related Information

■ "vHBA Removal Procedure in Special Environments" on page 85

vHBA Removal Procedure in Special Environments

Determine if the vHBA is in any of the following environments:

■ VHBAs in a Linux multipathing environment.
■ VHBAs that mount a file system for a Linux server.

If so, use the instructions in "Remove vHBAs Connected to Servers Using Direct Disk Access" on page 86 and "Removing vHBAs Connected to Linux Servers" on page 86.

⚠ **Caution -** If your vHBA is in any of these special situations, do not use the general procedure. If you do, you risk causing instability in the server.

In most circumstances, removing a vHBA requires special steps not presented in the general procedure. If your vHBA is used in a Linux multipathing environment that mounts a file system for a Linux server you must use the procedure listed in the following table.

Related Information

-

Remove vHBAs Connected to Servers Using Direct Disk Access

Use the following procedure for removing vHBAs when the host server is accessing the storage directly. This procedure applies to regular Linux servers that do not use VMFS.

Related Information

-

▼ Removing vHBAs Connected to Linux Servers

This procedure applies to regular Linux servers. Use the following procedure to gracefully remove the vHBA:

1. **On the host server, stop all I/O on the vHBA that you want to remove.**

2. **Stop all applications that might attempt to access storage over the vHBA.**

3. **If you have a file system mounted, unmount the volume by using the Linux `umount` command.**

   For example, to unmount the /home volume:

   `umount /home`

4. **Remove the vHBA.**

   For example, to delete the vHBA named `news_storage`:

   `remove vhba news_storage`

5. **If appropriate, mount the volume by using the Linux `mount` command.**

   For example, to mount the device /deva/abc27 as /home:

```
mount /deva/abc27 /home
```

Related Information

▼ Remove a vHBA While Maintaining Service

The procedure in this section is recommended for host servers that are running mission-critical applications or applications that you do not want interrupted. This procedure does not involve a host server reboot. Instead, it unloads the vHBA driver from memory, then reloads the driver. When the driver is reloaded, a rescan is triggered.

This case is useful for situations where the host server has already booted and the vHBA drivers have been loaded into the host server's memory at least once. By unloading and loading the vHBA driver, you trigger a rescan so that storage device changes are relearned.

Note - VHBAs are supported only for the virtualization switch. VHBAs are not supported for the leaf switch.

This example shows how to gracefully delete a vHBA connected to a Linux host server in a multipath environment.

1. **On the host server, stop all I/O on the vHBA that you want to remove.**

2. **Shut down all applications that might be using storage resources through the vHBA.**

3. **On the host server, unmount all file systems attached to the Oracle Fabric OS driver.**

   ```
   umount device
   ```

4. **On the host server, stop the PowerPath service by issuing either of the following commands:**

   - ```
     /etc/init.d/PowerPath stop
     ```

   - ```
     service PowerPath stop
     ```

5. **On the Oracle Fabric Interconnect, remove the vHBA.**

   For example, to delete the vHBA named news_storage:

```
remove vhba news_storage
```

6. **On the host server, unload the Oracle Fabric OS vHBA driver.**

    ```
    modprobe -rv vhba
    ```

7. **On the host server, load the Oracle Fabric OS vHBA driver.**

    ```
    modprobe -v vhba
    ```

    Note - This step reloads the vHBA driver and triggers a rescan of the storage accessible through the vHBA.

8. **Start the PowerPath service, by issuing one of the following commands.**

    ■   `/etc/init.d/PowerPath start`

    ■   `service PowerPath start`

    Related Information

    ■   "Removing vHBAs in a Linux Multipath Environment" on page 88

Removing vHBAs in a Linux Multipath Environment

Oracle Virtual Networking supports multipathing through EMC PowerPath software, which is documented in the following procedures for illustrative purposes. Follow the instructions in "Removing a vHBA and Rebooting the Server" on page 88 if rebooting the host server is not a problem in your network. If you need to maintain service while making your changes, follow the instructions in "Remove a vHBA While Maintaining Service" on page 87.

Related Information

■   "Removing a vHBA and Rebooting the Server" on page 88

▼ Removing a vHBA and Rebooting the Server

You can use the following procedure to gracefully remove the vHBAs from a Linux server using multipathing. This procedure is the quickest and easiest method of removing vHBAs

because it concludes with a reboot of the host server. Rebooting the server causes the vHBA driver to be reloaded into the server memory, which will in turn trigger an automatic rescan of the storage network to learn the changes among devices.

This procedure is useful for host servers that are not running mission-critical applications, or that are running applications that can tolerate a short span of service interruption due to a reboot of the host server. This procedure can be useful when you are first bringing a server online and no other services are running.

Note - Rebooting the server will cause service interruptions for any running applications, so this procedure is recommended only for host servers that are running non-mission critical applications. If your host server cannot be rebooted, see "Remove a vHBA While Maintaining Service" on page 87.

To gracefully remove a vHBA from a Linux host server in a multipathing environment, perform the following steps:

1. **On the host server, stop all I/O on the vHBA that you want to remove.**

2. **Shut down all applications that might be using storage resources through the vHBA.**

3. **On the host server, unmount all file systems attached to the Oracle Fabric OS vHBA.**

   umount *device*

4. **On the host server, stop the PowerPath service by issuing one of the following commands.**

   - **/etc/init.d/PowerPath stop**

   - **service PowerPath stop**

5. **On the Oracle Fabric Interconnect, remove the vHBA.**

   For example, to delete the vHBA named news_storage:

   remove vhba news_storage

6. **Reboot the host server.**

   This step loads the vHBA driver into memory, triggers the rescan, and restarts PowerPath.

   Related Information

   - "vHBA Statistics" on page 90

vHBA Statistics

Operational and performance statistics are available for individual vHBAs through the `show vhba` command.

```
show vhba vhba1.crawford stats
-------------------------------------------------
name                              vhba1.crawford
total-io                          27136
read-byte-count                   3380540138
write-byte-count                  0
outstanding-request-count         0
io-request-count                  27136
read-request-count                27042
write-request-count               0
task-management-request-count     94
target-count                      36
lun-count                         0
xsmp-xt-down-count                3
xsmp-xt-oper-state-request-count  4
map-fmr-count                     27042
ummap-fmr-count                   27042
used-map-fmr-count                0
abort-command-count               0
reset-lun-command-count           0
reset-target-command-count        0
reset-bus-command-count           0
link-down-count                   1
disc-info-update-count            3
target-lost-count                 0
target-found-count                0
cqp-disconnect-count              4
dqp-disconnect-count              4
cqp-ib-snd-err-count              1
dqp-ib-snd-err-count              0
cqp-ib-rcv-err-count              0
dqp-ib-rcv-err-count              0
cqp-ib-remote-disconnect-err-count  0
dqp-ib-remote-disconnect-err-count  0
-------------------------------------------------
1 record displayed
```

You can also display vHBA statistics for multiple vHBAs by using a *wildcard*, (for example, the `show vhba` *wildcard* `stats` command).

Related Information

-

FC Monitoring

Use show fc-port to display FC port information. Use set fc-port to control the FC port settings. See "Set FC Port Attributes" on page 81.

