Oracle® Private Cloud Appliance

Installation Guide for Release 2.1

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Preface

This document is part of the documentation library for Oracle Private Cloud Appliance (PCA) Release 2.1, which is available at:

http://docs.oracle.com/cd/E60765_01.

The documentation library consists of the following items:

Oracle Private Cloud Appliance Release Notes

The release notes provide a summary of the new features, changes, fixed bugs and known issues in Oracle PCA.

Oracle Private Cloud Appliance Licensing Information User Manual

The licensing information user manual provides information about the various product licenses applicable to the use of Oracle PCA.

Oracle Private Cloud Appliance Installation Guide

The installation guide provides detailed instructions to prepare the installation site and install Oracle PCA. It also includes the procedures to install additional compute nodes, and to connect and configure external storage components.

Oracle Private Cloud Appliance Safety and Compliance Guide

The safety and compliance guide is a supplemental guide to the safety aspects of Oracle PCA. It conforms to Compliance Model No. OCA1A.

Oracle Private Cloud Appliance Administrator's Guide

The administrator's guide provides instructions for using the management software. It is a comprehensive guide to how to configure, monitor and administer Oracle PCA.

Oracle Private Cloud Appliance Quick Start Poster

The quick start poster provides a step-by-step description of the hardware installation and initial software configuration of Oracle PCA. A printed quick start poster is shipped with each Oracle PCA base rack, and is intended for data center operators and administrators who are new to the product.

The quick start poster is also available in the documentation library as an HTML guide, which contains alternate text for ADA 508 compliance.

Oracle Private Cloud Appliance Expansion Node Setup Poster

The expansion node setup poster provides a step-by-step description of the installation procedure for an Oracle PCA expansion node. A printed expansion node setup poster is shipped with each Oracle PCA expansion node.

The expansion node setup poster is also available in the documentation library as an HTML guide, which contains alternate text for ADA 508 compliance.

Audience

The Oracle Private Cloud Appliance (PCA) documentation is written for technicians, authorized service providers, data center operators and system administrators who want to install, configure and maintain a

private cloud environment in order to deploy virtual machines for users. It is assumed that readers have experience installing and troubleshooting hardware, are familiar with web and virtualization technologies and have a general understanding of operating systems such as UNIX (including Linux) and Windows.

The Oracle PCA makes use of Oracle Linux and Oracle Solaris operating systems within its component configuration. It is advisable that administrators have experience of these operating systems at the very least. Oracle PCA is capable of running virtual machines with a variety of operating systems including Oracle Solaris and other UNIXes, Linux and Microsoft Windows. The selection of operating systems deployed in guests on Oracle PCA determines the requirements of your administrative knowledge.

Related Documentation

Additional Oracle components may be included with Oracle PCA depending on configuration. The documentation for such additional components is available as follows:

- Sun Rack II 1042 and 1242

  http://docs.oracle.com/cd/E19844-01/index.html

- Oracle Server X5-2

  http://docs.oracle.com/cd/E41059_01/index.html

- Sun Server X4-2

  http://docs.oracle.com/cd/E36975_01/index.html

- Sun Server X3-2

  http://docs.oracle.com/cd/E22368_01/index.html

- Oracle ZFS Storage Appliance ZS3-ES

  http://docs.oracle.com/cd/E37831_01/index.html

- Sun ZFS Storage Appliance 7320

  http://docs.oracle.com/cd/E28317_01/index.html

- Oracle Switch ES1-24

  http://docs.oracle.com/cd/E39109_01/index.html

- NM2-36P Sun Datacenter InfiniBand Expansion Switch

  http://docs.oracle.com/cd/E36265_01/index.html

- Oracle Fabric Interconnect F1-15

  http://docs.oracle.com/cd/E38500_01/index.html

- Oracle Integrated Lights Out Manager (ILOM) 3.1

  http://docs.oracle.com/cd/E24707_01/index.html

- Oracle VM

  http://docs.oracle.com/cd/E35328_01/index.html

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The following text conventions are used in this document:

Convention	Meaning
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italic	Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.
`monospace`	Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.

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Chapter 1 Introduction to Oracle Private Cloud Appliance

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This document provides instructions for installing Oracle Private Cloud Appliance (PCA) at your site. Instructions are also provided for extending an existing Oracle PCA at your site. This chapter provides an overview of these system installation procedures, and describes the features and hardware components of Oracle PCA.

1.1 System Installation Procedures

The following table lists the procedures you need to complete to install Oracle PCA at your site.

Step	Description	Links
1	Review the product notes for any late-breaking information about Oracle PCA.	*Oracle Private Cloud Appliance Product Notes* at: http://www.oracle.com/us/products/servers-storage/servers/virtual-compute-appliance/overview/index.html
2	Review important safety information.	Before performing the installation, refer to the following documents: • *Oracle Private Cloud Appliance Safety and Compliance Guide* • *Important Safety Information for Oracle's Hardware Systems*
3	Review information about Oracle Private Cloud Appliance features and hardware components.	Chapter 1, *Introduction to Oracle Private Cloud Appliance*
4	Complete the site preparation procedures.	Chapter 2, *Site Requirements*
5	Complete the site network preparation procedures.	Chapter 3, *Network Requirements*
6	Install Oracle Private Cloud Appliance at your site.	Chapter 4, *Installing Oracle Private Cloud Appliance*
7	Power on Oracle Private Cloud Appliance and perform initial system configuration.	Chapter 5, *Powering On Oracle Private Cloud Appliance*
8	(*Optional*) Extend Oracle Private Cloud Appliance compute capacity.	Chapter 6, *Extending Oracle Private Cloud Appliance - Additional Compute Nodes*
9	(*Optional*) Extend Oracle Private Cloud Appliance server memory.	Chapter 7, *Extending Oracle Private Cloud Appliance - Server Memory Kits*

Step	Description	Links
10	(*Optional*) Extend Oracle Private Cloud Appliance storage capacity.	Chapter 8, *Extending Oracle Private Cloud Appliance - External Storage*

1.2 About Oracle Private Cloud Appliance

Oracle Private Cloud Appliance (PCA) is an integrated hardware and software system engineered to enable rapid deployment of a converged compute, network, and storage infrastructure for hosting most applications and workloads, whether running on Linux, Oracle Solaris, or Microsoft Windows.

In combination with customer-provided storage from Oracle or other storage vendors, Oracle PCA incorporates Sun server and network hardware with Oracle operating system, virtualization, and orchestration software to automate the discovery, configuration, deployment, and management of converged infrastructure for hosting virtual machines (VMs).

Oracle PCA incorporates the Oracle Fabric Interconnect F1-15 to provide a converged, wire-once, software-defined networking and storage fabric for all servers and storage in the appliance. Leveraging the software-defined network fabric, users can rapidly and dynamically create or modify private or public networks without having to manually re-cable connections, saving time and reducing the risk of human error. Further, the consolidation of network connections results in up to 70 percent fewer cables and cards.

In addition to rapid infrastructure provisioning, Oracle PCA also accelerates complete application stack deployment through support for Oracle VM Templates and Assemblies. Oracle VM Templates and Assemblies are preconfigured applications, middleware, and databases packaged as ready-to-run VMs that can be dynamically configured at deployment time. The result is an unparalleled ability to go from “bare-metal” infrastructure power on to logging in to a newly deployed, running application within days or even hours, instead of weeks or months.

1.3 Features of Oracle Private Cloud Appliance

Oracle PCA includes the following features:

- **Converged infrastructure orchestration software:** Automated discovery, configuration, and management of included server, network, and storage resources for rapid infrastructure provisioning.
- **Unified, software-defined network fabric:** Incorporated Oracle Fabric Interconnect hardware provides a single, consolidated fabric allowing new networks to be dynamically added and existing networks to be modified without the need to manually modify cabling.
- **Rapid application stack deployment, not just infrastructure:** Support for ready-to-run Oracle VM Templates and Assemblies enables users to rapidly deploy not only the infrastructure, but also the applications that are hosted on the infrastructure.
- **Support for a wide variety of guest operating systems:** Support for Linux, Oracle Solaris, and Windows operating systems and applications.
- **Support for customer-provided storage:** Oracle PCA can be configured with external storage from Oracle or existing storage from other storage vendors.
- **Unified management:** Browser-based orchestration software provides at-a-glance status for all hardware components. Role-based access control permits secure administration of the appliance across multiple administrators.

1.4 Oracle Private Cloud Appliance Rack Components

Oracle PCA systems consist of virtualization compute nodes, storage appliances, as well as required InfiniBand and Ethernet networking components. Table 1.1 lists the quantity and description of each component in an Oracle PCA system.

Note

Oracle Private Cloud Appliance base racks are factory installed with Oracle Server X5-2 nodes. Earlier versions of the Oracle PCA were shipped with Sun Server X4-2 or Sun Server X3-2 nodes, but these servers are no longer available although they continue to be supported by the Oracle PCA controller software. If additional nodes have been installed, or if nodes have been replaced, an Oracle PCA rack that originally contained Sun Server X3-2 and/or Sun Server X4-2 nodes can also contain Oracle Server X5-2 nodes.

Software support for Oracle Server X5-2 nodes is available as of Release 2.0.3 of the Oracle PCA controller software. The software must be upgraded to Release 2.0.3 or above to support Oracle Server X5-2 hardware. Software installed on Oracle PCA racks that are currently being shipped is already at Release 2.0.3 or above.

Note

Earlier versions of the Oracle Private Cloud Appliance were shipped with the Sun ZFS Storage Appliance 7320. This hardware component has since been replaced with the Oracle ZFS Storage Appliance ZS3-ES. Software support for the Oracle ZFS Storage Appliance ZS3-ES is available as of Release 1.1.3. All software releases continue to support the Sun ZFS Storage Appliance 7320.

Table 1.1 Oracle Private Cloud Appliance Rack Components

Quantity	Description
2	Either Oracle Server X5-2, Sun Server X4-2, or Sun Server X3-2, used as management nodes
2 to 25	Either Oracle Server X5-2, Sun Server X4-2, or Sun Server X3-2, used as virtualization computing nodes
1	Sun Rack II 1242 base
2	NM2-36P Sun Datacenter InfiniBand Expansion Switch
2	Oracle Switch ES1-24
2	Oracle Fabric Interconnect F1-15
1	Either Oracle ZFS Storage Appliance ZS3-ES or Sun ZFS Storage Appliance 7320

1.5 Server Components

Table 1.2 lists the components of each of the server generations that may be installed in an Oracle PCA rack and which are supported by the current software release: Oracle Server X5-2, Sun Server X4-2, and Sun Server X3-2. While Sun Server X4-2 and Sun Server X3-2 nodes continue to be supported by the newer software releases, this hardware is no longer shipped within new Oracle PCA racks.

Table 1.2 Server Components

Quantity	Oracle Server X5-2	Sun Server X4-2	Sun Server X3-2
1	Oracle Server X5-2 base	Sun Server X4-2 base	Sun Server X3-2 base
2	Eighteen-core Intel Xeon processors E5-2699 v3 series (2.3 GHz)	Eight-core Intel Xeon processors E5-2650 v2 series (2.6 GHz)	Eight-core Intel Xeon processors E5-2600 series (2.2 GHz)
8 (or 16)	8x 32 GB DDR4 DIMMs (256 GB total)	16x 16 GB DDR3 DIMMs (256 GB total)	16x 16 GB DDR3 DIMMs (256 GB total)
2	1.2 TB, 2.5-inch, 10,000-RPM drives with LSI RAID controller	1.2 TB, 2.5-inch, 10,000-RPM drives with LSI RAID controller	900 GB, 2.5-inch, 10,000-RPM drives with LSI RAID controller
1	Ethernet port for remote management	Ethernet port for remote management	Ethernet port for remote management
1	Dual-port 4x QDR (80 Gbps) InfiniBand Host Channel Adapter Network Interface Card type CX3	Dual-port 4x QDR (80 Gbps) InfiniBand Host Channel Adapter Network Interface Card type CX3	Dual-port 4x QDR (40 Gbps) InfiniBand Host Channel Adapter Network Interface Card
2	Redundant power supplies and fans	Redundant power supplies and fans	Redundant power supplies and fans
4	Embedded 10-Gigabit Ethernet port	Embedded 10-Gigabit Ethernet port	Embedded 10-Gigabit Ethernet port
1	USB-2 8-GB MLC flash drive	USB-2 4-GB flash drive	USB-2 4-GB flash drive

1.6 Operational Procedures for Oracle Private Cloud Appliance

This section provides important operational instructions to help you minimize the risk of injury or damage.

1.6.1 Emergency Power-off Considerations

If there is an emergency, then power to Oracle PCA should be halted immediately. The following emergencies might require powering off the system:

- Natural disasters such as an earthquake, flood, hurricane, tornado or cyclone
- Abnormal noise, smell or smoke coming from the system
- Threat to human safety

1.6.1.1 Emergency Power-off Procedure

To perform an emergency power-off procedure for Oracle PCA, turn off power at the circuit breaker or pull the emergency power-off switch in the computer room.

1.6.1.2 Emergency Power-off Switch

Emergency power-off (EPO) switches are required in a computer room when computer equipment contains batteries capable of supplying more than 750 volt-amperes for more than five minutes. Systems that have these batteries include internal EPO hardware for connection to a site EPO switch or relay. Use of the EPO switch will remove power from the Oracle PCA.

1.6.2 Cautions and Warnings

The following cautions and warnings apply to Oracle PCA:

- Do not touch the parts of this product that use high-voltage power. Touching them might result in serious personal injury.
- Do not power off Oracle PCA unless there is an emergency. In that case, follow the Section 1.6.1.1, “Emergency Power-off Procedure”.
- Keep the front and rear cabinet doors closed. Failure to do so might cause system failure or result in damage to hardware components.
- Keep the top, front, and back of cabinets clear to allow proper airflow and prevent overheating of components.
- Use only the supplied hardware.

Chapter 2 Site Requirements

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This chapter describes the site requirements for the Oracle Private Cloud Appliance (PCA).

Note

For site checklists, refer to Appendix D, *Site Checklists*.

2.1 Space Requirements

All Oracle PCA racks have the same space requirements. The space requirements are as follows:

- Height: 42U - 1998 mm (78.66 inches)
- Width: 600 mm with side panels (23.62 inches)
- Depth (front door handle to rear door handle): 1200 mm (47.24 inches)
- Depth (doors removed): 1112 mm (43.78 inches)
- Weight (base rack, fully populated): 894 kg (1972 lbs)

The minimum ceiling height for the cabinet is 2300 mm (90 inches), measured from the true floor or raised floor, whichever is higher. An additional 914 mm (36 inches) is for top clearance. The space above the cabinet and its surroundings must not restrict the movement of cool air between the air conditioner and the cabinet, or the movement of hot air coming out of the top of the cabinet.

2.1.1 Receiving and Unpacking Requirements

Before your Oracle PCA arrives, ensure that the receiving area is large enough for the package. The following are the package dimensions and weights for an Oracle PCA system:

- Shipping height: 2159 mm (85 inches)
- Shipping width: 1219 mm (48 inches)
- Shipping depth: 1575 mm (62 inches)
- Shipping weight (base rack, fully populated): 996 kg (2197 lbs)

If your loading dock meets the height and ramp requirements for a standard freight carrier truck, then you can use a pallet jack to unload the rack. If the loading dock does not meet the requirements, then you must

provide a standard forklift or other means to unload the rack. You can also request that the rack be shipped in a truck with a lift gate.

When your Oracle PCA arrives, leave the rack in its shipping packaging until it arrives at its installation site. Use a conditioned space to remove the packaging material to reduce particles before entering the data center. The entire access route to the installation site should be free of raised-pattern flooring that can cause vibration.

Allow enough space for unpacking the system from its shipping cartons. Ensure that there is enough clearance and clear pathways for moving the Oracle PCA from the unpacking location to the installation location. Table 2.1 lists the access route requirements for the Oracle PCA.

Table 2.1 Access Route Requirements

Access Route Item	With Shipping Pallet	Without Shipping Pallet
Minimum door height	2184 mm (86 inches)	2040 mm (80.32 inches)
Minimum door width	1220 mm (48 inches)	600 mm (23.62 inches)
Minimum elevator depth	1575 mm (62 inches)	1200 mm (47.24 inches)
Maximum incline	6 degrees	6 degrees
Maximum elevator, pallet jack, and floor loading capacity	1134 kg (2500 lbs)	1134 kg (2500 lbs)

2.1.2 Maintenance Access Requirements

The maintenance area must be large enough for Oracle PCA, and have the required access space. For example, the required space to remove the side panels is 675.64 mm (26.6 inches). Table 2.2 lists the maintenance access requirements for the Oracle PCA.

Table 2.2 Maintenance Access Requirements

Location	Maintenance Access Requirement
Rear maintenance	914 mm (36 inches)
Front maintenance	914 mm (36 inches)
Top maintenance	914 mm (36 inches)

2.2 Flooring Requirements

Oracle recommends that the Oracle PCA be installed on raised flooring. The site floor and the raised flooring must be able to support the total weight of the system as specified in Section 2.1, “Space Requirements”.

Table 2.3 lists the floor load requirements.

Table 2.3 Floor Load Requirements

Description	Requirement
Maximum allowable weight of installed rack equipment	952.54 kg (2100 lbs)
Maximum allowable weight of installed power distribution units	52.16 kg (115 lbs)
Maximum dynamic load (maximum allowable weight of installed equipment including power distribution units)	1004.71 kg (2215 lbs)

2.3 Electrical Power Requirements

The Oracle PCA can operate effectively over a wide range of voltages and frequencies. However, it must have a reliable power source. Damage might occur if the ranges are exceeded. Electrical disturbances such as the following might damage the system:

- Fluctuations caused by brownouts
- Wide and rapid variations in input voltage levels or in input power frequency
- Electrical storms
- Faults in the distribution system, such as defective wiring

To protect your system from such disturbances, you should have a dedicated power distribution system, power-conditioning equipment, as well as lightning arresters or power cables to protect from electrical storms.

Each rack has two pre-installed power distribution units (PDUs). The PDUs accept different power sources. You must specify the type of PDU that is correct for your data center.

Table 2.4 lists the PDU low-voltage requirements.

Table 2.4 PDU Requirements for Low Voltage

Item		
Size	22 kVA	24 kVA
Market Part Number	7100873	6444A
Manufacturing Part Number	7018123	594-5596-01
Input Voltage Range	200-240 VAC	190-220 VAC
Number of Input Cords per PDU	3	2
Electrical Input Ratings	3x 1ph. [2W+ground] 208VAC 50/60Hz, max. 36.8A per phase	2x 3ph. [3W+ground] 208VAC 50/60Hz, max. 34.6A per phase
Data Center Receptacle	Hubbell CS8265C	IEC309-3P4W-IP67 (60A, 250V, AC, 3ph) IEC309 60A 3ph 4 Wire Hubbell HBL460R/C9W or equivalent
Number of Outlets Per Rack	6	4

Table 2.5 lists the PDU high-voltage requirements.

Table 2.5 PDU Requirements for High Voltage

Item		
Size	22 kVA	24 kVA
Market Part Number	7100874	6445A

Item		
Manufacturing Part Number	7018124	594-5600-01
Input Voltage Range	220-240 VAC	380-415 VAC
Number of Input Cords per PDU	3	2
Electrical Input Ratings	3x 1ph. [2W+ground] 230VAC 50/60Hz, max. 32A per phase	2x 3ph. [4W+ground] 230/400VAC 50/60Hz, max. 18A per phase
Data Center Receptacle	Hubbell CS8265C	IEC309-4P5W-IP44 (32A, 400V, AC, 3ph) IEC309 32A 3ph 5 Wire Hubbell HBL532R/C9W or equivalent
Number of Outlets Per Rack	6	4

2.3.1 Facility Power Requirements

Electrical work and installations must comply with applicable local, state, or national electrical codes. Contact your facilities manager or qualified electrician to determine what type of power is supplied to the building.

To prevent catastrophic failures, design the input power sources to ensure adequate power is provided to the power distribution units (PDUs). Use dedicated AC breaker panels for all power circuits that supply power to the PDU. When planning for power distribution requirements, balance the power load between available AC supply branch circuits. In the United States and Canada, ensure that the overall system AC input current load does not exceed 80 percent of the branch circuit AC current rating.

PDU power cords are 4 meters (13.12 feet) long, and 1 to 1.5 meters (3.3 to 4.9 feet) of the cord will be routed within the rack cabinet. The installation site AC power receptacle must be within 2 meters (6.6 feet) of the rack.

2.3.2 Circuit Breaker Requirements

To prevent catastrophic failures, the design of your power system must ensure that adequate power is provided to all of the compute nodes. Use dedicated AC breaker panels for all power circuits that supply power to the compute nodes. Electrical work and installations must comply with applicable local, state, or national electrical codes. Compute nodes require electrical circuits to be grounded to the Earth.

In addition to circuit breakers, provide a stable power source, such as an uninterruptable power supply (UPS) to reduce the possibility of component failures. If computer equipment is subjected to repeated power interruptions and fluctuations, then it is susceptible to a higher rate of component failure.

Note

Circuit breakers are supplied by the customer. One circuit breaker is required for each power cord.

2.3.3 Grounding Guidelines

The cabinets for the Oracle PCA are shipped with grounding-type power cords (three-wire). Always connect the cords to grounded power outlets. Because different grounding methods are used, depending

on location, check the grounding type, and refer to documentation, such as IEC documents, for the correct grounding method. Ensure that the facility administrator or qualified electrical engineer verifies the grounding method for the building, and performs the grounding work.

2.4 Temperature and Humidity Requirements

Airflow through the Oracle PCA is from front to back. For information, see Section 2.5, “Ventilation and Cooling Requirements”.

Studies have shown that temperature increases of 10 degrees Celsius (15 degrees Fahrenheit) above 20 degrees Celsius (70 degrees Fahrenheit) reduce long-term electronics reliability by 50 percent. Excessive internal temperatures might result in full or partial shutdown of the Oracle PCA.

Table 2.6 lists the temperature, humidity and altitude requirements for operating and non-operating systems.

Table 2.6 Temperature, Humidity, and Altitude Requirements

Condition	Operating Requirement	Non-operating Requirement	Optimum
Temperature	5 ° to 32 ° Celsius (59 ° to 89.6 ° Fahrenheit)	-40 ° to 70 ° Celsius (-40 ° to 158 ° Fahrenheit)	For optimal rack cooling, data center temperatures from 21 ° to 23 ° Celsius (70 ° to 47 ° Fahrenheit)
Relative humidity	10 to 90 percent relative humidity, non-condensing	Up to 93 percent relative humidity	For optimal data center rack cooling, 45 to 50 percent non-condensing
Altitude	3,048 meters (10,000 feet) maximum	12,000 meters (40,000 feet)	Ambient temperature is reduced by 1 ° Celsius per 300 meters above 900 meters altitude above sea level

Set conditions to the optimal temperature and humidity ranges to minimize the chance of downtime due to component failure. Operating an Oracle PCA for extended periods at or near the operating range limits, or installing it in an environment when it remains at or near non-operating range limits could significantly increase hardware component failure.

The ambient temperature range of 21 ° to 23 ° Celsius (70 ° to 74 ° Fahrenheit) is optimal for server reliability and operator comfort. Most computer equipment can operate in a wide temperature range, but near 22 ° Celsius (72 ° Fahrenheit) is desirable because it is easier to maintain safe humidity levels. Operating in this temperature range provides a safety buffer in the event that the air conditioning system goes down for a period of time.

Relative humidity is the percentage of the total water vapor that can exist in the air without condensing, and is inversely proportional to air temperature. Humidity goes down when the temperature rises, and goes up when the temperature drops. For example, air with a relative humidity of 45 percent at a temperature of 24 ° Celsius (75 ° Fahrenheit) has a relative humidity of 65 percent at a temperature of 18 ° Celsius (64 ° Fahrenheit). As the temperature drops, the relative humidity rises to more than 65 percent, and water droplets are formed.

The ambient relative humidity range of 45 to 50 percent is suitable for safe data processing operations. Most computer equipment can operate in a wide range (20 to 80 percent), but the range of 45 to 50 percent is recommended for the following reasons:

- Optimal range helps protect computer systems from corrosion problems associated with high humidity levels.
- Optimal range provides the greatest operating time buffer in the event of air conditioner control failure.
- This range helps to avoid failures or temporary malfunctions caused by intermittent interference from static discharges that may occur when relative humidity is too low.

Note

Electrostatic discharge (ESD) is easily generated, and hard to dissipate in areas of low relative humidity, such as below 35 percent. ESD becomes critical when humidity drops below 30 percent. It is not difficult to maintain humidity in a data center because of the high-efficiency vapor barrier and low rate of air changes normally present.

2.5 Ventilation and Cooling Requirements

Always provide adequate space in front of and behind the rack to allow for proper ventilation. Do not obstruct the front or rear of the rack with equipment or objects that might prevent air from flowing through the rack. Rack-mountable servers and equipment typically draw cool air in through the front of the rack and let warm air out the rear of the rack. There is no airflow requirement for the left and right sides due to front-to-back cooling.

If the rack is not completely filled with components, then cover the empty sections will filler panels. Gaps between components can adversely affect airflow and cooling within the rack.

Air conditioning facilities usually do not precisely monitor or control temperature and humidity throughout an entire computer room. Generally, monitoring is done at individual points corresponding to multiple exhaust vents in the main unit, and other units in the room. Special consideration should be paid to humidity when using underfloor ventilation. When underfloor ventilation is used, monitoring is done at each point close to an exhaust vent. Distribution of the temperature and humidity across the entire room is uneven.

The Oracle PCA has been designed to function while installed in a natural convection airflow. The following requirements must be followed to meet the environmental specification:

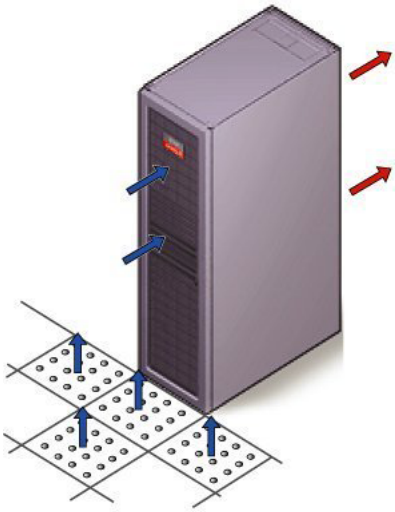
- Ensure that there is adequate airflow through the system.
- Ensure that the system has front-to-back cooling. The air intake is at the front of the system, and the air outlet is at the rear of the system.
- Allow a minimum clearance of 914 mm (36 inches) at the front of the system, and 914 mm (36 inches) at the rear of the system for ventilation.

Use perforated tiles, approximately 400 CFM/tile, in front of the rack for cold air intake. The tiles can be arranged in any order in front of the rack, as long as cold air from the tiles can flow into the rack. Inadequate cold airflow could result in a higher intake temperature in the system due to exhaust air recirculation. The following is the recommended number of floor tiles:

- Four floor tiles for an Oracle PCA with up to 25 compute nodes (fully loaded)
- Three floor tiles for an Oracle PCA with up to 16 compute nodes (half loaded)
- One floor tile for an Oracle PCA with 8 compute nodes (quarter loaded)

Figure 2.1 shows a typical installation of the floor tiles in a data center for Oracle PCA with more than 16 compute nodes.

Figure 2.1 Typical Data Center Configuration for Perforated Floor Tiles



Chapter 3 Network Requirements

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3.1.1 Network Connection Requirements 15
3.1.2 IP Address Requirements 16
3.2 General Network Configuration 16

This chapter describes the network requirements for the Oracle Private Cloud Appliance (PCA).

Note

See Appendix A, *Default IP Addresses* for default IP addresses.

3.1 Network Connection and IP Address Requirements

This section describes the network connection requirements and IP address requirements to connect the Oracle PCA to your existing network infrastructure.

3.1.1 Network Connection Requirements

Before installation, you must run network cables from your existing network infrastructure to the Oracle PCA installation site.

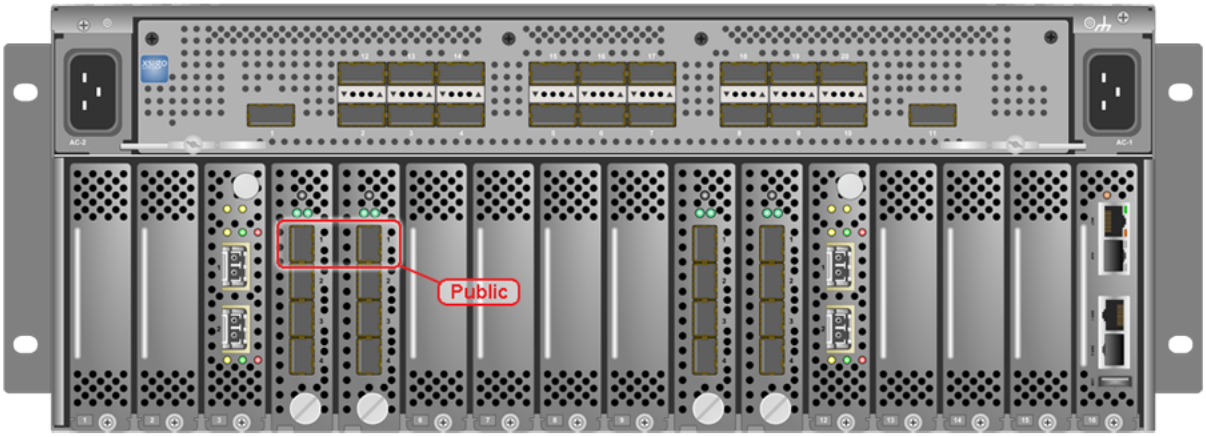
You must connect two 10 Gigabit Ethernet (GbE) IO module ports labeled “Public” on each Fabric Interconnect to your public Ethernet network.

Caution

The IO modules only support 10 GbE transport and cannot be connected to gigabit Ethernet switches. The Oracle PCA must be connected externally to 10GbE optical switch ports.

Figure 3.1 shows the location of the 10 GbE Public IO module ports on the Fabric Interconnect.

Figure 3.1 Oracle Fabric Interconnect F1-15 10 GbE Public IO Module Ports



Caution

It is critical that **both** Fabric Interconnects have **two** 10GbE connections each to a pair of next-level data center switches. This configuration with four cable connections provides redundancy and load splitting at the level of the Fabric Interconnects, the 10GbE ports and the data center switches. This outbound cabling should not be crossed or meshed, because the internal connections to the pair of Fabric Interconnects are already configured that way. The cabling pattern plays a key role in the continuation of service during failover scenarios involving Fabric Interconnect outages and other components.

In addition to the public Ethernet connection, you may connect the management network port on each Oracle Switch ES1-24 switch to a management or machine administration network at your installation site. The system contains two Oracle Switch ES1-24 switches, making up one logical management network. The daisy-chained Oracle Switch ES1-24 arrangement has a special high availability (HA) configuration. Each switch can have an uplink to the customer management network, but only one link will be active at a given time. Link tracking is done in software on the Oracle Switch ES1-24.

3.1.2 IP Address Requirements

The Oracle PCA requires a large number of IP addresses. For lists of default IP addresses that are preassigned to your Oracle PCA, see Appendix A, *Default IP Addresses*.