Related Information

- "Example: Display FC Port Information" on page 91
- "Configuring Ethernet Connectivity" on page 93

Example: Display FC Port Information

```
show fc-port
name    type         state   descr   wwnn                      wwpn                     vhbas
-------------------------------------------------------------------------------------------------
8/1     sanFcPort    up/up            50:01:39:71:00:00:80:49   50:01:39:70:00:00:80:49  0

show fc-port 8/1 -detail
-------------------------------------------------------
name                        8/1
type                        sanFcPort
state                       up/up
descr                       for Pubs testing
wwnn                        50:01:39:71:00:00:80:47
wwpn                        50:01:39:70:00:00:80:47
rate                        auto/0
frame-size                  2048/2048
exec-throttle               65535
int-delay                   1000
fc-link-down-timeout        20
login-retry                 8
login-timeout               4
fc-target-port-down-timeout 60
topo                        F
loop-delay                  5
tape-support                true
vhbas                       1
-------------------------------------------------------
1 record displayed

show fc-port 8/1 stats
-------------------------------
name                        8/1
controller-errs             0
device-errs                 0
```

```
link-fails                   0
loss-of-syncs                1
loss-of-signals              0
primitive-seq-protocol-errs  0
transmission-word-errs       0
crc-errs                     0
-------------------------------
1 record displayed
```

Related Information

-

Configuring Ethernet Connectivity

The leaf switch and the virtualization switch provide high-speed GbE connectivity to connect cloud servers to a data center's LAN. These terms describe Ethernet connectivity:

- Default Ethernet gateway – Enables IP communication with hosts on different IP subnets. A default gateway enables centralized IP address administration from the fabric. A default gateway is configured as part of the OS installation, so you do not need to add or configure a default gateway.
- Public network – Enables access to other networks or an external Ethernet network.
- Server profile – Assigns connections and I/O configuration properties to a physical server.
- VNIC – Virtualizes Ethernet connectivity. A vNIC is a virtual NIC that appears to the OS as a physical NIC and enables a server to have an Ethernet network attachment without having a physical NIC present.
- LAGs – Combines multiple physical gateway ports into one logical port group to increase bandwidth and provide HA.
- PVI – Provides 100-GbE connections within the fabric.

Tip - The term *GUI* refers to the Oracle Fabric Manager GUI, while *CLI* refers to the Oracle Fabric OS CLI. Some procedures are performed in the GUI, some procedures are performed in the CLI, and some procedures use both.

These topics explain how to work with public networks, PVIs, and server profiles.

- "Working with Public Networks" on page 94
- "Configuring a PVI" on page 96
- "Creating Server Profiles" on page 98
- "Configuring Ethernet Connectivity With vNICs and vHBAs" on page 99

Related Information

- "Configuring IB Switching" on page 45
- "Understanding the Hardware" on page 25
- "Configuring Ethernet Connectivity With vNICs and vHBAs" on page 99

Working with Public Networks

A public network is used to connect to other networks or the Internet. A public network has few or no restrictions, so consider possible security risks when you access it. There is no technical difference between a private and public network in terms of hardware and infrastructure, except for the security, addressing, and authentication systems you use.

You can use the GUI to combine public networks into a single public cloud. For more information, refer to "Working With Public Clouds" in *Oracle Fabric Manager 5.0.2 Administration Guide*.

Related Information

- "Allowed VLAN Overview" on page 94
- "Create a Public Network" on page 95
- "Configure a Public Network" on page 95
- "Remove a Public Network" on page 96
- "Configuring a PVI" on page 96

Allowed VLAN Overview

Adding an allowed VLAN range controls which VLANs are allowed to pass over vNICs. When you specify `trunk` mode on a public network, you must also add a VLAN range. You cannot use `access` mode to receive the allowed VLANs setting. With this set of ranges of VLAN IDs that are allowed, only traffic that is in the specified VLAN range is allowed to pass over the vNICs connected to the network cloud. By default, this option is set to allow all VLANs (1-4095) on the network cloud. Allowed VLANs are configured per network, so the server will receive the associated VLAN traffic when one or more vNICs terminated in a network cloud is deployed to any number of servers.

The allowed VLAN range configured for the vNIC follows the vNIC. If you move or re-terminate the vNIC on a different server, the VLAN range remains configured for the vNIC as long as the vNIC is connected to the network cloud.

Related Information

- "Create a Public Network" on page 95

▼ Create a Public Network

This procedure creates a public network and configures it to use VLANs. This procedure is for the CLI.

1. **Create a public network and assign it to a group.**

   For example, this public network is named LLL on slot 2, port 1, and it belongs to the West group.

   ```
   [OFOS] add public-network LLL 333 2/1 -group-name=West
   ```

2. **Configure the public network to use VLANs.**

   For example, this public network uses a VLAN named INT.

   ```
   [OFOS] set public-network add allowed-vlans INT [start1-end,start2-end2]
   ```

   For a list of default values of a public network, refer to the "public-network" in *Oracle Fabric OS 1.0.2 Command Reference*.

3. **Verify the public network you created and configured.**

```
[OFOS] show public-network
name  group-name id   pkey  state  type    trunkMode mtu  oper-mtu mode description uplink allowed-vlans
----------------------------------------------------------------------------------------------------------
KKK   default    777  7fff  up/up  subnet true      1500 1500     UD                4.2    1-11
LLL   West       333  7fff  up/up  subnet true      1500 1500     UD                2/1    none
```

4. **(Optional) If you plan to use server profiles, create them now.**

   See "Create a Server Profile" on page 98.

   ### Related Information

   ■ "Configure a Public Network" on page 95

▼ Configure a Public Network

This procedure is for the CLI.

1. **Change the value specified for a public network.**

   For example, change the MTU value for the LLL public network by specifying a number between 1500 and 9194. The MTU value controls the maximum size of packet that is transmitted without fragmentation. The default value is 1500.

```
[OFOS] set public-network LLL  -mtu=4000
```

2.   Verify that the change was made to the public network.

```
[OFOS] show public-network
name  group-name id   pkey  state  type    trunkMode mtu   oper-mtu  mode description uplink allowed-vlans
-----------------------------------------------------------------------------------------------------------
KKK    default   777  7fff  up/up  subnet true       1500  1500      UD                0.1   1-11
LLL    default   333  7fff  up/up  subnet true       4000  4000      UD                2/1   none
```

Related Information

- "Create a Public Network" on page 95
- "Remove a Public Network" on page 96

▼ Remove a Public Network

Removing a public network removes all the connections to it. This procedure is for the CLI.

1.   Remove the public network.

For example, to remove the network called LLL.

```
[OFOS] remove public-network LLL
```

2.   Verify that the public network was removed.

```
[OFOS] show public-network
name  group-name id   pkey  state  type    trunkMode mtu  oper-mtu  mode description uplink allowed-vlans
----------------------------------------------------------------------------------------------------------
KKK    default   777  7fff  up/up  subnet true       1500 1500      UD               0.1    none
```

Related Information

- "Configuring a PVI" on page 96

Configuring a PVI

A PVI provides 100-GbE connections within the fabric. Use the set public-network command to make changes to a PVI. For more information, refer to "pvi" in *Oracle Fabric OS 1.0.2 Command Reference* and "public-network" in *Oracle Fabric OS 1.0.2 Command Reference*.

Related Information

-
-

PVI Cloud Overview

The GUI uses the term *PVI cloud*. PVI clouds are used with the fabric device to provide connections over the IB fabric to move non-data, non-I/O traffic around the network quickly. For example, you can use PVI clouds (and the PVI vNICs within them) for east-west traffic such as migrating one virtual machine from one server to another. For more information, refer to "Working With PVI Clouds" in *Oracle Fabric Manager 5.0.2 Administration Guide*.

Related Information

-

▼ Configure a PVI

This procedure is for the CLI.

1. **Review .**

2. **Create a PVI.**
   For example, add a subnet PVI called MMM with an ID of 321, and a pkey of 222.

   ```
   [OFOS] add pvi MMM 321 -type=subnet —pkey=222
   ```

   The -type option enables you to choose global to describe traffic between subnets, or subnet to indicate traffic within the subnet only.

3. **Configure the public network for the PVI.**

   ```
   [OFOS] set public-network MMM  -pkey=222
   ```

4. **Verify that the PVI was created.**

   ```
   [OFOS] show pvi
   name    id    pkey    state    type     mtu    oper-mtu    mode    description
   --------------------------------------------------------------------------------
   MMM     321   222     up/up    subnet   9000   1500        RC
   JJJ     444   7fff    up/up    global   9000   1500        RC
   ```

5. **(Optional) If you plan to use server profiles, create them now.**

See "Create a Server Profile" on page 98.

Related Information

- "Creating Server Profiles" on page 98

Creating Server Profiles

A server profile holds properties, such as vNIC configuration information, and the profile is assigned to a physical server.

Related Information

- "Server Profile Overview" on page 98
- "Create a Server Profile" on page 98

Server Profile Overview

When you assign a server profile, the host server assumes all of the server profile's I/O characteristics. Server profiles provide the flexibility to move an I/O configuration from one physical server to another. A server profile is connected to an HCA port. If your server uses dual-port HCAs, do not assign the same server profile to both ports.