To gain initial access to the Oracle PCA Dashboard, you must connect a terminal or workstation with a web browser directly to the management network. Connect an Ethernet cable to the available port 19 in one of the Oracle Switch ES1-24 switches, and statically configure the wired network connection of the workstation to use the IP address `192.168.4.254`.

Caution

The IP address `192.168.4.254` is the only one available for customer use in the appliance management network.

During the initial software configuration of the Oracle PCA, you reconfigure the network settings of the management nodes. For this purpose, you should reserve three IP addresses in the public (data center) network: one for each management node, and one to be used as virtual IP address by both management nodes. The virtual IP address provides access to the Dashboard once the software initialization is complete.

3.2 General Network Configuration

Table 3.1 is a general network configuration worksheet to help you configure your Oracle PCA. These selections are optional for the Oracle PCA. Information entered in this worksheet is used as input in the Dashboard. This worksheet includes fields in the utility that typically require data.

Table 3.1 General Network Configuration Worksheet

Item	Your Configuration	Description and Example
Domain Name		Company network domain name. Example: `abc.example.com`
Region		Name of the country in which Oracle PCA resides.
Time Zone		Valid time zone.

Item	Your Configuration	Description and Example
IP address of the Domain Name Server		IP address of one or more network name servers (up to three servers). Example: `10.25.45.123` , `10.25.45.125`
NTP Server		IP address of a Network Time Protocol server. Example: `10.12.13.14`
Search Domains		A list of search domains for name lookup. Example: `example.com` , `example.org`
Default Gateway		IP address of the default gateway in your organization. Example: `10.203.72.2`
IP address of Management node 1		IP address of the first management node in your company network. Example: `10.203.72.101`
IP address of Management node 2		IP address of the second management node in your company network. Example: `10.203.72.102`
Management virtual IP address		Virtual IP address of the management node cluster in your company network. Example: `10.203.72.100`

Chapter 4 Installing Oracle Private Cloud Appliance

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This chapter explains how to prepare for the installation of your Oracle Private Cloud Appliance (PCA) and how to install the system at your site.

4.1 Installation Task Map

Table 4.1 describes the steps for installing an Oracle PCA at your site.

Table 4.1 Steps for Installing Oracle Private Cloud Appliance

Step	Description	Links
1	Review the safety precautions, guidelines, site checklists, and site requirements.	Section 4.2.2, “Review Safety Guidelines”
2	Ensure that the site is prepared for the installation of the system.	Section 4.2.3, “Prepare the Installation Site”
3	Unpack the system.	Section 4.2.5, “Unpack Oracle Private Cloud Appliance”
4	Install the system in its allocated place.	Section 4.3, “Install Oracle Private Cloud Appliance in Its Allocated Space”

4.2 Prepare to Install Oracle Private Cloud Appliance

This section describes the preparation steps to perform before installing your Oracle PCA.

4.2.1 Before You Begin

Before installing your Oracle PCA, or installing any server equipment into the rack, read the *Important Safety Information for Oracle's Hardware Systems* (7063567) document that is shipped with the system.

Observe all safety notices printed on the packaging and listed in the *Sun Rack II Safety and Compliance Guide* (820-4762) and the *Sun Rack II Power Distribution Units User's Guide* (E23956-01). Go to http://download.oracle.com/docs/cd/E19657-01/index.html to download these guides.

4.2.2 Review Safety Guidelines

Before your Oracle PCA arrives, review the following safety precautions to ensure that the site is safe, as well as ready for delivery. Failure to observe these precautions can result in personal injury, equipment damage, or malfunction.

- Do not block ventilation openings.
- Do not install the system in a location that is exposed to direct sunlight or near a device that may become hot.
- Do not install the system in a location that is exposed to excessive dust, corrosive gases, or air with high salt concentrations.
- Do not install the system in a location that is exposed to frequent vibrations. Install the system on a flat, level surface.
- Use a power outlet that uses proper grounding. When using shared grounding, the grounding resistance must not be greater than 10 ohms. Ensure that your facility administrator or a qualified electrical engineer verifies the grounding method for the building, and performs the grounding work.
- Ensure that each grounding wire used for the system is used exclusively for the Oracle PCA. Also observe the precautions, warnings, and notes about handling that appear on labels on the equipment.
- Do not place cables under the equipment or stretch the cables too tightly.
- Do not disconnect power cords from the equipment while its power is on.
- Do not place anything on top of the system or perform any work directly above it.
- If you cannot reach the connector lock when disconnecting LAN cables, then press the connector lock with a flathead screwdriver to disconnect the cable. You could damage the system board if you force your fingers into the gap rather than using a flathead screwdriver.
- Do not let the room temperature rise sharply, especially in winter. Sudden temperature changes can cause condensation to form inside the system. Allow for a sufficient warm-up period prior to server operation.
- Do not install the system near a photocopy machine, air conditioner, welding machine, or any other equipment that generates loud, electronic noises.
- Avoid static electricity at the installation location. Static electricity transferred to the system can cause malfunctions. Static electricity is often generated on carpets.
- Confirm that the supply voltage and frequency match the electrical ratings indicated on your Oracle PCA.
- Do not insert anything into any Oracle PCA opening, unless doing so is part of a documented procedure. The system contains high-voltage parts. If a metal object or other electrically-conductive object enters an opening in the system, then it could cause a short circuit. This could result in personal injury, fire, electric shock, and equipment damage.

4.2.3 Prepare the Installation Site

The following procedure describes how to prepare the site prior to unpacking and situating your Oracle PCA.

1. Thoroughly clean and vacuum the area in preparation for the installation.

2. Note problems or peculiarities at the site that require special equipment.
3. Verify that the installation site flooring has a strength rating to withstand the combined weight of the Oracle PCA and any other installed equipment.

   For more information, see Section 2.1, “Space Requirements”.
4. Install all necessary electrical equipment and ensure that sufficient power is provided.

   See also the *Sun Rack II Power Distribution Units User's Guide* for the Sun Rack II Power Distribution Unit (PDU) power requirements.
5. Ensure that the installation site provides adequate air conditioning.

   For details, see Chapter 2, *Site Requirements*.
6. Operate the air conditioning system for 48 hours to bring the room temperature to the appropriate level.

4.2.4 Tools Required for Unpacking and Installation

The following tools are required for installation:

- Screwdriver handle (magnetic)
- T-30 Torx wrench key
- T-25 Torx wrench key
- 6-mm hexagon Allen wrench key
- SW 12-mm single-headed wrench
- Side panel removal tool
- Keys to the front door, rear door, and side panel locks
- Cage nut mounting tool
- 32 M6 cage nuts
- 32 M6 screws
- Straight tip

4.2.5 Unpack Oracle Private Cloud Appliance

Refer to the *Sun Rack II Unpacking Guide* (820-5210) included with the packaging when unpacking the Oracle PCA rack from the shipping carton. After unpacking the rack, follow local laws and guidelines to recycle the packaging properly.

Caution

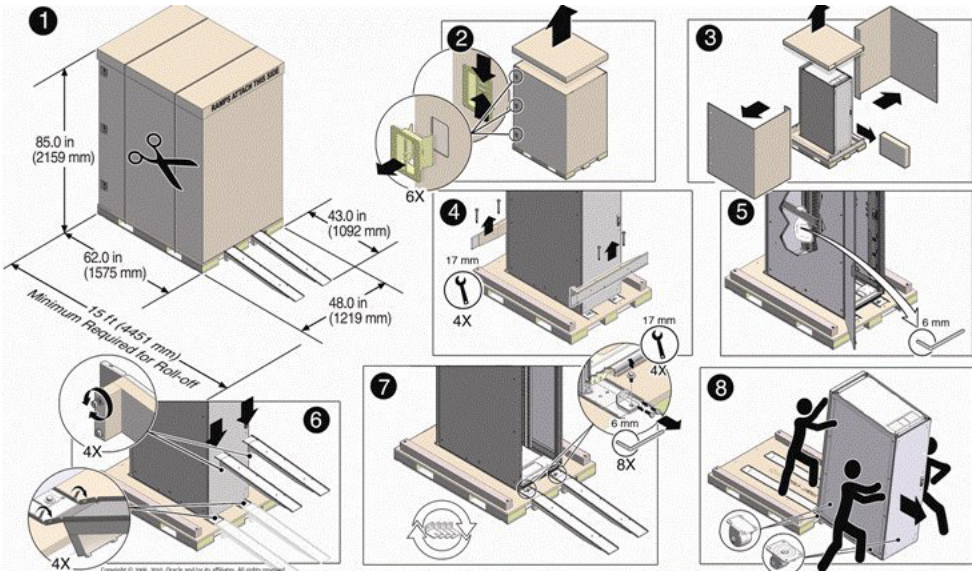
Carefully unpack the rack from the packaging and shipping pallet. Rocking or tilting the rack can cause it to fall over and cause serious injury or death. You should always use professional movers when unpacking and installing this rack.

Note

After unpacking the rack from the packaging, save the mounting brackets used to secure the rack to the shipping pallet. You can use these mounting brackets to

secure the rack permanently to the installation site floor. Do not dispose of these brackets, as you will not be able to order replacement brackets.

Figure 4.1 Unpacking the Oracle Private Cloud Appliance



4.3 Install Oracle Private Cloud Appliance in Its Allocated Space

This section describes each phase of the hardware installation procedure for the Oracle PCA.

4.3.1 Move Oracle Private Cloud Appliance

The following procedure describes how to move the Oracle PCA:

1. Ensure that the rack doors are closed and secured.
2. Ensure that the leveling and stabilizing feet on the rack are raised and out of the way.
3. Push the system from the back of the rack to the installation site.

Caution

Never attempt to move an Oracle PCA by pushing on the rack side panels. Pushing on the rack side panels can tip over the rack. This action can cause serious personal injury or death as well as damage to the equipment.

When moving your Oracle PCA to the installation site, the front casters do not pivot; you must steer the unit by moving the rear casters. You can safely maneuver the system by carefully pushing it. See Figure 4.2.

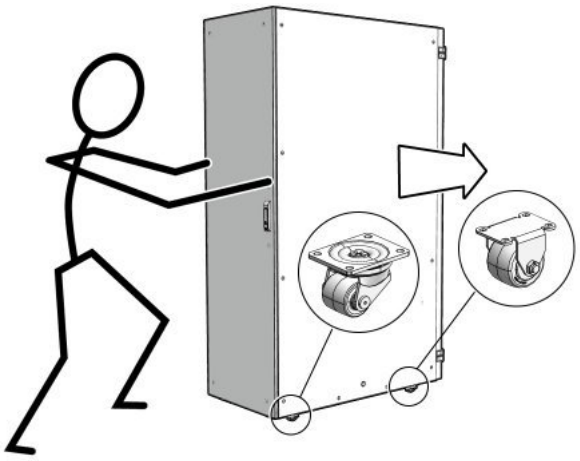
It is preferred to use three people to move the rack: one person in front and two persons in back to help guide the rack. When transporting configured racks from one location to another, take care to move them slowly, 0.65 meters per second (2.13 feet per second) or slower.

Carefully examine the transportation path. Avoid obstacles such as doorways or elevator thresholds that can cause abrupt stops or shocks. Go around obstacles by using ramps or lifts to enable smooth transport.

Caution

Never tip or rock the Oracle PCA because the rack can fall over.

Figure 4.2 Carefully Push the Oracle PCA From the Back of the Rack



4. When the rack is at the installation site, verify that no components or connections have become dislodged or disconnected during transport. If necessary, re-attach components and cables properly.

4.3.2 Stabilize Oracle Private Cloud Appliance

After moving Oracle PCA to the installation site, stabilize the rack to ensure that it does not move or tip over. You can stabilize the rack permanently by extending the rack leveling feet, using mounting brackets, or both. After installation, use the leveling feet and the brackets to stabilize the system.

4.3.3 Stabilize Oracle Private Cloud Appliance Using Leveling Feet

The rack contains four leveling feet that can be lowered to stabilize the rack. The leveling feet can be used even when the rack is permanently secured to the floor. To adjust the leveling feet, do the following:

1. Locate the four leveling feet at the bottom four corners of the rack. See Figure 4.3.

Figure 4.3 Location of Leveling Feet on Rack

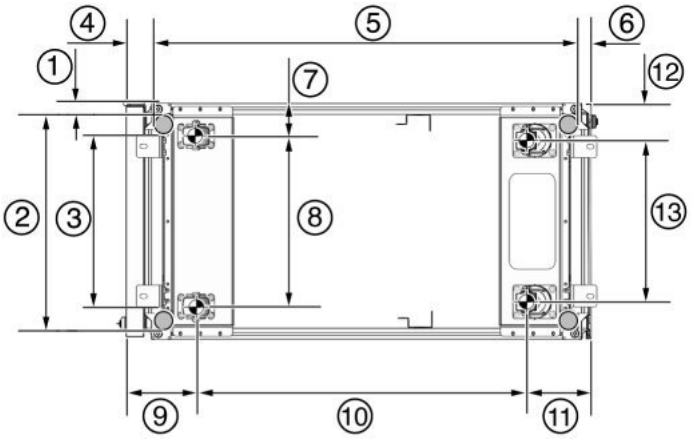


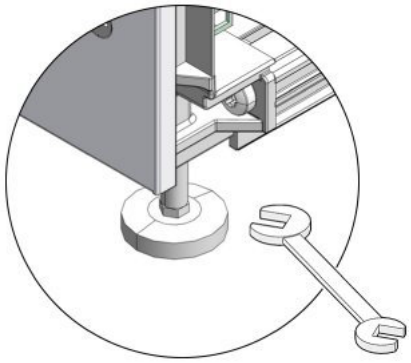
Table 4.2 Figure Legend

Item	Description
1	Distance from the edge of the mounting feet to the side of the rack is 33.75 mm (1.33 inches)
2	Width from the outside edges of the leveling feet is 532.5 mm (20.96 inches)
3	Width from the inside edges of the leveling feet is 429 mm (16.89 inches)
4	Distance from the edge of the feet to the front rack surface is 73.75 mm (2.90 inches)
5	Depth of the outside edges of the leveling feet is 1058.5 mm (41.67 inches)
6	Distance from the edge of the leveling feet to the rear rack surface is 32.5 mm (1.28 inches)
7	Distance from the center of front casters to the side of the rack is 86.7 mm (3.41 inches)
8	Width between the center of the front casters is 426.6 mm (16.80 inches)
9	Distance from the center of the rear casters to the rear of the rack is 173.7 mm (6.83 inches)
10	Depth between the front and rear casters is 828.6 mm (32.62 inches)
11	Distance between the rear casters and the rear of the rack is 162.4 mm (6.39 inches)
12	Distance from the center of rear casters to the side of the rack is 96.4 mm (3.80 inches)
13	Width between the center of the rear casters is 407.2 mm (16.03 inches)

2. Using the SW 12-mm wrench, lower the leveling feet to the floor. See Figure 4.4.

   When lowered correctly, the four leveling feet should support the full weight of the Oracle PCA.

Figure 4.4 Securing the Rack Using the Leveling Feet



4.3.4 Stabilize Oracle Private Cloud Appliance Using Mounting Brackets

The rack can be permanently mounted to the installation site floor using the same four mounting brackets that secured the rack to the shipping pallet. Use the front and rear brackets to stabilize the rack to the installation floor. Prepare the installation site by drilling four holes into the floor. Before permanently stabilizing the Oracle PCA rack using the mounting brackets, drill the mounting holes.

1. Obtain four bolts and washers to mount the system to the floor.

   The bolt holes in the mounting bracket have a 10-mm diameter.

   Oracle does not provide mounting bolts because different floors require different bolt types and strengths.