For more detail on creating and managing a server profile using the CLI, refer to "server-profile" in *Oracle Fabric OS 1.0.2 Command Reference*.

Related Information

- "Create a Server Profile" on page 98

▼ Create a Server Profile

You can create a server profile in the CLI or the GUI. For the GUI procedure, refer to "Create an I/O Profile" in *Oracle Fabric Manager 5.0.2 Administration Guide*. This procedure is for the CLI.

1. **Create a server profile.**

For example, the server profile is named `mytest`.

```
[OFOS] add server-profile mytest ?
Possible completions:
  alexander@iowa:ServerPort8   Connection to host alexander (up)
  ceasar@iowa:ServerPort24     Connection to host caesar (up)
```

All the physical servers connected to the fabric are displayed. The two servers listed (`alexander` and `caesar`) were automatically discovered by the fabric.

2. **Select the desired server and create the server profile.**

```
[OFOS] add server-profile mytest alexander@iowa:ServerPort8
```

3. **Verify that the profile was created correctly.**

```
[OFOS] show server-profile mytest
name     state          descr                      connection  def-gw  vnics  vhbas
-------------------------------------------------------------------------------
mytest   up/unassigned  My first server profile                        1      1
1 record displayed
```

No I/O resources (vNICs or vHBAs) have been assigned to the new server profile. Resources will be assigned to the profile. See "Configuring Ethernet Connectivity With vNICs and vHBAs" on page 99.

If the state displays *unassigned*, the profile is created but not yet assigned to an actual host server. Use the `set server-profile` *name* `connect` *phys-server* command to assign the profile to a host server.

4. **(Optional) If you plan to use vNICs, configure them now.**
See "Create a vNIC" on page 100.

Related Information

- "Configuring Ethernet Connectivity With vNICs and vHBAs" on page 99
- "Planning a VLAN" on page 41

Configuring Ethernet Connectivity With vNICs and vHBAs

An Oracle vNIC virtualizes Ethernet connectivity. A vNIC is a virtual NIC that appears to the OS as a physical NIC and enables a server to have an Ethernet network attachment without having a physical NIC present. Instead of the client server using a NIC, an IB HCA is used and then virtualizes the NIC to allow Ethernet connectivity. The vNIC state information is stored on the chassis.

You might choose to create a VLAN to manage vNICs. A VLAN is a private, independent, logical network that is created within a physical network. A VLAN behaves like an ordinary LAN, but connected devices do not have to be physically connected to the same network segment. See "Planning a VLAN" on page 41.

Related Information

- "Configuring a VNIC" on page 100
- "Configuring IB Switching" on page 45

Configuring a VNIC

These topics describe how to create a vNIC and establish Ethernet connectivity.

Step	Action	Link	Method
1.	Add a server profile.	"Create a Server Profile" on page 98	CLI
2.	Create and configure a vNIC.	"Create a vNIC" on page 100	GUI or CLI

Related Information

- "Create a vNIC" on page 100

▼ Create a vNIC

During vNIC creation, you assign the vNIC to a server profile and set other properties. You can perform this task using either the CLI or the GUI. For the GUI procedure, refer to "Add a vNIC" in *Oracle Fabric Manager 5.0.2 Administration Guide*. This procedure is for the CLI.

1. Create a server profile.

For example, name the server profile `server1` and include the public network name.

`[OFOS]` **`add server-profile server1 alexander@iowa:ServerPort8`**

2. Create a vNIC.

For example, create a vNIC called *vnic1* and terminate it on the public network port `AAA`.

`[OFOS]` **`add vnic vnic1.server1 AAA`**

3. Configure the vNIC.

Assign the vNIC to a server profile and add a static address type and an IP address.

```
[OFOS] set vnic vinc1.server1 -addr-type=static -IP-address=10.1.1.1/32
```

4.   Verify the vNIC and its server profile.

```
[OFOS] show vnic vnic1.server1
name          state  mac-addr  ipaddr      if   if-state  type     vlans
------------------------------------------------------------------------
vnic1.server1 up/up            10.1.1.1/32      up        static   none
```

Related Information

- "Edit a vNIC" on page 101
- "Planning a VLAN" on page 41

▼ Edit a vNIC

You can change the properties of a vNIC. You can perform this task using either the CLI or the GUI. For the GUI procedure, refer to "Managing VNICs on a Physical Server" in *Oracle Fabric Manager 5.0.2 Administration Guide*. This procedure is for the CLI.

1.   Change the properties of the vNIC.

For example, you can change the address type to DHCP.

```
[OFOS] set vnic vinc1.server1 -addr-type=dhcp -IP-address=10.1.1.1/32
```

2.   Verify the change to the vNIC.

```
[OFOS] show vnic vnic1.server1
name          state  mac-addr  ipaddr        if   if-state   type    vlans
----------------------------------------------------------------------------
vnic1.server1 up/up            10.1.1.1/32        up         dhcp    none
```

Related Information

- "Remove a vNIC" on page 101
- "Create a vNIC" on page 100

▼ Remove a vNIC

You can perform this task using either the CLI or the GUI. For the GUI procedure, refer to "Delete vNICs" in *Oracle Fabric Manager 5.0.2 Administration Guide*. This procedure is for the CLI.

1.   Remove the vNIC.

Using the -noconfirm option causes the removal process to complete without prompting you for confirmation. The argument automatically answers yes to any prompts.

[OFOS] **remove vnic vinc1.server1 -noconfirm**

2. Verify that the vNIC was removed.

[OFOS] **show vnic**

Related Information

- "Display and Clear VNIC Counters and Statistics" on page 102
- "Edit a vNIC" on page 101

▼ Display and Clear VNIC Counters and Statistics

There are several ways to gather vNIC counters and statistics that are collected by the vNIC statistics model in the chassis. You can perform this task using either the GUI or the CLI. For the GUI procedure, refer to "Display vNIC Throughput" in *Oracle Fabric Manager 5.0.2 Administration Guide*. This procedure uses the CLI.

1. Display vNIC counters and statistics.

- **On the host server, display statistics collected by the OS through the network layer and the vNIC driver.**

    [OFOS] **ifconfig** *vnic-name*

    [OFOS] **cat /proc/driver/vnic/devices/** *vnic-name*

- **On the fabric, display statistics.**

    [OFOS] **show vnic** *vnic-name* *** throughput**

    [OFOS] **show vnic** *vnic-name* **vnic-stats**

2. Clear the vNIC counters and statistics.

- **On the host server, collect and dump monitoring and troubleshooting information for the host software installation.**

    → **/opt/xsigo/bin/xsigo-support**

- **On the fabric, clear the vNIC counters and statistics.**

    [OFOS] **set vnic** *vnic-name*.*server-name* **clear igmp-stats vnic-stats**

Related Information

-

Admin State Control

Use the Oracle Fabric OS `set vnic up|down` command to control the Admin State of a configured vNIC. For more detail, refer to "vnic" in *Oracle Fabric OS 1.0.2 Command Reference*.

Related Information

-

Working with a LAG

A LAG is a group of physical Ethernet gateway ports. A LAG enables you to combine multiple individual physical gateway ports into one logical port group. The ports that are combined into a LAG can operate in parallel to increase bandwidth and provide HA. The fabric supports multiple LAGs.

These topics explain how to configure a LAG and provide those benefits to your virtual resources.

- "Understanding LAGs" on page 105
- "Configuring LAGs" on page 108

Related Information

- "Configuring Ethernet Connectivity" on page 93

Understanding LAGs

When you configure a LAG, you specify a group name consisting of a slot number and LAG ID from 1 to 5, and then assign ports to the group. You must specify at least one port when you initially create the LAG. The Oracle Fabric OS software automatically checks and blocks incorrect overlapping operations.

Configure the LAG so that it contains an even number of ports. If the LAG contains an odd number of ports, the traffic load balance is not even. For example, if the LAG contains three ports, traffic load balance is 25%, 25% and 50%, rather than 33.3% on each port.

Tip - A vNIC can be bound to a LAG when the vNIC is created. If you are configuring a vNIC in a LAG, you must configure the LAG first. Doing this makes the LAG available as a selectable object.

LAGs are assigned on a one-to-one basis between the fabric and the peer Ethernet device. Therefore, the same ports cannot be assigned to multiple LAGs. For example, ports 1 through 5 cannot be assigned to LAG 2 and LAG 4.

LAGs are supported on 10-GbE ports and a 40-GbE port. Choose ports of the same speed when configuring a LAG. The Oracle Virtual Networking implementation of LAGs was designed with guidelines from the IEEE 802.3ad LAG standard.

Related Information

-
-
-
-

Port Assignment in the LAG

When you initially create a LAG, you must specify at least one of the 10 GbE ports. After the LAG is created, you can add individual ports to the LAG.

When a LAG contains multiple ports, traffic is mapped to the appropriate port based on a hashing algorithm that considers the following parameters of the packets originating from the vNICs in a LAG:

- Source and destination MAC address (if applicable)
- IPv4 source and destination addresses (if applicable)
- TCP and UDP source and destination ports (if applicable)

Ports that are assigned to a LAG remain part of the LAG regardless of their state. If a port is in the up/up state, and transitions to the up/down state, the port does not leave the LAG. Instead, it remains a member of the LAG but does not support traffic until it transitions back to the up/up state. When the port returns to the up/up state, it can resume operation in the LAG. However, only new traffic flows can be assigned to this port. Existing traffic flows are not remapped onto the port when it comes back up.

You assign static port membership in a LAG. Ports are not dynamically added or deleted based on LAG changes on the peer Ethernet switch. As a result, any time you make a LAG change on the peer device at the end of the Gigabit Ethernet link, you must make the corresponding change to the LAG on the fabric.

Related Information

-
-
-

LAG Considerations

As a general rule, the LAG configured on the fabric must match the LAG configuration on the peer device at the other end of the Ethernet link. Be aware of the following considerations:

- A LAG consists of multiple physical ports of the same speed. A LAG consisting of all 1-GB links is valid, but you cannot create a LAG with a mixture of speeds.
- Link properties between the fabric and the peer Ethernet device must be identical at both ends of the LAG. For example:
  - Link speed – Auto-negotiation on the peer Ethernet device can cause link speed to change.
  - Full duplex mode – Oracle Virtual Networking LAGs support only full-duplex communication.
  - These settings must be identical on both ends of the LAG. They cannot be changed for the LAG in runtime, so verify that they are identical before creating the LAG and populating it with ports.
- A LAG's ports must all reside on the same fabric slot. For example, you cannot create a LAG from ports on slot 5 and slot 6.
- LAG port changes are not reverted. As a result, if a port in the LAG goes down, traffic flows are remapped based on the hashing algorithm (see "Port Assignment in the LAG" on page 106). When the port comes back up, traffic does not revert back to the port that was originally supporting the traffic. Only new traffic flows can be mapped onto this port.

Related Information

- "LAG Numbering" on page 107
- "Configuring LAGs" on page 108

LAG Numbering

The fabric uses a slot and port numbering convention to identify the physical port that is the termination point for a vNIC. However, the standard slot and port numbering convention is not used for a LAG. Instead, you use a slot and a LAG ID from 0 to 5 separated by a period (.). For example, to specify LAG 4 on slot 0, you would identify that LAG as 0.4.

Related Information

- "Configuring LAGs" on page 108

Configuring LAGs

LAGs are supported on the fabric, but the LAG must also be configured on the peer Ethernet device. For syntax information, refer to "lag" in *Oracle Fabric OS 1.0.2 Command Reference*.

Setting options on the LAG might also require you to set the corresponding value for the peer Ethernet device's LAG configuration.

To set LAG options, vNICs cannot be assigned to the port. As a result, if a port is unassigned to a LAG and you want to assign it to a LAG, perform the following actions:

1. Delete any vNICs supported by the port.
2. Add the port to the LAG.
3. Add the vNICs to the port.

Note - After setting the LAG options, run the `show lag` command to verify the configuration changes.

There is no dependency for when to configure the peer or the fabric, so these commands can be issued on the peer before or after LAG is configured on the fabric. Refer to "Configuring LAGs" in *Oracle Fabric OS 1.0.2 Command Reference* for an example of LAG configuration for a peer device.

Related Information

- "Configure a Static LAG" on page 108

▼ Configure a Static LAG

This procedure assumes that you are creating a LAG with a LAG ID of 4 on slot 0, for ports 3,4,7, and 8. The LAG will use the default value for autonegotiation.

You can perform this task using either the CLI or the GUI. For the GUI procedure, refer to "Create a LAG" in *Oracle Fabric Manager 5.0.2 Administration Guide*. This procedure is for the CLI.

1. Create the LAG on the fabric.

Specify the first port that you want in the LAG. For example:

```
[OFOS] add lag embedded.4 port 3,4,7,8
```

⚠ **Caution -** LAGs require a period (not a slash) to differentiate them from a standard slot and port termination. The leaf switch always uses slot 0.

2. **Repeat Step 1 to add individual ports to the LAG.**

Note - The total number of ports that you can add to a LAG depends on the number of LAGs configured, with the maximum number of ports ranging from 10 configured in a single LAG to two ports configured in each of five LAGs.

3. **After you have configured the ports in the LAG, verify that the LAG was correctly added to the fabric.**

```
[OFOS] show lag
name         state   mac-addr          descr    mode     access-vlan   ports
---------------------------------------------------------------------------
embedded.4   down    00:13:97:5D:A0:01          access   1             3,4,7,8
```

4. **Configure vNICs that terminate on the LAG.**

   Use the add vnic command.

5. **(Optional) If you have not yet set up the Oracle Fabric OS tools to monitor your hardware and software, do that now.**

   See "Monitoring Hardware and Software" on page 111.

   Related Information

   - "Delete a LAG" on page 109

▼ Delete a LAG

You can delete a LAG at any time. When you delete a LAG, you also delete the LAG on the fabric's peer Ethernet device.

If you delete a LAG that contains ports, a confirmation warning is displayed. Deleting a port from a LAG can potentially cause a delay in packet transmission and reception on the vNICs that are configured on the port. This potential delay is temporary as traffic flows are remapped to another port in the LAG, and while TCP retransmits the packets. If you delete an empty LAG, the confirmation warning is not displayed.

You can perform this task using either the CLI or the GUI. For the GUI procedure, refer to "Remove a LAG" in *Oracle Fabric Manager 5.0.2 Administration Guide*. This procedure is for the CLI.

1. **Determine if you want to delete a LAG port, a single LAG, or all LAGs.**

   a. **Delete all LAGS from the chassis.**

   ```
   [OFOS] remove lag *
   Removing LAGs may disrupt virtual network traffic.  Remove all LAGs (y/n)?y
   ```

   Tip - Use the wildcard options of * or *.*.

   b. **Delete a single LAG from the fabric.**

   The LAG name is a slot and LAG ID separated by a dot. For example, LAG 0.4 is removed from the fabric:

   ```
   [OFOS] remove lag 0.4
   Removing LAGs may disrupt virtual network traffic. Remove LAG 0.4 (y/n)?y
   ```

   c. **Delete a port from a LAG.**

   You can delete a port from a LAG at any time, regardless of the port's state. If you delete the last port from the LAG, the LAG itself remains configured as an empty object. For example, port 8 is removed from LAG 0.4:

   ```
   [OFOS] remove lag 0.4 port 8
   Removing LAG ports may disrupt virtual network traffic.
   Remove port 8 from LAG 0.4 (y/n)?y
   ```

2. **Ensure that the port or LAG was removed.**

   ```
   [OFOS] show lag
   ```

   ### Related Information

   - "Monitoring Hardware and Software" on page 111
   - "Managing Oracle Fabric OS" on page 121

Monitoring Hardware and Software

The Oracle Fabric OS uses these tools to monitor the hardware, chassis, and software:

- SNMP – Monitor hardware and the chassis. Oracle Fabric OS supports only SNMP version 3.
- Alarms – View current alarms that are reported by the fabric.
- Diagnostics – Track and display performance statistics and error counters.