2. See Figure 4.5 to find the location and dimensions of the mounting brackets.

Figure 4.5 Location of Mounting Brackets on Oracle Private Cloud Appliance Rack

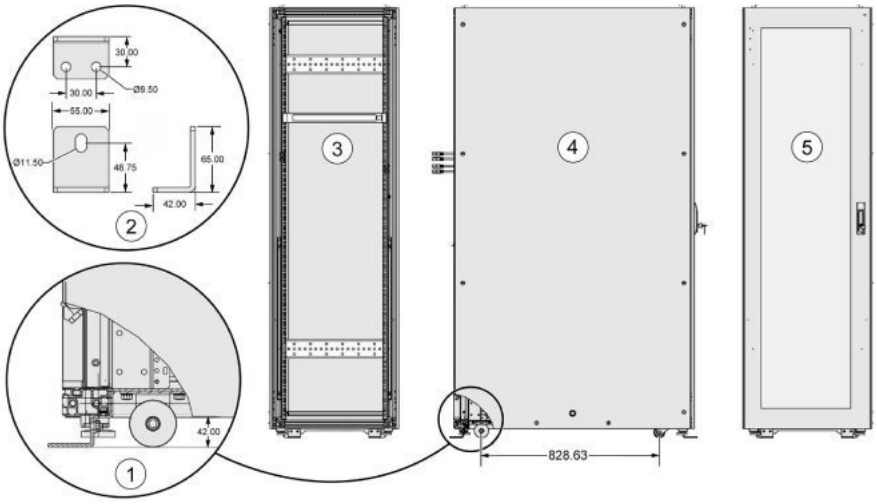


Table 4.3 Figure Legend

Item	Description
1	Mounting bracket location
2	Mounting bracket dimensions
3	Rack rear
4	Rack side
5	Rack front

3. Position the Oracle PCA rack over the drilled holes.

   Figure 4.6 shows the bottom view of the system, and the location for the mounting hole and floor cutout dimensions.

Figure 4.6 Bottom View of Oracle Private Cloud Appliance Rack Showing Mounting Hole and Floor Cutout Dimensions

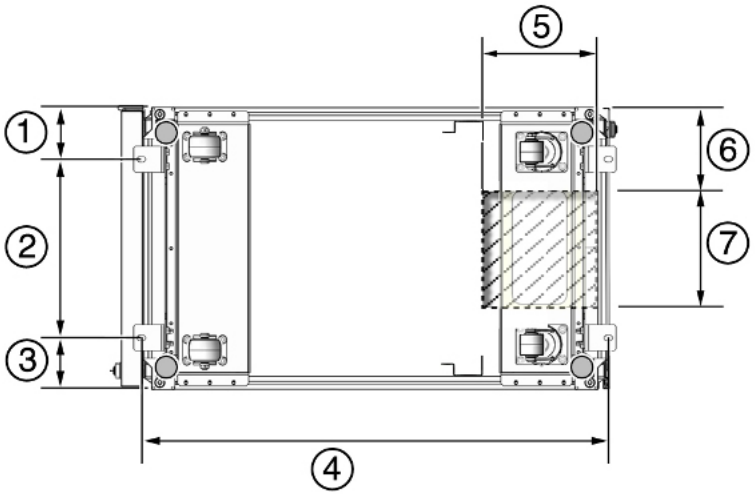


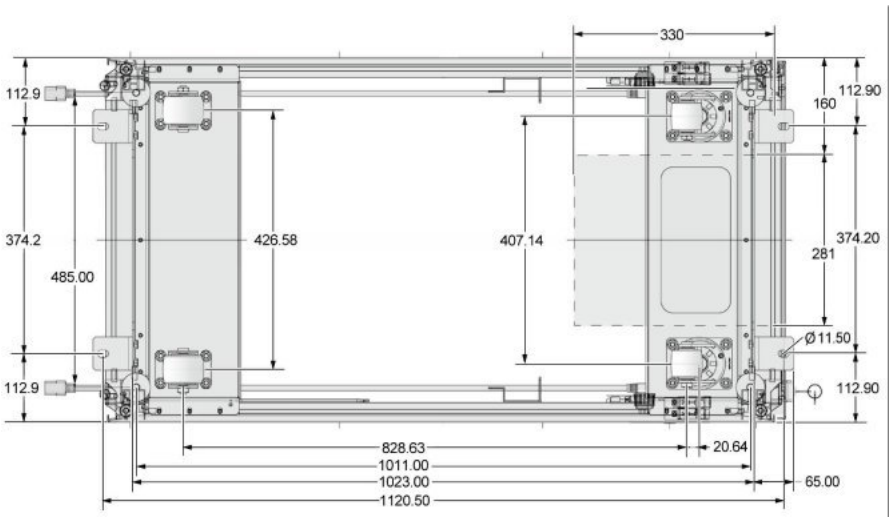
Table 4.4 Figure Legend

Item	Description
1	Distance from mounting bracket to the edge of the rack is 113 mm (4.45 inches)
2	Width between the centers of the mounting hole slots is 374 mm (14.72 inches)
3	Distance between mounting bracket to the edge of the rack is 113 mm (4.45 inches)
4	Distance between the centers of the front and rear mounting hole slots is 1120 mm (44.1 inches)
5	Depth of cable-routing floor cutout is 330 mm (13 inches)
6	Distance between the floor cutout and the edge of the rack is 160 mm (6.3 inches)
7	Width of cable-routing floor cutout is 280 mm (11 inches)

4. (Optional) If you plan to route data or power distribution unit (PDU) power cords down through the bottom of the rack, you will need to cut a hole in the installation site floor. Cut a rectangular hole below the rear portion of the rack, between the two rear casters and behind the RETMA (Radio Electronics Television Manufacturers Association) rails.

   Figure 4.7 shows the base positions of the rack from the bottom.

Figure 4.7 Base Position to Measure

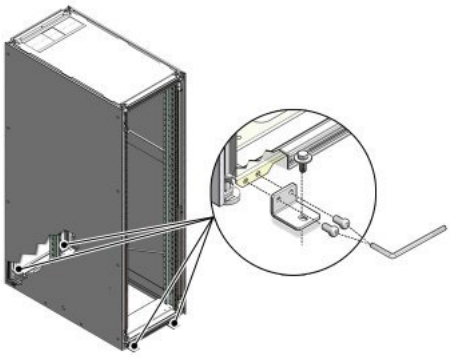


Caution

Do not create a hole where the rack casters or leveling feet brackets will be placed.

5. Open the front and rear Oracle PCA rack doors.
6. Using a 6-mm hexagon Allen wrench key, install the mounting brackets to the rack. See Figure 4.8.

Figure 4.8 Securing the Oracle Private Cloud Appliance Using Mounting Brackets



7. Using bolts and washers that are appropriate for your installation site, permanently mount your system to the floor using the four mounting brackets. See Figure 4.8.

Note

The bolts that are required for securing the Oracle PCA rack to the floor vary depending on the installation location. Select bolts that are appropriate for your location.

8. Firmly tighten all of the bolts that secure the mounting brackets to the Oracle PCA rack side doors and to the floor.

4.3.5 Attach a Ground Cable (Optional)

Oracle PCA power distribution units (PDUs) achieve earth ground through their power cords. Final chassis ground is achieved by way of the ground prong when you connect the power cord to a socket. For additional grounding, attach a chassis earth ground cable to the system. The additional ground point enables electrical current leakage to dissipate more efficiently.

Caution

The PDU power input lead cords and the ground cable must reference a common earth ground. If they do not, then a difference in ground potential can be introduced. If you are unsure of your facility's PDU receptacle grounding, then do not install a ground cable until you confirm that there is a proper PDU receptacle grounding. If a difference in ground potential is apparent, then you must take corrective action.

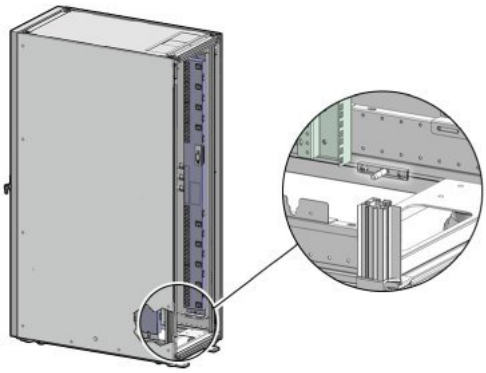
Note

A grounding cable is not shipped with the Oracle PCA.

1. Ensure that the installation site has properly grounded the power source in the data center. The facility PDU must have earth ground.
2. Ensure that all grounding points, such as raised floors and power receptacles, reference the facility ground.
3. During manufacturing, the ground cable attachment area might be a painted or coated surface. Ensure that direct, metal-to-metal contact is made for this installation.
4. Attach the ground cable to one of the attachment points located at the bottom rear of the system frame. See Figure 4.9.

   The attachment point is an adjustable bolt that is inside the rear of the system cabinet on the right side.

   Figure 4.9 Earth Ground Attachment Bolt Location

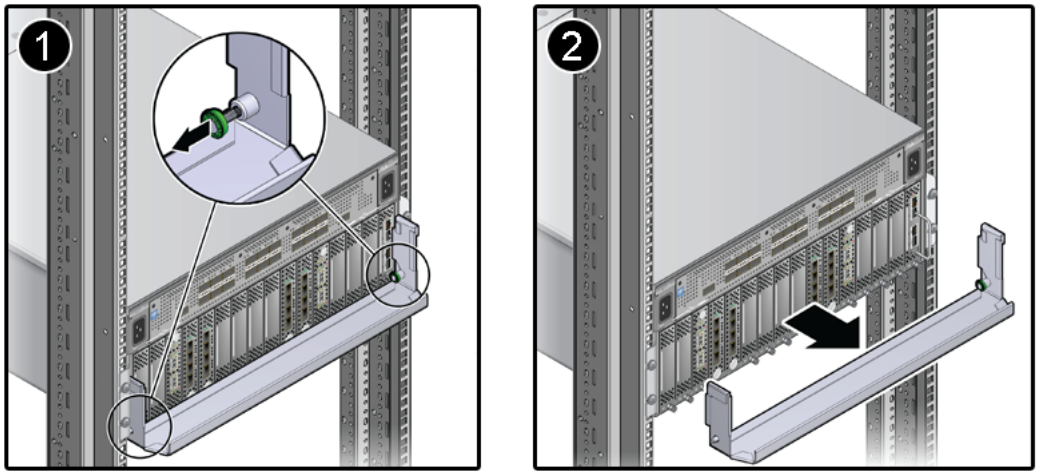


4.3.6 Remove the Oracle Fabric Interconnect F1-15 Bracket

Each Oracle Fabric Interconnect F1-15 is shipped with a bracket that secures the IO modules in their installed position. This shipping bracket is removed after the Oracle PCA is installed and stabilized in its allocated space.

1. Locate the shipping bracket at the rear of the Fabric Interconnect.
2. Pull the tabs on the left and right hand side towards the center to unlock the bracket.

Figure 4.10 Unlocking and removing the bracket securing the IO modules in the Oracle Fabric Interconnect F1-15



3. Carefully pull the bracket away from the Fabric Interconnect and out of the rack.
4. Repeat these steps to remove the shipping bracket on the second Fabric Interconnect.

4.4 What's Next?

After installing the Oracle PCA at your site, continue the installation process by powering on and performing the initial configuration of the system. For instructions, see Chapter 5, *Powering On Oracle Private Cloud Appliance*.

Chapter 5 Powering On Oracle Private Cloud Appliance

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This chapter explains how to power on Oracle Private Cloud Appliance (PCA) for the first time at your site.

Warning

Before starting the system and applying the initial configuration, read and understand the Oracle Private Cloud Appliance Release Notes. The section Known Limitations and Workarounds provides information that is critical for correctly executing the procedures in this document. Ignoring the release notes may cause you to configure the system incorrectly. Bringing the system back to normal operation may require a complete factory reset.

5.1 Power On Task Map

Table 5.1 describes the steps for powering on the Oracle PCA at your site.

Table 5.1 Steps for Powering On Oracle Private Cloud Appliance

Step	Description	Links
1	Review the safety precautions, guidelines, site checklists, and site requirements.	Section 5.3.1, “Review Safety Guidelines”
2	Perform preliminary checks before connecting the power cords.	Section 5.3.2, “Inspect Oracle Private Cloud Appliance”
3	Verify the hardware by visually inspecting the system.	
4	Connect theFabric Interconnects and Oracle Switch ES1-24 switches. Also connect a workstation with monitor to the Oracle Switch ES1-24.	Section 5.2, “Before Initial Power On”
5	Supply rack power, and perform the power-on self-test device checks.	Section 5.3.3, “Connect the Power Cords”
6	Switch on the two power distribution unit (PDU) circuit breakers located on the rear of the main PDU (PDU A).	Section 5.3.4, “Power On Oracle Private Cloud Appliance”
7	Power on the management nodes.	
8	Wait 5 to 10 minutes and then connect to the Oracle PCA Dashboard.	

5.2 Before Initial Power On

Before you power on the Oracle PCA for the first time, ensure that you have connected the Fabric Interconnects according to the network installation requirements in Section 3.1, “Network Connection and IP Address Requirements”.

In addition, you need to connect a workstation with a monitor to the available Ethernet port 19 in one of the Oracle Switch ES1-24 switches and start a web session in order to initially administer your Oracle PCA using the pre-defined IP address (`192.168.4.216`). For information, see Section 5.3.5, “Connect Oracle Private Cloud Appliance to the Network”.

5.3 Power On for the First Time

This section provides instructions for each phase of the initial power-on sequence.

5.3.1 Review Safety Guidelines

Before powering on the system or installing any server equipment into the rack, read the *Important Safety Information for Oracle's Hardware Systems* (7063567) document included with the system.

Before powering on the system, review the following safety precautions. Failure to observe these precautions can result in personal injury, equipment damage, or malfunction.

- Do not block ventilation openings.
- Do not place cables under the equipment or stretch the cables too tightly.
- Do not disconnect power cords from the equipment while its power is on.
- If you cannot reach the connector lock when disconnecting LAN cables, then press the connector lock with a flathead screwdriver to disconnect the cable. You could damage the system board if you force your fingers into the gap rather than using a flathead screwdriver.
- Do not place anything on top of the system or perform any work directly above it.
- Do not let the room temperature rise sharply, especially during winter. Sudden temperature changes can cause condensation to form inside the system. Allow for a sufficient warm-up period prior to system operation.
- Avoid static electricity at the installation location. Static electricity transferred to the system can cause malfunctions. Static electricity is often generated on carpets.
- Confirm that the supply voltage and frequency match the electrical ratings indicated on your Oracle PCA.
- Do not insert anything into any system opening, unless doing so is part of a documented procedure. The system contains high-voltage parts. If a metal object or other electrically-conductive object enters an opening in the system, then it could cause a short circuit. This could result in personal injury, fire, electric shock, and equipment damage.

5.3.2 Inspect Oracle Private Cloud Appliance

The following procedure describes how to visually inspect your Oracle PCA after it is in place at your site, and prior to power being applied to the system.

1. Check for rack damage.
2. Check the rack for loose or missing screws.

3. Check your Oracle PCA for the ordered configuration. Refer to the Customer Information Sheet (CIS) on the side of the packaging.

Note

Oracle PCA is preconfigured by Oracle as a self-contained system. You should not move any equipment or add any unsupported hardware to the system.

4. Check that all cable connections are secure and firmly in place as follows:

   a. Check the power cables. Ensure that the correct connectors have been supplied for the data center facility power source.

   b. Check the network data cables.

5. Check the site location tile arrangement for cable access and airflow.

6. Check the data center airflow that leads in to the front of the system.

   For more information, see Section 2.5, “Ventilation and Cooling Requirements”.

5.3.3 Connect the Power Cords

The following procedure describes how to connect power cords to your Oracle PCA.

1. Open the rear cabinet door.

2. Ensure that the correct power connectors have been supplied.

3. Unfasten the power cord cable ties.

   The ties are for shipping only and are no longer needed.