These topics describe how to configure and use the monitoring tools.

Related Information

Configuring SNMP

Use SNMP to configure trap hosts (trap destinations) that will receive events and errors. Oracle Fabric Manager also supports configuring SNMP variables, such as system ID strings.

The `get`, `getnext`, and `getbulk` operations are all supported. The `set` operations are not supported. Community strings are read-only. For more information, refer to "snmp" in *Oracle Fabric OS 1.0.2 Command Reference*.

You can use the GUI or the CLI to configure SNMP properties and users. For the GUI, refer to "Managing SNMP" in *Oracle Fabric Manager 5.0.2 Administration Guide*.

Related Information

- "Configure SNMP" on page 112
- "MIB Support" on page 113
- "IF-MIB" on page 113

SNMP Trap Destinations

In the CLI, use this command to inform the fabric where to forward the traps: `add snmp trap-dest` *IP-address*. Replace the *IP-address* with the IP address of the system that will receive SNMP traps.

Note - Trap IDs are not sequential because they use the virtual resource ID. Removed virtual resources will leave gaps in the virtual resource ID sequence.

Related Information

- "Configure SNMP" on page 112
- "MIB Support" on page 113
- "IF-MIB" on page 113

▼ Configure SNMP

You can configure SNMP in the Oracle Fabric Manager GUI or the CLI. For the GUI, refer to "Managing SNMP" in *Oracle Fabric Manager 5.0.2 Administration Guide*. The steps in this procedure use the CLI to configure SNMP.

1. Create an SNMP trap destination.

For example, this IP address will be the system that will receives SNMP traps.

```
[OFOS] add snmp trap-dest 192.168.100.10:162
```

2. Configure the details for SNMP.

For example, add a description, a contact name, hardware location, and system name.

```
[OFOS] set snmp -descr="Oracle Central"
[OFOS] set snmp -sys-contact=Macki_Anderson
[OFOS] set snmp -sys-location=Rack_C9
[OFOS] set snmp -sys-name=Colorado
```

3. Verify the SNMP configuration.

```
[OFOS] show snmp
```

```
descr            sys-contact     sys-name    sys-loc   trap-destinations
------------------------------------------------------------------------
Oracle Central   Macki_Anderson  Colorado    Rack_C9   192.168.100.10:162
(private/SNMPv3)
1 record displayed
```

4. **(Optional) You can perform system management tasks as needed.**

   See "Managing Oracle Fabric OS" on page 121.

   Related Information

   - "MIB Support" on page 113
   - "IF-MIB" on page 113

MIB Support

The MIB file is available on the fabric through the standard `admin` user login. The Oracle Fabric MIB is located in the `/opt/xsigo/xsigos/mibs` directory.

The only supported MIB is `IF.mib`, which is the fabric implementation of the standard MIBs.

Related Information

- "IF-MIB" on page 113

IF-MIB

These tables return valid values for SNMP queries:

- The `ifXTable` – 64-bit counters, object ID 1.3.6.1.2.1.31.1.1.1
- The `ifTable` – 32-bit counters, object ID 1.3.6.1.2.1.2.2.1

This table lists statistics available in the `ifXTable`.

IF Attribute	vNIC	vHBA	Ethernet Port	FC Port	IB Port
ifHCInOctets	y	y	y	y	y
ifHCInUcastPkts	y		y		
ifHCInBroadcastPkts	y				
ifHCOutOctets	y	y	y	y	y

IF Attribute	vNIC	vHBA	Ethernet Port	FC Port	IB Port
ifHCOutUcastPkts			y		
ifHCOutBroadcastPkts	y				

This table lists statistics available in the `ifTable` file.

IF Attribute	vNIC	vHBA	Ethernet Port	FC Port	IB Port
ifInDiscards	y		y		
ifOutDiscards					y
ifInErrors	y		y		y
ifOutErrors			y		y

Related Information

- "Alarms" on page 114

Alarms

You can use the GUI or the CLI to view alarms. For the GUI, refer to "Displaying and Clearing Alarms" in *Oracle Fabric Manager 5.0.2 Administration Guide*.

In the CLI, use the `show alarms` command to display alarms in the system database. For syntax and examples, refer to "show alarms" in *Oracle Fabric OS 1.0.2 Command Reference*.

Alarms have a severity of info, warning, minor, major, or critical. These categories align with the definitions used in `ITU-T X.733E`, Alarm Reporting Function.

Related Information

- "Display the System Configuration" on page 114
- "System Statistics" on page 116

▼ Display the System Configuration

You can perform this task using either the GUI or the CLI. For the GUI procedure, refer to "Maintaining the Software" in *Oracle Fabric Manager 5.0.2 Administration Guide* and

"Managing General System Tasks" in *Oracle Fabric Manager 5.0.2 Administration Guide*. This procedure is for the CLI.

In the Oracle Fabric OS, several commands display various system attributes and log files. For syntax and examples, refer to "show system" in *Oracle Fabric OS 1.0.2 Command Reference*.

● **Display the event levels configured for all the processes running on the fabric.**

```
[OFOS] show system loglevel
service               processor    slot      level      level-no
-------------------------------------------------------------------
CLILogger             scp          1         WARNING    4
CommandService        scp          1         WARNING    4
EventManager          scp          1         WARNING    4
IBSmServiceAgt        scp          1         INFO       6
ImageManager          scp          1         WARNING    4
IMSService            scp          1         WARNING    4
IMSSlaveService       scp          1         WARNING    4
LDAAgt                scp          1         NOTICE     5
ProcessMonitor        scp          1         INFO       6
Sysconfig             scp          1         WARNING    4
Service               scp          1         WARNING    4
StatsService          scp          1         WARNING    4
SystemController      scp          1         INFO       6
SyslogRelay           scp          1         WARNING    4
XCManager             scp          1         NOTICE     5
XSM                   scp          1         NOTICE     5
XSMP                  scp          1         NOTICE     5
xvnd_svc              scp          1         NOTICE     5

service               processor    slot      level      level-no
-------------------------------------------------------------------
VNICManager           scp          1         WARNING    4
chassisMgr            scp          1         WARNING    4
chassisTestServer     scp          1         WARNING    4
CommandService        scp          1         WARNING    4
DiagService           scp          1         WARNING    4
EventManager          scp          1         WARNING    4
HealthMonService      scp          1         WARNING    4
ImageManager          scp          1         WARNING    4
IMSService            scp          1         WARNING    4
IMSSlaveService       scp          1         WARNING    4
LicenseManager        scp          1         WARNING    4
ProcessMonitor        scp          1         INFO       6
Sysconfig             scp          1         WARNING    4
Service               scp          1         WARNING    4
StatsService          scp          1         WARNING    4
SystemController      scp          1         INFO       6
SyslogRelay           scp          1         WARNING    4
XCManager             scp          1         WARNING    4
XSM                   scp          1         WARNING    4
```

```
XSMP                 scp        1       WARNING    4
chassisCtr           fpp        1       WARNING    4
chassisTestClient    fpp        1       WARNING    4
DiagService          fpp        1       WARNING    4
ProcessMonitor       fpp        1       INFO       6
VN2agent             iop        3       WARNING    4
chassisAgt           iop        3       WARNING    4
chassisTestClient    iop        3       WARNING    4
DiagService          iop        3       WARNING    4
ProcessMonitor       iop        3       INFO       6
xvnd_svc             iop        3       WARNING    4
VN2agent             iop        4       WARNING    4
chassisAgt           iop        4       WARNING    4
chassisTestClient    iop        4       WARNING    4
DiagService          iop        4       WARNING    4
ProcessMonitor       iop        4       INFO       6
xvnd_svc             iop        4       WARNING    4
VNICAgent            iop        14      WARNING    4
chassisAgt           iop        14      WARNING    4
chassisTestClient    iop        14      WARNING    4
DiagService          iop        14      WARNING    4
ProcessMonitor       iop        14      INFO       6
42 records displayed
```

Related Information

- "System Statistics" on page 116

System Statistics

The system collects real-time statistics, which can be cleared at any time.