4. Route the power cords to the facility receptacles either above the rack or below the flooring. See Figure 5.1 and Figure 5.2.

5. Secure the power cords in bundles. See Figure 5.1.

6. Plug the power distribution unit (PDU) power cord connectors into the facility receptacles.

Figure 5.1 Power Cord Routing From the Bottom of the Rack

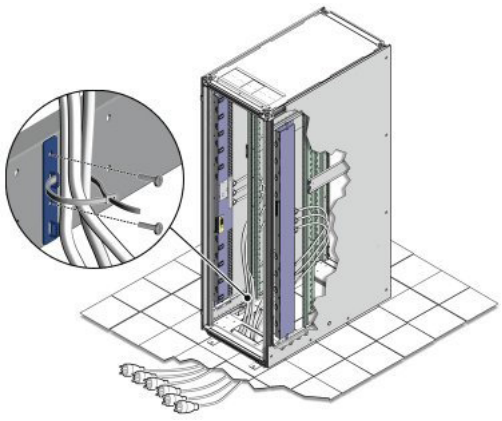
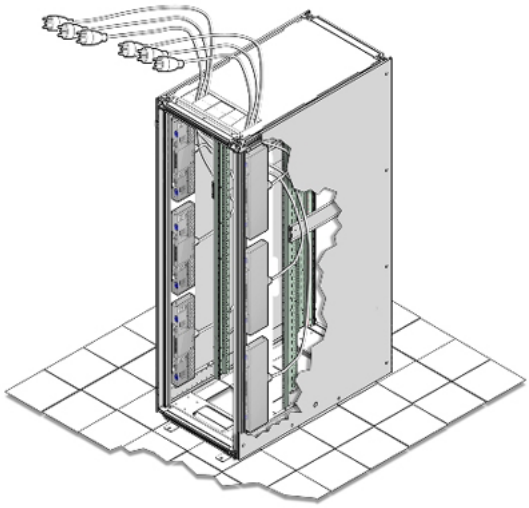


Figure 5.2 Power Cord Routing From the Top of the Rack



5.3.4 Power On Oracle Private Cloud Appliance

The following procedure describes how to power on your Oracle PCA.

Note

You can connect to your Oracle PCA using a network connection to monitor the system power-on procedure. For instructions, see Section 5.3.5, “Connect Oracle Private Cloud Appliance to the Network”.

1. Ensure that the three main power cords are connected to a reliable power source.

   For more information, see Section 2.3, “Electrical Power Requirements”.

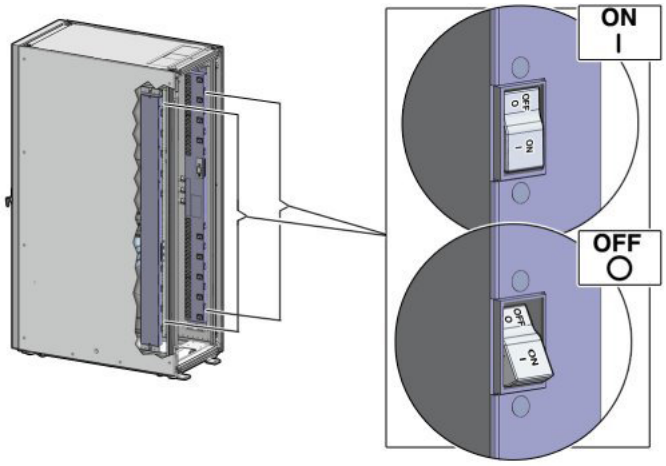
2. Switch on the power distribution unit (PDU) circuit breakers located on the rear of PDU A and B inside the Oracle PCA.

   The circuit breakers are on the rear of the system cabinet as shown in Figure 5.3. Press the ON (|) side of the toggle switch.

Note

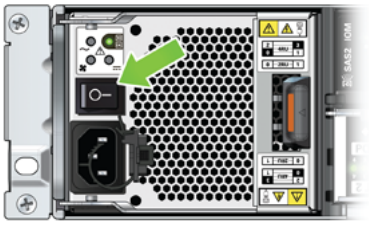
Ensure that the PDU switches have had power applied for approximately two minutes to complete power-on configuration before starting the management nodes.

Figure 5.3 PDU Switch Locations



3. Make sure that the circuit breakers located on the rear left and right side power supplies of the Oracle ZFS Storage Appliance ZS3-ES are in the ON (|) position.

Figure 5.4 Oracle ZFS Storage Appliance ZS3-ES Circuit Breakers



4. Press the Power button located on the front of the first (bottom) management node. See Figure 5.5.

   The first management node is located in rack unit 5 (U5). The second management node is located in rack unit 6 (U6). It is switched on and configured automatically during the initial power-on sequence.

   A management nodes take approximately five to ten minutes to power on completely. Once complete, the Power/OK LED illuminates and remains a steady green.

Figure 5.5 Oracle Private Cloud Appliance Management Node

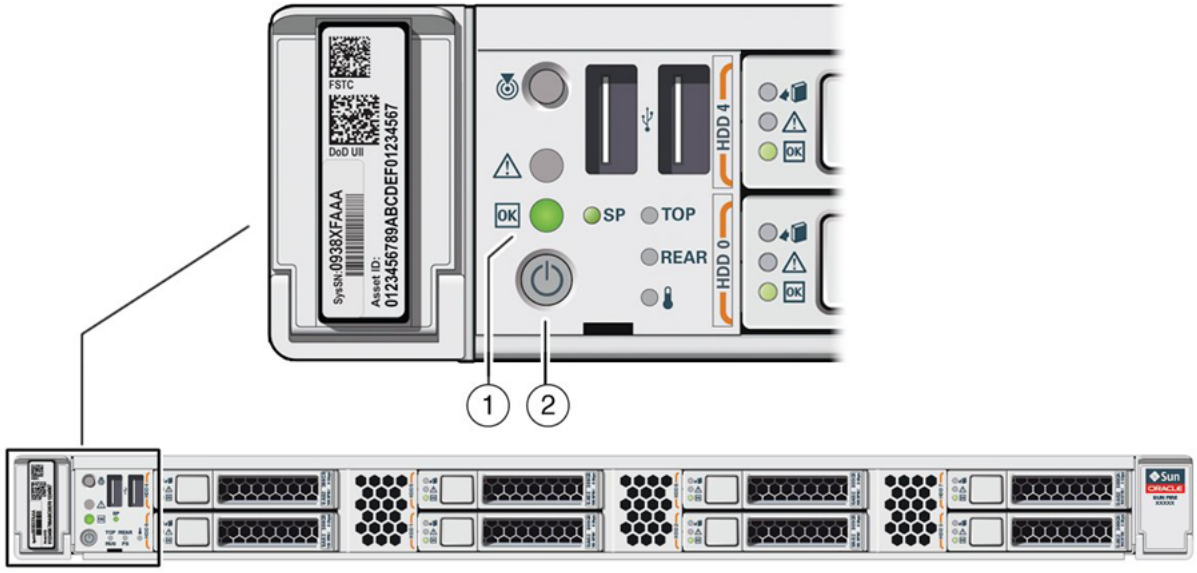


Table 5.2 Figure Legend

Item	Description
1	Power/OK LED
2	Power button

5. After powering on the first management node, wait while the second management node and all compute nodes are powered on and discovered.

Note

After power is applied, the LEDs on all compute nodes and storage server heads will start to blink after approximately two minutes. From the rear of the rack, you can see the green LEDs on the power supply units (PSUs) on the compute nodes turn on instantly after power is applied. In addition, from the rear of the rack, you can see the display on the power distribution units (PDUs) illuminate once power is available.

The management nodes will verify all components within the system. The management nodes ensure that the correct networking switches and storage devices are installed in the system, and search for compute nodes to add to the compute fabric. Once compute nodes are located, the management nodes automatically install the proper drivers and the Oracle VM Server version 3.2.10 operating system on each compute node.

Depending on your system configuration, the Oracle PCA power-on process should take approximately five to ten minutes to become available for initialization, and up to a few hours for the entire fabric to be ready. When completed, use the web browser configuration utility to configure initial system settings (for example: network properties and passwords). For instructions on connecting to the Oracle PCA and accessing the Dashboard UI, see Section 5.3.5, “Connect Oracle Private Cloud Appliance to the Network”.

5.3.5 Connect Oracle Private Cloud Appliance to the Network

For initial access to Oracle PCA, you must connect a workstation with a monitor to the available Ethernet port 19 in one of the Oracle Switch ES1-24 switches. The Oracle PCA Dashboard can be reached by means of a web browser.

Note

You can connect to the Ethernet port at any time during the system power-on process. However, you should wait approximately two to three minutes after starting the power-on process to allow the IP address to become active. If you connect too soon to the port, you will see an HTTP error code 404 or similar code. If this occurs, wait a few minutes and try to connect again.

You can connect your Oracle PCA to the network as follows:

1. Ensure that the Fabric Interconnects are connected to your data center (public) network.

   For details, see Section 3.1.1, “Network Connection Requirements”.

2. Connect a workstation with a web browser directly to the management network using an Ethernet cable connected to port 19 of an Oracle Switch ES1-24.

3. Configure the wired network connection of the workstation to use the static IP address `192.168.4.254`.

4. Using the web browser on the workstation, connect to the Oracle PCA Dashboard on the master management node at `http://192.168.4.216` .

   `192.168.4.216` is the predefined virtual IP address of the management node cluster for configuring Oracle PCA. If there is another device on your network that is using this IP address, you should change the conflicting device's IP address prior to connecting to the Oracle PCA.

5. Log into the Dashboard using the user name `admin` and password `Welcome1`.

   The Dashboard opens in the Hardware View tab. This view indicates the status of the appliance as it is being powered on. All the networking and storage should be green. As the compute nodes are discovered, they will change from yellow to green. Wait until all compute nodes have been discovered and provisioned before making configuration changes in the Dashboard interface.

6. Using the Dashboard, configure the system environment parameters, including: domain name, NTP and DNS servers.

   Warning

   Before reconfiguring the system network settings, make sure that no provisioning or upgrade processes are running. For details, refer to the section “Do Not Reconfigure Network During Compute Node Provisioning or Upgrade” in the Oracle Private Cloud Appliance Release Notes.

7. Go to the Network Settings tab and replace the default IP configuration of the management nodes with the reserved IP addresses in your data center network. Enter the default gateway of your data center network.

Note

During the initial configuration of the Oracle PCA, you change the predefined configuration IP address to the reserved virtual IP address in your data center network. For details, see Section 3.1.2, “IP Address Requirements”.

8. Reconnect to the Oracle PCA Dashboard at the new virtual IP address of the management node cluster: `https://<virtual_ip>:7002/dashboard`.

For details about the software configuration process, and for advanced configuration and update options, refer to the Oracle Private Cloud Appliance Administrator's Guide.

5.4 What's Next?

After powering on your Oracle PCA and performing the initial system configuration, the environment is ready for virtual machine deployment. Refer to the Oracle Private Cloud Appliance Administrator's Guide for information about working with an operational environment:

- See Monitoring and Managing Oracle Private Cloud Appliance for instructions to work with the Oracle PCA Dashboard.
- See Managing the Oracle VM Virtual Infrastructure for instructions to work with virtual machines within Oracle VM.
- Refer to the section Update in the Oracle Private Cloud Appliance Administrator's Guide for instructions to update the Oracle PCA controller software.
- See Servicing Oracle Private Cloud Appliance Components for instructions to service customer-replaceable components in the Oracle PCA.

Note

Optionally, you can extend Oracle PCA by adding more compute nodes to the system, by installing extra memory in the compute nodes, or by connecting the appliance to additional external storage. For more information and instructions, refer to the following chapters:

- Chapter 6, *Extending Oracle Private Cloud Appliance - Additional Compute Nodes*
- Chapter 7, *Extending Oracle Private Cloud Appliance - Server Memory Kits*
- Chapter 8, *Extending Oracle Private Cloud Appliance - External Storage*

.

Chapter 6 Extending Oracle Private Cloud Appliance - Additional Compute Nodes

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Extension of Oracle Private Cloud Appliance (PCA) may involve increasing the number of compute nodes within a rack to maximize the number of virtual machines that are capable of running on the appliance and to increase the processing power and memory available to existing virtual machines. The process of extending the Oracle PCA in this way requires that you install additional servers into the rack. This operation does not require that the system is powered down, but physical changes are made to the system. Therefore you should review the task map provided in Section 6.1, “Extending Compute Capacity Task Map” before continuing. Each step to perform the operation is described in detail in this section.

This chapter explains how to extend your Oracle PCA by adding compute nodes to the system.

6.1 Extending Compute Capacity Task Map

Table 6.1 describes the steps for extending the Oracle PCA at your site by installing additional compute nodes within the rack.

Table 6.1 Steps for Extending Oracle Private Cloud Appliance By Adding Compute Nodes

Step	Description	Links
1	Review safety guidelines and site checklists.	Section 6.2, “Review Safety Guidelines”
2	Review safety precautions for rack-mounting a server.	Section 6.3, “Rack-mount Safety Precautions”
3	Prepare to add the server to the rack, including: • Unpacking the upgrade kit • Removing the rear doors from the rack	Section 6.4, “Prepare to Add a Server”
4	Install the server into the rack, including: • Installing mounting brackets to the server • Attaching slide-rail assemblies to the rack • Installing the server into the slide-rail assemblies	Section 6.5, “Install the Server Into the Rack”

Step	Description	Links
	• Installing the cable management arm • Cabling the server • Replacing the doors on the rack	

6.2 Review Safety Guidelines

Before expanding Oracle PCA, read the following important safety information:

- *Important Safety Information for Oracle's Hardware Systems* (7063567)
- Section 2.3, “Electrical Power Requirements”
- Section D.5, “Facility Power Checklist”

6.3 Rack-mount Safety Precautions

This section describes rack-mount safety precautions you must follow when installing a compute node into your Oracle PCA.

Caution

Deploy the anti-tilt bar or legs on the equipment rack before beginning an installation.

Caution

Always load equipment into a rack from the bottom up so that the rack will not become top-heavy and tip over. Deploy your rack's anti-tilt bar to prevent the rack from tipping during equipment installation.

Caution

Elevated operating ambient temperature: If the server is installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment might be greater than room ambient temperature. Therefore, consideration should be given to installing the equipment in an environment compatible with the maximum ambient temperature specified for the server. For information, refer to Section 2.5, “Ventilation and Cooling Requirements”.

Caution

Reduced airflow: Installation of the equipment in a rack should be such that the amount of airflow required for safe operation of the equipment is not compromised.

Caution

Mechanical loading: Mounting of the equipment in the rack should be such that a hazardous condition is not created due to uneven mechanical loading.

Caution

Circuit overloading: Consideration should be given to the connection of the equipment to the supply circuit and the effect that overloading of the circuits might

have on over-current protection and supply wiring. Appropriate consideration of equipment nameplate power ratings should be used when addressing this concern.

Caution

Reliable earthing: Reliable earthing of rack-mounted equipment should be maintained. Particular attention should be given to supply connections other than direct connections to the branch circuit (for example, use of power strips).

Caution

Slide-rail-mounted equipment is not to be used as a shelf or a work space.

6.4 Prepare to Add a Server

This section describes the preparation steps to perform before installing an additional compute node as part of your Oracle PCA.

Caution

When adding expansion nodes, always populate the compute rack units starting from the bottom most open slot, and work your way up. If you do not populate the rack units in the right order, the monitoring software may no longer report the correct status of the rack components.

6.4.1 Unpack the Server Upgrade Kit

Perform the following procedure to unpack the server upgrade kit.

1. Remove the packaging from the Oracle PCA Expansion Node upgrade kit.
2. Verify that all items are included. The upgrade kit should contain the following:
   - Oracle Server X5-2
   - Cable management arm assembly with installation instructions
   - Rack-mount kit containing rack rails and installation instructions
   - (Optional) Oracle server documentation

Note

Cables are not included in the server upgrade kit. Oracle PCA comes with pre-installed and labeled cables for all rack units. These should not be unplugged or removed from the rack.

6.4.2 Prepare the Oracle Private Cloud Appliance Rack

Perform the following procedure to prepare the rack.

Caution

To reduce the risk of personal injury, stabilize the rack cabinet and extend all anti-tilt devices before performing this procedure.

1. Remove the Oracle PCA front and rear rack doors, as follows:

a. Unlock the front and rear rack doors.

b. Open the doors.

c. Detach the grounding straps connected to the doors by pressing down on the tabs of the grounding strap's quick-release connectors, and pull the straps from the frame.

d. Lift the doors up and off their hinges. See Figure 6.1.

Figure 6.1 Removing the Rack Doors

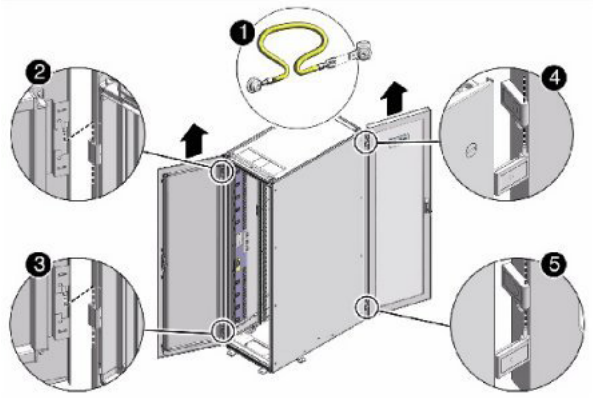


Table 6.2 Figure Legend

Item	Description
1	Detaching the grounding cable
2	Top rear hinge
3	Bottom rear hinge
4	Top front hinge
5	Bottom front hinge

2. Remove the filler panel(s) where the upgrade server will be installed.

   The filler panels have snap-in attachments. No screwdriver is required to remove them.

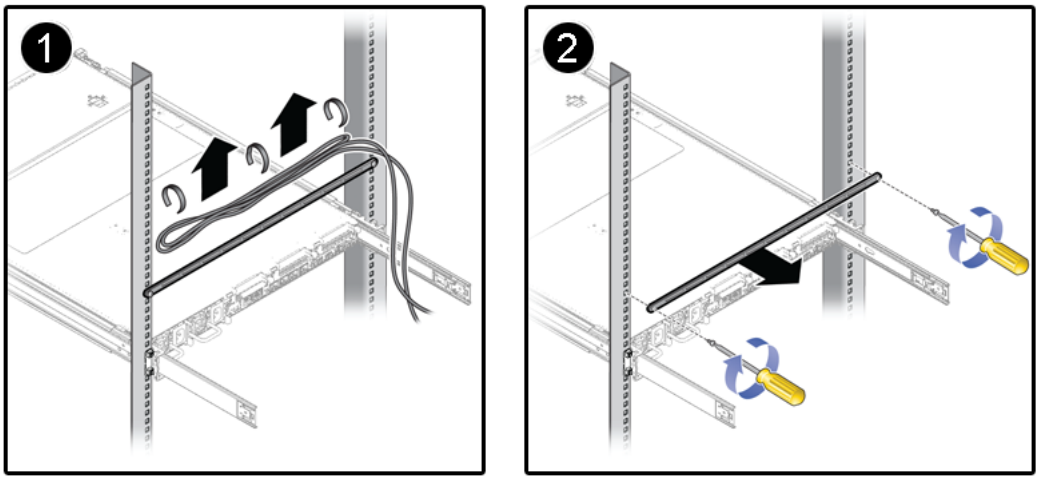
3. Remove the lacer bar that holds the pre-installed cables in place at the rear side of the rack. See Figure 6.2

   a. Detach the pre-installed cables from the lacer bar on the rack unit for the new expansion node.

   b. Use a No. 2 Phillips screwdriver to remove the M6 screws from the lacer bar.

   c. Remove the lacer bar from the rack. Save lacer bar and screws for future use.

Figure 6.2 Removing the Lacer Bar



6.5 Install the Server Into the Rack

This section describes the steps to install an additional compute node as part of your Oracle PCA.

6.5.1 Install Mounting Brackets

Perform the following procedure to install mounting brackets onto the sides of the server.

1. Position a mounting bracket against the chassis so that the slide-rail lock is at the server front, and the five keyhole openings on the mounting bracket are aligned with the five locating pins on the side of the chassis. See Figure 6.3.

Figure 6.3 Aligning the Mounting Bracket With the Server Chassis

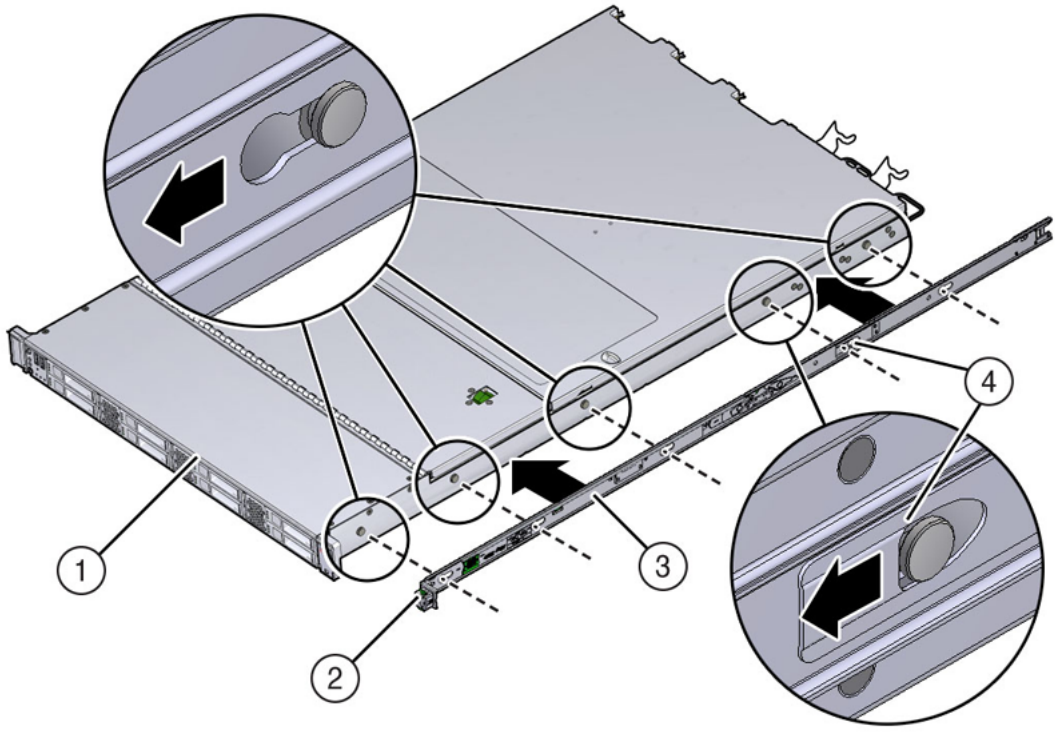


Table 6.3 Figure Legend

Item	Description
1	Chassis front
2	Slide-rail lock
3	Mounting bracket
4	Mounting bracket clip

2. With the heads of the five chassis locating pins protruding through the five keyhole openings in the mounting bracket, pull the mounting bracket toward the front of the chassis until the mounting bracket clip locks into place with an audible click.
3. Verify that the rear locating pin has engaged the mounting bracket clip.
4. Repeat these steps to install the remaining mounting bracket on the other side of the server.

6.5.2 Attach Slide-Rail Assemblies

Perform the following procedure to attach slide-rail assemblies to the rack.

1. Orient the slide-rail assembly so that the ball-bearing track is forward and locked in place.

Figure 6.4 Orienting the Slide-Rail With the Ball-Bearing Track

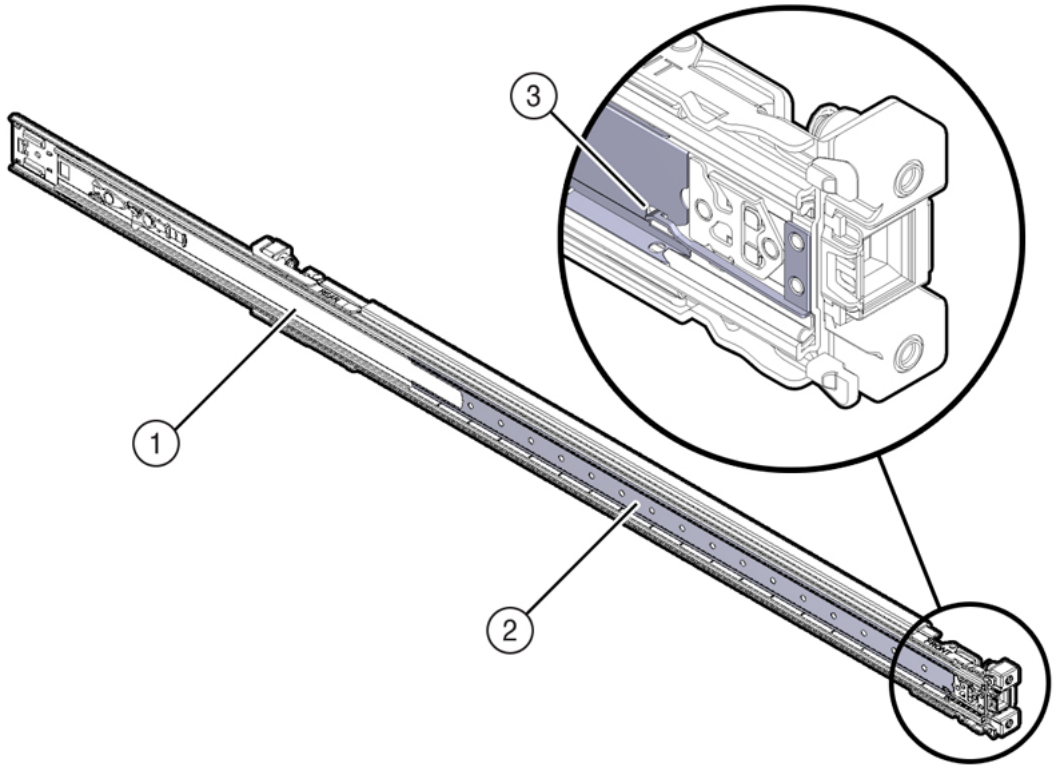
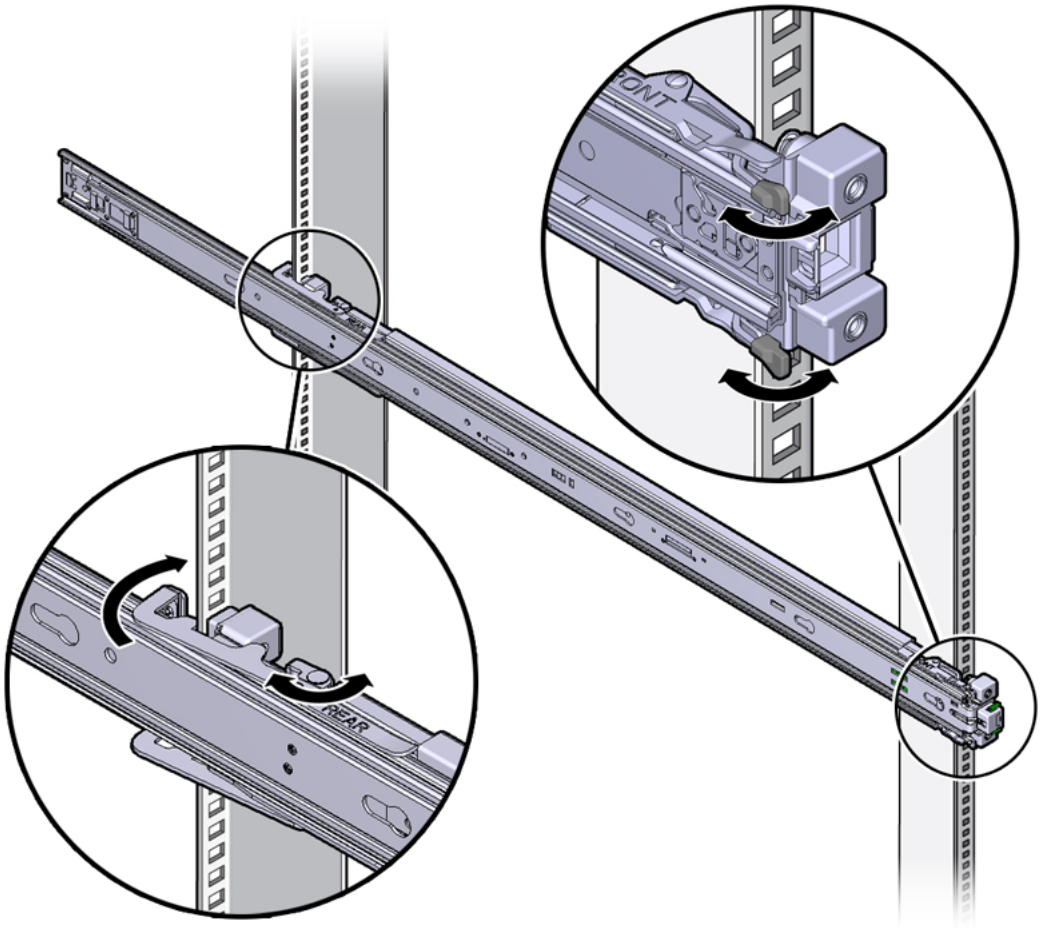


Table 6.4 Figure Legend

Item	Description
1	Slide-rail
2	Ball-bearing track
3	Locking mechanism

2. Starting with either the left or right side of the rack, align the rear of the slide-rail assembly against the inside of the rear rack rail, and push until the assembly locks into place with an audible click. See Figure 6.5.

Figure 6.5 Aligning the Slide-Rail Assembly With the Rack



3. Align the front of the slide-rail assembly against the outside of the front rack rail, and push until the assembly locks into place with an audible click. See Figure 6.5.
4. Repeat these steps to attach the slide-rail assembly to the other side of the rack.

6.5.3 Install the Server Into the Slide-Rail Assemblies

Perform the following procedure to install the server, with mounting brackets, into the slide-rail assemblies that are mounted to the rack.

Caution

This procedure requires a minimum of two people because of the weight of the server. Attempting this procedure alone could result in equipment damage or personal injury.

Caution

Always load equipment into a rack from the bottom up so that the rack will not become top-heavy and tip over. Extend your rack's anti-tilt bar to prevent the rack from tipping during equipment installation.

1. Push the slide-rails as far as possible into the slide-rail assemblies in the rack.
2. Position the server so that the rear ends of the mounting brackets are aligned with the slide-rail assemblies that are mounted in the rack. See Figure 6.6.
3. Insert the mounting brackets into the slide-rails, and then push the server into the rack until the mounting brackets encounter the slide-rail stops (approximately 30 cm, or 12 inches).