You can use the Oracle Fabric GUI or the Oracle Fabric OS to display system configuration. Refer to "Display Real-Time Grapher Statistics" in *Oracle Fabric Manager 5.0.2 Administration Guide*.

In the CLI, use the show *xyz* stats command. For syntax and examples, refer to "show xyz stats" in *Oracle Fabric OS 1.0.2 Command Reference*.

Related Information

- "Creating Scripts" on page 117
- "Managing Oracle Fabric OS" on page 121

Creating Scripts

The Oracle Fabric OS software provides ready-to-use scripts, or you can use the fabric's script editor (SEDIT) from the CLI to create your own scripts.

These topics describe how to use the scripts included with Oracle Fabric OS or to create a customized script.

- "Scripts That Mimic UNIX Commands" on page 117
- "Using the SEDIT Script Editor" on page 118

Related Information

- "Monitoring Hardware and Software" on page 111
- "Managing Oracle Fabric OS" on page 121

Scripts That Mimic UNIX Commands

The Oracle Fabric OS CLI provides scripts in the `/bin` directory, working as simplified UNIX commands:

```
ls /bin
pwd
grep
testsuite
ls
printevents
showlog
stress
cd
cat
chmod
sedit
mkdir
rm
mv
```

Related Information

Using the SEDIT Script Editor

SEDIT is a simple but powerful onboard text editor that runs from within the Oracle Fabric OS CLI.

Related Information

Syntax

Start SEDIT and open a file using one of the following methods:

```
[OFOS] sedit filename
[OFOS] file edit filename
[OFOS] vi filename
```

Related Information

Example: Redirect CLI Output to a File and Edit the File

This example redirects (>) the output of show system to a file named foo, then uses file edit *filename* command to start the editor and open the file:

```
[OFOS] show system > foo
[OFOS] sedit foo
```

Command summary:

```
^w   write file (save)
```

```
^d   quit editor
^f   find regular expression
^g   find next
^p   for help
...
```

SEDIT runs as a script named sedit:

```
[OFOS] file edit /bin/sedit
```

See `help sedit` for documentation:

```
[OFOS] help sedit
```

Related Information

- "Create Your Own Commands" on page 119

▼ Create Your Own Commands

Use the fabric's SEDIT to create your own commands (scripts) and aliases.

1. Create and open a file.

```
[OFOS] file edit who
```

The SEDIT starts.

2. Define the behavior.

```
[OFOS] l   show user
```

3. Save the file and exit the editor.

```
[OFOS] ctrl-w
ctrl-d
```

4. Set the file access permissions and make the file executable.

```
[OFOS] chmod +x who
```

5. Test the command.

```
[OFOS] who
------------------------
name        admin
descr
```

```
roles      administrator
```

Related Information

- "Managing Oracle Fabric OS" on page 121
- "Monitoring Hardware and Software" on page 111

Managing Oracle Fabric OS

These topics describe how to manage the Oracle Fabric OS.

- "View System Configuration" on page 121
- "Control System Attributes" on page 122
- "Network Time Protocol Server" on page 122
- "Set System Password Strength" on page 122
- "Set the Management IP Address of the Fabric" on page 123
- "Display Software Information" on page 126

Related Information

- http://docs.oracle.com/cd/E64522_01

▼ View System Configuration

Use the show config command to display the running configuration in table format. There is also an XML version of the config.xml file in the /config directory. The config.xml file is large and not easy to parse on the fabric. Use the file copy command to copy the config.xml file to a remote location and read the file with an XML reader. You can also print the file.

This procedure is for the CLI.

● **View the system configuration.**

```
[OFOS] show config
printconfig /config/config.xml
```

Related Information

- "Control System Attributes" on page 122

▼ Control System Attributes

Use the `system` command to control various system attributes, such as sending a broadcast message before a reboot.

This procedure is for the CLI.

1. Broadcast a system message to all CLI users that are logged in to the system.

```
[OFOS] system broadcast Ensure that you log off when you are finished.
Message received from admin at Mon Nov 23 21:51:02 GMT 2011
Broadcast message
Ensure that you log off when you are finished.
```

2. Perform a warm reboot of the CPUM on the management board.

```
[OFOS] system restart-ofos
```

You can restart Oracle ILOM by typing `system restart-ilom`.

Related Information

-

Network Time Protocol Server

The Oracle Fabric OS supports NTP servers. An NTP server synchronizes the time on multiple systems. This is especially useful when it is important to track the timing of transactions.

Related Information

-
-

▼ Set System Password Strength

Non-default local users that log in to the fabric are prompted for a password for authentication. With Oracle Fabric OS, you can set the strength of passwords by specifying criteria for the passwords using the `set system password-strength` command.

Set the following criteria for the minimum number of characters for each of these attributes:

- Characters allowed for the password string
- Lowercase letters required for fabric passwords
- Numbers required for fabric passwords
- Special characters required for fabric passwords
- Uppercase letters required for fabric passwords

This feature is supported for local passwords, which are the passwords that allow users to log in to the fabric. The following passwords are not affected by the password strength feature:

- Oracle Fabric Manager login passwords.
- Passwords authenticated through AD or another IMS are not supported by this command.
- The default user admin password (`root` or `admin`).

This procedure is for the CLI.

1. **Determine the strategy for password strength.**

2. **Set the strength for the password.**
   For example, this password for non-default local user accounts must be at least eight characters, and must contain at least three lower case characters, two numbers, two special characters, and one upper case character:

```
[OFOS] set system password-strength -min-length=8 -min-lower-case=3 -min-number=2 -min-special=2 -min-
upper-case=1
```

Related Information

-

▼ Set the Management IP Address of the Fabric

To use the fabric's management interface remotely, you must configure an IP address and prefix length for the interface. You initially configure these parameters when you first run the installation wizard at the console port. If you have changes to your management network, you might need to change the IP address you use for the fabric.

You can perform this task using either the CLI or the GUI. For the GUI procedure, refer to "Discover Devices" in *Oracle Fabric Manager 5.0.2 Administration Guide*. This procedure is for the CLI.

1. **(Optional) Check the current settings.**

```
[OFOS] show system info
------------------------------------------------------
```

```
hostname            SalesCentral
descr
domain              abc.example.com
address             192.168.10.85
netmask             192.255.255.0
model-num           Oracle Fabric Interconnect F2-12
serial-num          To be filled by O.E.M
ipconfig            static
default-gateway     10.129.86.1
mtu                 1500
support-jumbo-packet  true
timezone            US_Pacific
nameservers
console-speed       115200
------------------------------------------------------
1 record displayed
```

2.   If other administrators manage virtual I/O, check if anyone is logged in.

```
[OFOS] show login
```

3.   If other users are logged on, send a system broadcast to warn them of the change.

For example:

```
[OFOS] system broadcast Changing management IP to 192.168.10.97 in 2 minutes!
```

Note - Changing the system management address can affect management connectivity to the fabric for other administrators and for management systems. If you are connected remotely, this command breaks that connection.

---

4.   If you have a leaf switch that is running version 1.0, follow these steps to change the IP address.

a.   Log in to the chassis as the root user.

```
hostname login: root
Password:password
Last login: Fri Mar 25 09:51:36 on ttyS0
[root@hostname ~]#
```

The default password is changeme.

b.   Start the nm3tool.

```
[root@hostname ~]# nm3tool
```

For more information about using the nm3tool, refer to "Updating the Firmware" in *Oracle EDR InfiniBand Switch and Virtualized I/O Systems Administration Guide*.

c. **At the Main Menu, select `1` to change the IP address.**

You can also change the host name or perform a chassis upgrade.

d. **Type the new IP address.**

e. **Type `q` to exit the menu.**

f. **Reboot the SCP.**

```
[root@hostname ~]# reboot
```

5. **If you have a virtualization switch, follow these steps to change the IP address.**

The following commands are supported on Oracle Fabric OS 1.0.1 and 1.0.2. You can set a static or DHCP IP address.

For example, to set a static IP address:

```
[OFOS] set system management-interface -address 192.168.3.56
```

Use the `set system ipconfig dhcp` command to set a DHCP IP address. For more information, refer to "set system" in *Oracle Fabric OS 1.0.2 Command Reference*.