Figure 6.6 Inserting the Server With Mounting Brackets Into the Slide-Rails

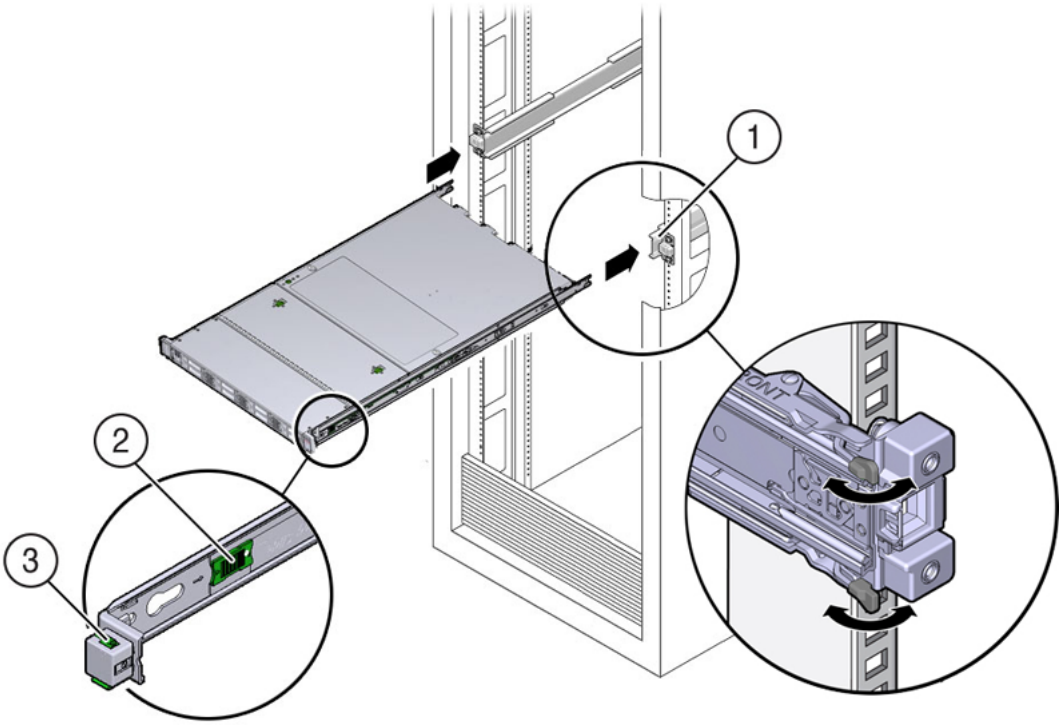


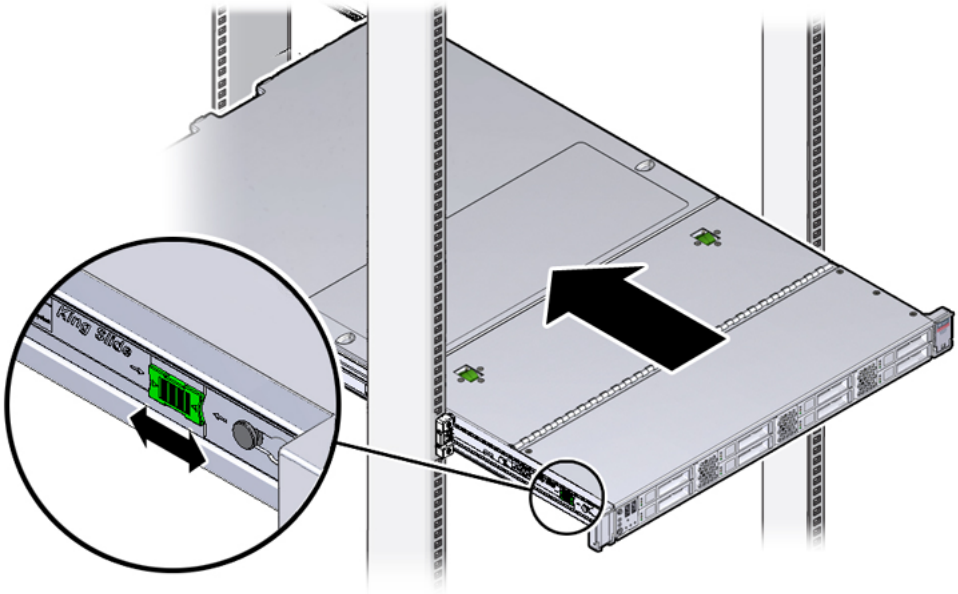
Table 6.5 Figure Legend

Item	Description
1	Inserting mounting bracket into slide-rail
2	Slide-rail release button
3	Slide-rail lock

4. Simultaneously push and hold the green slide-rail release buttons on each mounting bracket while you push the server into the rack. Continue pushing the server into the rack until the slide-rail locks (on the front of the mounting brackets) engage the slide-rail assemblies. See Figure 6.7.

   You will hear an audible click.

Figure 6.7 Sliding the Server Into the Rack



6.5.4 Install the Cable Management Arm

Perform the following procedure to install the cable management arm (CMA) to rear of the server.

1. Unpack the CMA.
2. To make it easier to install the CMA, extend the server approximately 13 cm (5 inches) out of the front of the rack.
3. Take the CMA to the back of the equipment rack, and ensure that you have adequate room to work at the back of the server.

Note

References to “left” or “right” in this procedure assume that you are facing the back of the equipment rack.

Note

Throughout this installation procedure, support the CMA and do not allow it to hang under its own weight until it is secured at all four attachment points.

4. Insert the CMA's connector A into the front slot on the left slide-rail until it locks into place with an audible click. See Figure 6.8, frames 1 and 2.

   The connector A tab (see call-out 1) goes into the slide-rail's front slot (call-out 2).

   Gently tug on the left side of the front slide bar to verify that connector A is properly seated.

Figure 6.8 Installing Connector A Into the Left Slide-Rail

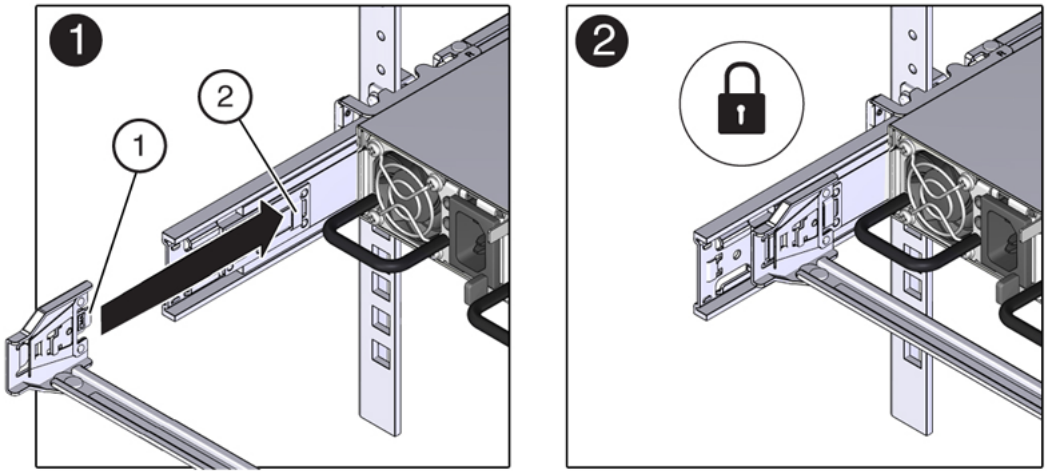


Table 6.6 Figure Legend

Item	Description
1	Connector A tab
2	Left slide-rail front slot

5. Insert the CMA's connector B into the front slot on the right slide-rail until it locks into place with an audible click. See Figure 6.9, frames 1 and 2.

   The connector B tab (call-out 1) goes into the slide-rail front slot (call-out 2).

   Gently tug on the right side of the front slide bar to verify that connector B is properly seated.

Figure 6.9 Installing Connector B Into the Right Slide-Rail

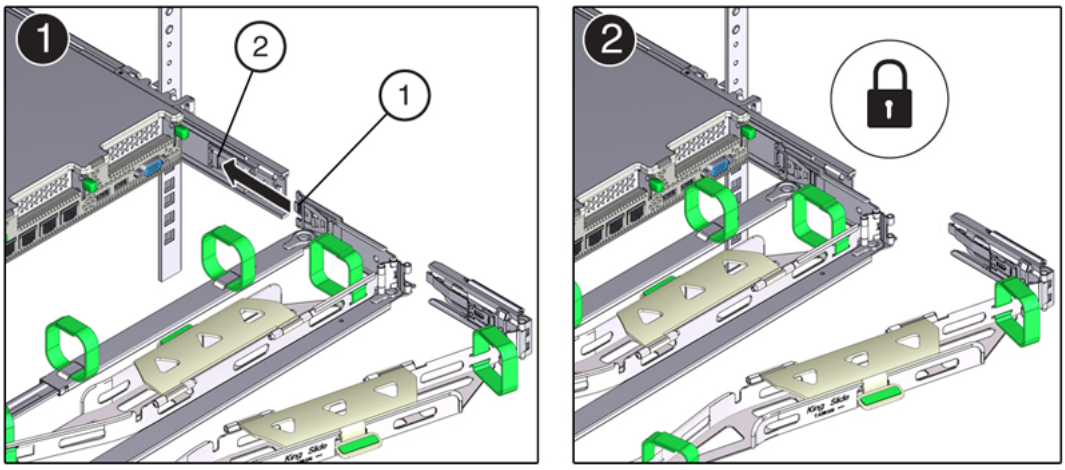


Table 6.7 Figure Legend

Item	Description
1	Connector B tab

Item	Description
2	Right slide-rail front slot

6. To install the CMA's connector C into the right slide-rail, perform the following steps:

   a. Align connector C with the slide-rail so that the locking spring (call-out 1) is positioned inside (server side) of the right slide-rail. See Figure 6.10, frame 1.

Figure 6.10 Installing Connector C Into the Right Slide-Rail

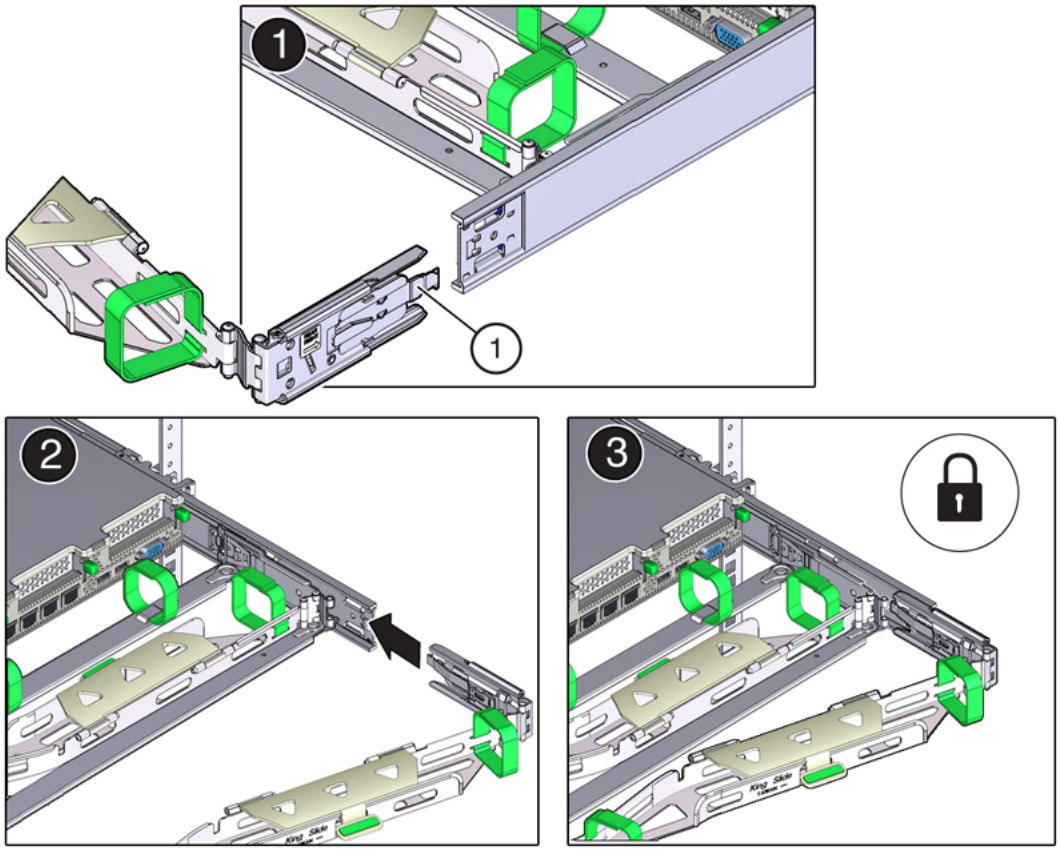


Table 6.8 Figure Legend

Item	Description
1	Connector C locking spring

   b. Insert connector C into the right side-rail until it locks into place with an audible click (frames 2 and 3).

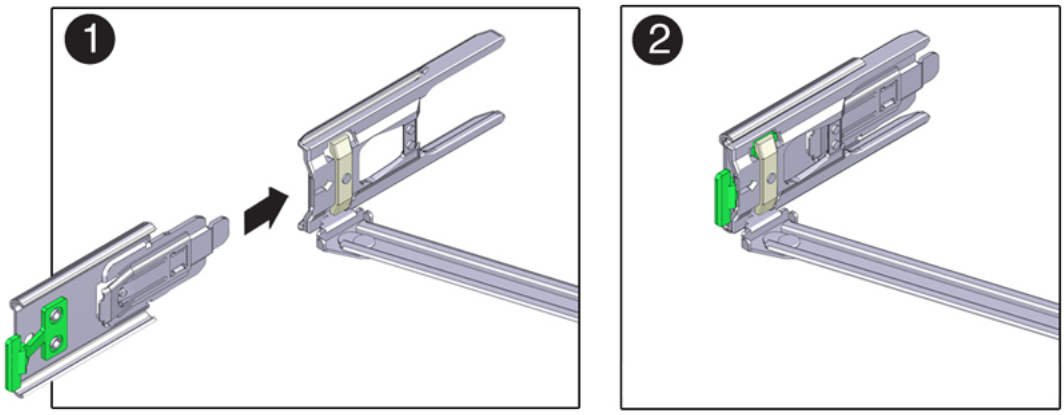
   c. Gently tug on the right side of the CMA's rear slide bar to verify that connector C is properly seated.

7. To prepare the CMA's connector D for installation, remove the tape that secures the slide-rail latching bracket to connector D and ensure that the latching bracket is properly aligned with connector D. See Figure 6.11, frames 1 and 2.

Note

The CMA is shipped with the slide-rail latching bracket taped to connector D. You must remove the tape before you install this connector.

Figure 6.11 Aligning the CMA Slide-Rail Latching Bracket With Connector D



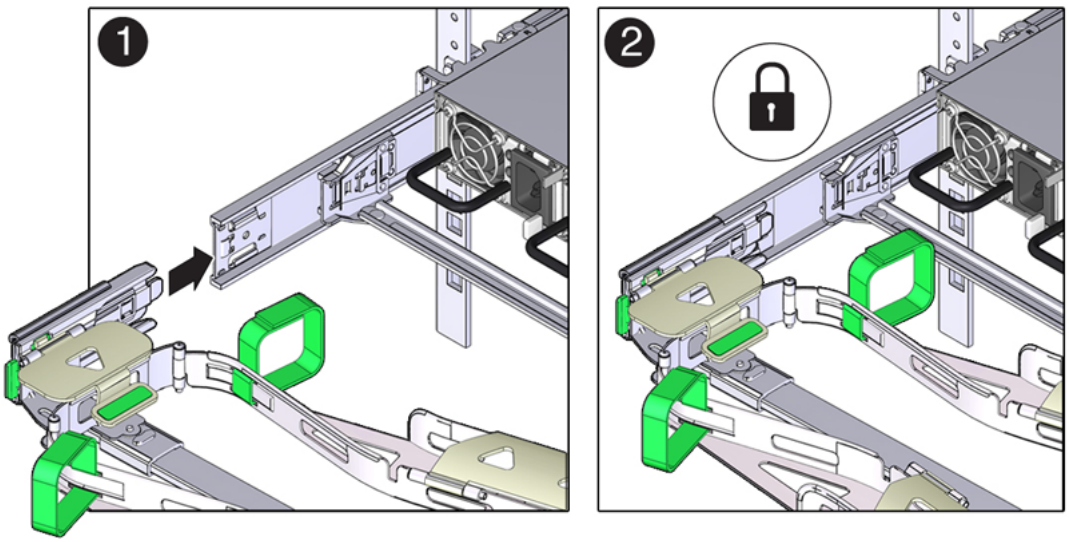
8. While holding the slide-rail latching bracket in place, insert connector D and its associated slide-rail latching bracket into the left slide-rail until connector D locks into place with an audible click. See Figure 6.12, frames 1 and 2.