6. **(Optional) Verify that the new IP address is active.**

```
[OFOS] show system info
-----------------------------------------------------
hostname            SalesCentral
descr
domain              abc.example.com
address             192.168.3.56
netmask             192.255.255.0
model-num           Oracle Fabric Interconnect F2-12
serial-num          unknown
ipconfig            static
default-gateway     10.129.86.1
mtu                 1500
support-jumbo-packet  true
timezone            US_Pacific
nameservers
console-speed       115200
-----------------------------------------------------
1 record displayed
```

The current IP address is now 192.168.3.56.

Related Information

- "Display Software Information" on page 126

▼ Display Software Information

This procedure is for the CLI.

- **Display software information.**

```
[OFOS] show software
## System status ############################################################

Booted on: Thu Oct 13 11:29:31 PDT 2016
uptime: 10 days, 21 hours, 45 minutes, 17 seconds

RECENT UPGRADES, DOWNGRADES AND PATCHES
Sun Oct 23 01:51:21 GMT 2016: Upgraded to nm3-branch-OFOS-1.0.0-47205-DEBUG.xpf
Sun Oct 23 01:02:39 GMT 2016: Upgraded to nm3-branch-OFOS-1.0.0-47205-DEBUG.xpf
Sat Oct 22 17:09:13 GMT 2016: Upgraded to nm3-branch-OFOS-1.0.0-47205-DEBUG.xpf
Fri Oct 21 23:48:16 GMT 2016: Upgraded to nm3-branch-OFOS-1.0.0-47205-DEBUG.xpf
Fri Oct 21 21:47:20 GMT 2016: Upgraded to nm3-branch-OFOS-1.0.0-47205-DEBUG.xpf

Current BIOS Revision Information
    bios-vendor: American Megatrends Inc.
    bios-version: 43.00.00.16
    bios-release-date: 06/21/2016

Current Base OS Version Information
    Oracle Linux Server release 6.7
    4.1.12-32.el6uek.x86_64

INSTALLED OFOS VERSIONS
Current: oibos-branch-OFOS-1.0.0-47205_0
Previous: oibos-branch-OFOS-1.0.0-47205

MEMORY INFORMATION
Total memory: 31.069G
Used memory: 2.627G
Free memory: 28.441G
Swap space used: 0.000M

DISK STATUS
Partition            Size    Available      Used   %used
/                  15.624G      9.384G     5.425G    34%  |#######-------------|
/shared/config      3.812G      3.589G     8.035M     0%  |--------------------|
/shared/data       15.624G     14.765G    43.965M     0%  |--------------------|
/shared/variable   15.624G      4.854G     9.954G    63%  |############--------|
/shared/temporary  23.498G     19.815G     2.468G    10%  |#-------------------|
/shared/coredumps  15.624G     14.765G    43.969M     0%  |--------------------|

## Processes ################################################################
name           processor   slot  memory    cpu-time   num-restarts  time-started
--------------------------------------------------------------------------------------
```

```
xgdiscoverd    scp           2.28125   00:00:00   0           2016-10-23 01:52:33.502
xdsd           scp           2.29688   00:00:20   0           2016-10-23 01:52:33.502
mysqld_safe    scp           2.30469   00:00:00   0           2016-10-23 01:52:33.502
scd            scp           2.39844   00:01:42   0           2016-10-23 01:52:33.502
lda            scp           5.19922   00:00:15   0           2016-10-23 01:53:03.488
clilog         scp           7.92578   00:02:45   0           2016-10-23 01:52:33.502
imagemanager   scp           9.34375   00:02:45   0           2016-10-23 01:52:33.502
chassisAgt     scp           9.64453   00:05:00   0           2016-10-23 01:52:33.502
ib_smsvcagt    scp           34.0703   00:02:45   0           2016-10-23 01:52:33.502
xc_xsmp        scp           34.4531   00:02:58   0           2016-10-23 01:53:03.488
serviceMgr     scp           34.5      00:05:16   0           2016-10-23 01:52:33.502
xvnd_GW_1      scp           34.6953   00:02:50   0           2016-10-23 01:52:33.502
xvnd_GW_5      scp           34.6953   00:02:51   0           2016-10-23 01:52:33.502
xvnd_GW_10     scp           34.7031   00:02:50   0           2016-10-23 01:52:33.502
xvnd_GW_6      scp           34.7773   00:02:53   0           2016-10-23 01:52:33.502
xvnd_GW_8      scp           34.8359   00:02:53   0           2016-10-23 01:52:33.502
xvnd_GW_7      scp           35.0234   00:02:52   0           2016-10-23 01:52:33.502
ldaAgt         scp           35.9453   00:02:50   0           2016-10-23 01:52:33.502
...
---------------------------------------------------------------------------------------------------
34 records displayed
## Core dumps (in /log/coredumps/)
############################################################
```

Related Information

-

Troubleshooting

These topics explain how to use log files to troubleshoot issues.

Related Information

-
-

Types of Log Files

Log files are stored in the /log directory.

```
[OFOS] ls /log
lost+found      user.log        osinstall.err        user.log.8.gz
```

```
coredumps       user-debug.log  user.log.2.gz           user.log.4.gz
btmp            daemon.log      user.log.3.gz           user.log.5.gz
ulog            lastlog         user-debug.log.2.gz     user.log.6.gz
apache2         kern.log        user-debug.log.3.gz     user.log.9.gz
wtmp            ib.log          user-debug.log.4.gz     osm.log.2.gz
postgresql      postgresql.log  user-debug.log.5.gz     user.log.10.gz
news            createdb.log    user-debug.log.6.gz     user.log.1.gz
ntpstats        osm.log         user-debug.log.7.gz     osm.log.1.gz
ulog-acctd      install.log     user-debug.log.8.gz     user-debug.log.1.gz
ksymoops        apache2.pid     user-debug.log.9.gz
xml             dumpster.log    user-debug.log.10.gz
dmesg           osinstall.out   user.log.7.gz
```

The last bootup data of the chassis is stored in the dmesg file:

```
[OFOS] cat /log/dmesg
```

Standard syslog messages go to the user.log file, where log rotation and auto-archive occurs for up to 10 gzipped files:

```
user.log
user.log.1.gz
user.log.2.gz
user.log.3.gz
user.log.4.gz
user.log.5.gz
user.log.6.gz
user.log.7.gz
user.log.8.gz
user.log.9.gz
user.log.10.gz
```

Following is the format of a log message:

[OFOS] *date time hostname* [*process-ID*]: [*msg-level*] *object*::*text-message*

For example:

```
Jun  6 00:00:01 iowa vnicmanager[12532]: [ERR] VNIC::VNICManager process_simm_message::
 ENTRY
```

User debugging goes to the user-debug.log file, where log rotation occurs automatically:

```
user-debug.log
user-debug.log.1.gz
user-debug.log.2.gz
user-debug.log.3.gz
user-debug.log.4.gz
user-debug.log.5.gz
user-debug.log.6.gz
user-debug.log.7.gz
user-debug.log.8.gz
```

```
user-debug.log.9.gz
user-debug.log.10.gz
```

Related Information

-

▼ Troubleshoot With System Log Files

You can gather information from the fabric and some host information, and compile the
information into compressed files. You can then send these files to Oracle Customer Support for
diagnosis. Fore more information, see "Types of Log Files" on page 127. You can perform
this task using either the CLI or the GUI. For the GUI procedure, refer to "Collect Device Log
Files" in *Oracle Fabric Manager 5.0.2 Administration Guide*. This procedure is for the CLI.

1. **View the installed software.**

   ```
   [OFOS] show software
   ```

2. **Redirect content to an output file.**

   The redirection switch (>) sends the current show tech-support command contents to an
   output file, which can be sent to Oracle Customer Support. There is no progress indicator or
   completion message. When the command prompt returns, the command has completed.

   ```
   [OFOS] show tech-support > July2016
   ```

3. **Gather log files.**

   Use any of the following options:

   ```
   -files output-file -all
   get log-files output-file -noarchives
   get log-files output-file -nocores
   get log-files output-file -silent
   ```

   This example shows how to gather all available files, logs, and cores, as well as the output of
   the show tech-support command. These files are placed into a gzipped tar file, which you can
   send to Oracle Customer Support.

   ```
   [OFOS] get-log-files -all
   copying /log/cli.log...
   copying /log/createdb.log...
   copying /log/daemon.log...
   copying /log/dumpster.log...
   copying /log/ib.log...
   ```

```
copying /log/install.log...
copying /log/kern.log...
copying /log/osm.log...
copying /log/postgresql.log...
copying /log/syslog.log...
copying /log/upgrade.log...
copying /log/upgrade_sw.log...
copying /log/user-debug.log...
copying /log/user-debug_old.log...
copying /log/user.log...
copying /log/xdsd.log...
copying /log/xms.log...
copying /log/createdb.log.1.gz...
copying /log/dmesg.1.gz...
copying /log/dmesg.2.gz...
copying /log/dmesg.3.gz...
copying /log/dmesg.4.gz...
copying /log/ib.log.1.gz...
copying /log/ib.log.2.gz...
copying /log/ib.log.3.gz...
copying /log/ib.log.4.gz...
copying /log/ib.log.5.gz...
copying /log/osm.log.1.gz...
copying /log/osm.log.2.gz...
copying /log/postgresql.log.1.gz...
copying /log/postgresql.log.2.gz...
copying /log/syslog.log.1.gz...
copying /log/user-debug.log.10.gz...
copying /log/user-debug.log.1.gz...
copying /log/user-debug.log.2.gz...
copying /log/user-debug.log.3.gz...
copying /log/user-debug.log.4.gz...
copying /log/user-debug.log.5.gz...
copying /log/user-debug.log.6.gz...
copying /log/user-debug.log.7.gz...
copying /log/user.log.8.gz...
copying /log/user.log.9.gz...
copying /log/wtmp.1.gz...
copying /log/coredumps/dmsg_iocard-8_ts67_0...
copying /log/coredumps/dmsg_iocard-8_ts68_0...
copying /log/coredumps/dmsg_iocard-8_ts74_0...
copying /log/coredumps/dmsg_iocard-8_ts86_0...
copying /log/coredumps/mimm.1727.core...
*** output file is xsigo-logs.tar.gz (49.12M)
You can use the 'file copy' command to transfer it off the Oracle system
```

Related Information

- *Oracle Fabric OS 1.0.2 Command Reference*

Glossary

A

AD   Active Directory. An implementation of LDAP directory services by Microsoft for use primarily in Windows environments. Its main purpose is to provide central authentication and authorization services for Windows based computers. AD also enables administrators to assign policies, deploy software, and apply critical updates to an organization.

Admin State   Administrative State. The intention of the operator by setting a given resource up or down. See also Oper State.

C

CLI   The Oracle Fabric OS CLI. (This CLI is separate from the Oracle Fabric Manager CLI.)

D

DHCP   Dynamic Host Configuration Protocol. Enables network devices to automatically obtain a valid IP address from a server.

E

EDR   Enhanced Data Rate.

F

fabric   Oracle's EDR InfiniBand fabric. A 100-Gb converged fabric for network, storage, and interprocess communication.

G

gateway The connections between the IB fabric and the data center LAN. Ethernet gateways present a collection of NICs to the Ethernet LAN.

gateway port A general term that includes both IB ports and Ethernet gateway ports.

GB Abbreviation of Gigabyte.

GbE Abbreviation of GigabitEthernet.

Gbit/sec Abbreviation of Gigabits per second.

GUI Graphical user interface. The recommended interface for Oracle Fabric Manager 5.0.1.

H

HA High Availability.

HBA Host bus adaptor. A Fibre Channel NIC used in a SAN fabric. HBAs are replacing SCSI HBAs.

HCA Host channel adapter. An InfiniBand NIC used in an InfiniBand network. Provides high-speed connectivity and virtual interfaces, based on the IB interface. An HCA can have one or two ports.

hypervisor A virtualization platform that enables multiple guest operating systems to run at the second level above the hardware.

I

I/O Input/output. In computer architecture, the combination of the CPU and main memory (that is, memory that the CPU can read and write to directly, with individual instructions) is considered the "heart" of a computer. Any movement of information to or from that complex, for example to or from a disk drive, is considered I/O.

I/O port A single port on an Ethernet module, an HBA module, or one of the 38 IB server ports.

IB InfiniBand. A high bandwidth messaging technology used for very high performance computing.

IMS Identity Management System.

L

LAG Link Aggregation Group.

LDAP	Lightweight Directory Access Protocol. An application protocol for querying and modifying directory services running over TCP/IP. A client starts an LDAP session by connecting to an LDAP server, by default on TCP port 389. The client then sends operation requests to the server, and the server sends responses in turn.
leaf switch	Oracle InfiniBand Switch IS2-46.
LID	Local identifier for the HCA or local identifier number that the IB path uses.

M

MIB	Oracle ILOM management information base. Must be installed and support SNMP traps.
MTU	Maximum Transmission Unit. The largest physical packet size (in bytes) that a network can transmit. MTU values are only applicable to Ethernet ports, and the MTU of the I/O port must match the MTU of the neighboring switch.

N

NIC	Network interface card.
NPIV	N_Port ID Virtualization. A technology that defines how multiple virtual servers can share a single physical FC port identification.

O

OpenSM	The default subnet manager running on the Oracle Fabric Interconnect.
Oper State	Operative State. Indicates whether a resource is configured and operating properly. See also Admin State.
Oracle EDR InfiniBand Fabric	The fabric used to build and manage an Oracle cloud network infrastructure.

P

PVI	Private virtual interconnect. Connects the switch to the fabric and manages those Ethernet connections.

R

RADIUS
Remote Authentication Dial In User Service (RADIUS). An Authentication, Authorization, and Accounting (AAA) protocol for controlling access to network resources. RADIUS is commonly used by ISPs and corporations managing access to Internet or internal networks across an array of access technologies including modem, DSL, wireless, and VPNs.

RAID
Redundant Array of Independent Disks. A data storage virtualization technology that combines multiple physical disk drive components into a single logical unit for the purposes of data redundancy and performance improvement.

Role
One of five fixed-privilege levels that a user may be assigned (such as, Operators, Administrators, or Storage).

RSCN
Registered State Change Notification.

S

SCP
System Control Processor.

SEDIT
Script Editor contained in the fabric.

server profile
One instance of a server I/O configuration that is assignable to a single physical server through an IB port.

SM
Embedded subnet manager. SM groups manage and monitor the switching and pathing tables in an IB subnet. When there are multiple SMs on a subnet, one SM will be the master SM through an election algorithm. The remaining SMs become standby SMs. There is only one master SM per subnet.

SM device
An IB switch.

state
Displayed in Oracle Fabric Manager and the CLI as a pair of statuses, for example: up/up. The first is the Admin State while the second is the Oper State. When using SNMP, these statuses are returned individually.

subnet manager
Configures all aspects of an IB fabric, including assigning LIDs to all HCAs and switch ports in the fabric, providing lookup service for end nodes, configuring program switch forwarding tables based upon the selected routing algorithm, and programming PKEY tables for HCAs and switches.

U

user
An internal or external representation of a person. Users exist locally through LDAP. By default, an `admin` user is created locally.

V

vHBA Virtual Host Bus Adapter. Connects a computer, which acts as the host system, to other network and storage devices.

virtualization switch Oracle Fabric Interconnect F2- Switch. This virtualization switch supports several I/O modules that provide FC and Ethernet connectivity.

VLAN Virtual local area network. A private, independent, logical network that is created within a physical network. A VLAN behaves like an ordinary LAN, but connected devices don't have to be physically connected to the same network segment.

VM Virtual machine. A software entity that runs its own operating systems and applications, as if it were a physical computer. A VM behaves exactly like a physical computer and contains its own virtual (software based) CPU, RAM, hard disk, and NIC. An OS installed on a VM is called a guest operating system.

vNIC Virtual network interface card. An Ethernet interface, provided without a physical NIC.

W

WWNN World Wide Network Name.

WWPN World Wide Port Name.

Index

137

W
WWNN, 71
WWPN, 71