Note

When inserting connector D into the slide-rail, the preferred and easier method is to install connector D and the latching bracket as one assembly into the slide-rail.

Gently tug on the left side of the CMA's rear slide bar to verify that connector D is properly seated.

Figure 6.12 Installing Connector D Into the Left Slide-Rail



Note

The slide-rail latching bracket has a green release tab. This tab is used to release and remove the latching bracket so that you can remove connector D.

9. Gently tug on the four CMA connection points to ensure that the CMA connectors are fully seated before you allow the CMA to hang by its own weight.

10. To verify that the slide-rails and the CMA are operating properly before routing cables through the CMA, perform the following steps:

    a. Extend the server from the front of the rack until the CMA is fully extended.

    Caution

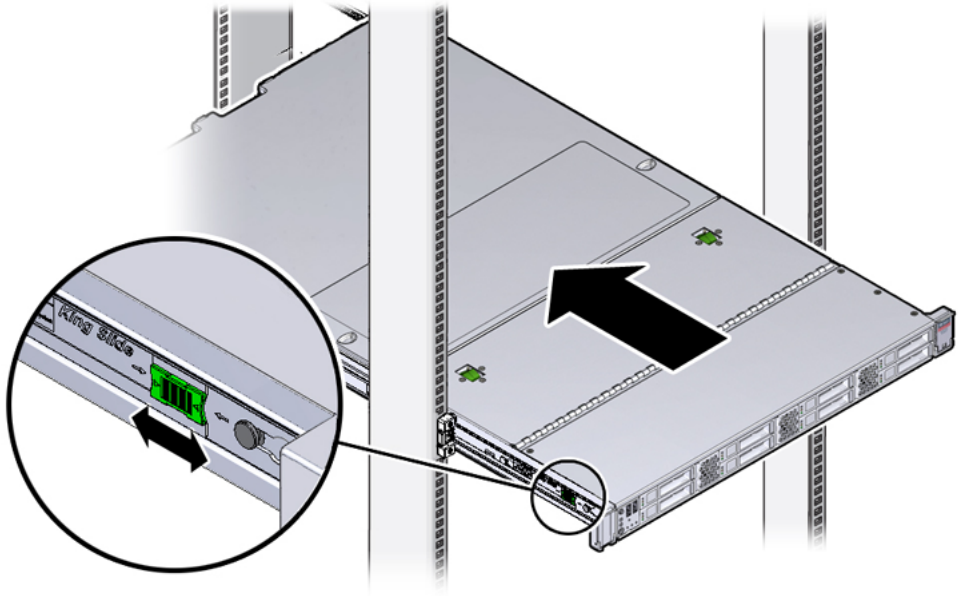
    To reduce the risk of personal injury, stabilize the rack cabinet and extend all anti-tilt devices before extending the server from the rack.

    b. Simultaneously pull and hold the two green release tabs (one on each side of the server) toward the front of the server (see the following figure) while you push the server into the rack. As you push the server into the rack, verify that the CMA retracts without binding. See Figure 6.13.

    Note

    To pull the green release tabs, place your finger in the center of each tab, not on the end, and apply pressure as you pull the tab toward the front of the server.

    Figure 6.13 Location of the Slide-Rail Release Tabs



    c. Continue pushing the server into the rack until the slide-rail locks (on the front of the server) engage the slide-rail assemblies.

    You will hear an audible click when the server is in the normal rack position.

11. Connect the cables to the server, as required.

    Instructions for connecting server cables are provided in Section 6.5.5, “Cable the Server”.

6.5.5 Cable the Server

After the server is installed in the rack and proper cable management arm (CMA) operation is verified, perform the procedures in this section to cable the server.

Note

If you are installing more than one server into the rack, perform the procedures in the previous sections for each server before performing the cabling steps in this section.

You should observe the following guidelines when attaching cables to a newly rack-mounted server:

- Do not remove existing cable connections in the rack.
- Attach and route cables in the CMA and rear panel one server at a time. Do not slide out more than one server at a time.
- Start from the bottom of the rack, and work upward. Route cables through the CMA with the dongle on the top and power cables on the bottom.

Note

The Oracle PCA rack is pre-cabled for all Ethernet and InfiniBand cabling, including for future compute nodes. Cable bundles are cable-tied to the correct rack unit for each future server. You should not modify any of the cabling on the Oracle Switch ES1-24 switches, NM2-36P Sun Datacenter InfiniBand Expansion Switches, Oracle ZFS Storage Appliance ZS3-ES, or the InfiniBand ports on the Fabric Interconnects. For cabling reference information, see Appendix B, *Cabling Reference*.

1. Connect the pre-installed power and data cables of the appropriate rack unit to the back of the expansion node. The cables are labeled for your convenience, and should be connected according to Figure 6.14.

Figure 6.14 Server Cabling Requirements

Table 6.9 Figure Legend

Item	Description
A	Power supplies
B	InfiniBand connectors

Item	Description
C	NET0 Ethernet port

2. Open the CMA cable covers, route server cables through the CMA's cable troughs, close the cable covers, and secure the cables with the six Velcro straps. See Figure 6.15.

   a. First through the front-most cable trough.

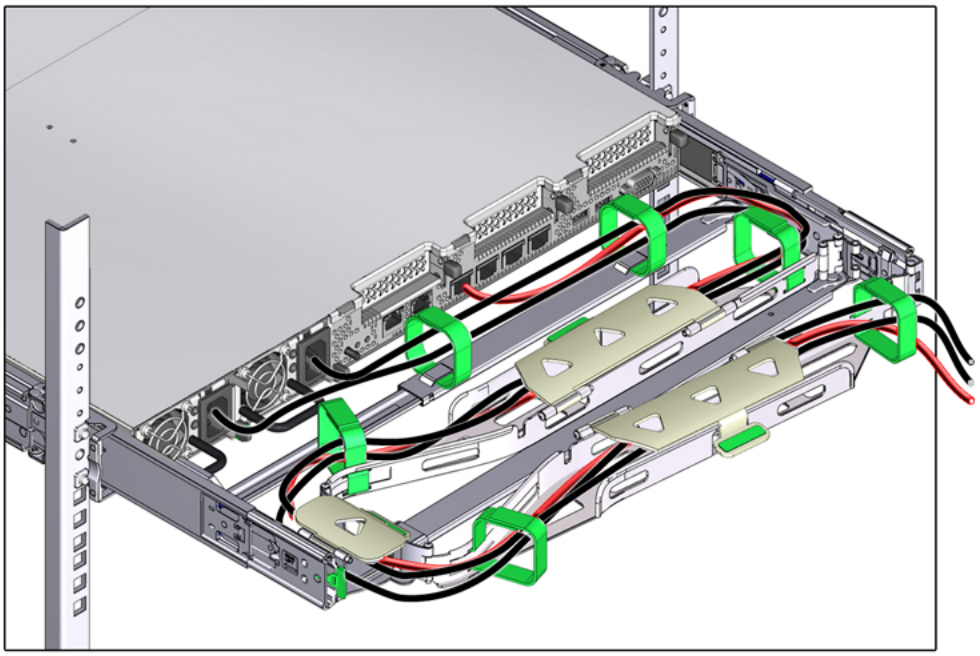
   b. Then through the small cable trough.

   c. Then through the rear-most cable trough.

Note

When securing the cables with the Velcro straps located on the front slide bar, ensure that the Velcro straps do not wrap around the bottom of the slide bar; otherwise, expansion and contraction of the slide bar might be hindered when the server is extended from the rack and returned to the rack.

Figure 6.15 CMA With Cables Installed



3. Ensure that the secured cables do no extend above the top or below the bottom of the server to which they are attached; otherwise, the cables might snag on other equipment installed in the rack when the server is extended from the rack or returned to the rack.

Note

If necessary, bundle the cables with additional Velcro straps to ensure that they stay clear of other equipment. If you need to install additional Velcro straps, wrap the straps around the cables only, not around any of the CMA components; otherwise, expansion and contraction of the CMA slide bars might be hindered when the server is extended from the rack and returned to the rack.

4. Verify the operation of the CMA with all cables installed.

Note

Oracle recommends that two people execute this step. One person to move the server in and out of the rack, and another person to observe the cable and CMA operation.

a. Slowly pull the server out of the rack until the slide rails reach their stop.

b. Inspect the attached cables for any binding or kinks.

c. Verify that the CMA extends fully from the slide rails.

5. Push the server back into the rack.

a. Simultaneously pull and hold the two green release tabs (one on each side of the server) toward the front of the server while you push the server into the rack. See Figure 6.13.

Note

To pull the green release tabs, place your finger in the center of each tab, not on the end, and apply pressure as you pull the tab toward the front of the server.

b. Verify that the CMA retracts without binding.

6. Repeat the previous steps for each additional server that you add to the rack.

The Oracle PCA monitoring software detects that one or more new compute nodes are present in the rack. It automatically powers on the new hardware and executes the provisioning procedure. The expansion compute nodes are incorporated seamlessly into the active system. This requires no further interventions by an administrator.

6.5.6 Replace the Rack Doors

Perform the following procedure to replace the rack front and rear doors:

1. Retrieve the doors, and place them carefully on the door hinges. See Figure 6.1.

2. Connect the front and rear door grounding strap to the frame. See Figure 6.1.

3. Close the doors.

4. (Optional) Lock the doors.

Chapter 7 Extending Oracle Private Cloud Appliance - Server Memory Kits

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7.3 Installing the Memory Upgrade Kit 58
7.4 Configuring the System Software to Use Additional Memory 61

Extending the Oracle Private Cloud Appliance (PCA) by installing additional physical RAM can enhance the product by providing more resources for virtual machines performing memory-intensive tasks beyond the capacity already available in the default compute node configuration. This process requires the server to be powered down, but virtual machines can be migrated to other compute nodes temporarily to avoid unnecessary downtime.

There are different memory kits available for the different generations of server hardware that may be installed in an Oracle PCA environment. This chapter describes how to install the memory kits and reconfigure the servers before returning them to normal operation.

7.1 Extending Server Memory Task Map

Table 7.1 describes the steps for extending the Oracle PCA at your site by installing memory kits to upgrade the compute nodes.

Table 7.1 Steps for Extending Oracle Private Cloud Appliance By Installing Server Memory Kits

Step	Description	Links
1	Review safety guidelines and site checklists.	Section 6.2, “Review Safety Guidelines”
2	Identify the servers to upgrade and the memory kit to install: • Replace DIMMs in a Sun Server X3-2 or Sun Server X4-2. • Add DIMMs to an Oracle Server X5-2.	Section 7.2, “Selecting a Server Memory Kit”
3	Install the memory upgrade kit. This involves migrating running virtual machines to avoid service interruptions, and powering down the compute node.	Section 7.3, “Installing the Memory Upgrade Kit”
4	Configure the system for optimal performance with the extended RAM. **Caution** This section applies **only** to systems running **software release 2.0.5 or earlier**. This refers to software configuration on the upgraded compute node. In addition, a configuration	Section 7.4, “Configuring the System Software to Use Additional Memory”

Step	Description	Links
	change on the active management node is required to ensure that compute nodes are provisioned and reprovisioned correctly with the new RAM configuration.	

7.2 Selecting a Server Memory Kit

Any Oracle Private Cloud Appliance may contain more than one generation of server hardware. This depends on when the system was purchased and installed, and whether it has since been extended with additional compute nodes. At the time of the Oracle PCA Software Release 2.1.1, these server hardware generations may be part of your installation:

Table 7.2 Oracle Private Cloud Appliance Server Hardware Generations

Server Hardware	Default Memory Configuration
Sun Server X3-2 Sun Server X4-2	• 16 DIMMs with 16GB DDR3-1600 RAM • total: 256GB RAM • free DIMM slots: none
Oracle Server X5-2	• 8 DIMMs with 32GB DDR4-2133 RAM • total: 256GB RAM • free DIMM slots: 16

The default memory configuration can be extended for each of these server generations, but the options are different.

- A Sun Server X3-2 or Sun Server X4-2 may be upgraded by *replacing* the default 16x 16GB DIMMs with 16x 32GB DDR3-1600 DIMMs. This increases the amount of RAM from 256GB to 512GB.
- An Oracle Server X5-2 may be upgraded by *adding* DIMMs in the available slots. Two upgrade kits are available for these servers:
  - 8x 32GB DDR4-2133 DIMMs, increasing the amount of RAM from 256GB to 512GB while leaving 8 more free DIMM slots
  - 16x 32GB DDR4-2133 DIMMs, increasing the amount of RAM from 256GB to 768GB and filling all available DIMM slots

7.3 Installing the Memory Upgrade Kit

In general, installing or replacing memory modules are tasks performed by an Oracle-qualified service technician. DIMMs are not hot-swappable parts, so the server must be powered down for this procedure. This section provides a high-level overview of the steps required for a server memory extension. Links to more detailed information are included for your reference.

Table 7.3 Summary of the Compute Node Memory Extension Procedure

Step	Description	Detailed Instructions
1	Read and follow the safety considerations and prerequisites for component replacement procedures.	Refer to the section “Preparing Oracle Private Cloud Appliance for Service” in the Oracle Private Cloud Appliance Administrator's Guide.

Step	Description	Detailed Instructions
2	Migrate virtual machines to another compute node and place the server in maintenance mode.	Refer to the applicable section in the Oracle Private Cloud Appliance Administrator's Guide: • Powering Down Oracle Server X5-2 for Service (When Required) • Powering Down Sun Server X4-2 for Service (When Required) • Powering Down Sun Server X3-2 for Service (When Required)
3	Power down the server, disconnect all power cords and data cables, and then extend the server to the maintenance position.	Consult the Service Manual for your server model: • Refer to the chapter “Preparing for Service” in the Oracle Server X5-2 Service Manual (part no. E48320). • Refer to the chapter “Preparing for Service” in the Sun Server X4-2 Service Manual (part no. E38041). • Refer to the chapter “Preparing for Service” in the Sun Server X3-2 Service Manual (part no. E22313).
4	Open the server fan door, and then remove the server top cover.	Consult the Service Manual for your server model. These specific instructions are part of the section “Preparing the Server for Component Replacement” in the chapter referenced in step 3.
5	If the compute node is a Sun Server X3-2 or Sun Server X4-2, first remove the installed 16GB DIMMs from their slots.	For these detailed steps, you must navigate to a particular section in the Service Manual of your server model. a. First, refer to the applicable in the Oracle Private Cloud Appliance Administrator's Guide: • Service Procedures for Sun Server X4-2 Components • Service Procedures for Sun Server X3-2 Components b. Click the URL for the service procedures for DIMMs. This opens the Service Manual. c. Look for the section entitled “Identify and Remove a Faulty DIMM”, which contains the correct steps you must follow to remove a DIMM.
6	Install the new 32GB DIMMs.	For these detailed steps, you must navigate to a particular section in the Service Manual of your server model.

Step	Description	Detailed Instructions
		a. First, refer to the applicable in the Oracle Private Cloud Appliance Administrator's Guide: • Service Procedures for Oracle Server X5-2 Components • Service Procedures for Sun Server X4-2 Components • Service Procedures for Sun Server X3-2 Components b. Click the URL for the service procedures for DIMMs. This opens the Service Manual. c. Follow the steps in the section entitled “Install a DIMM”.
7	Install the server top cover, and then close the server fan door.	Consult the Service Manual for your server model. Follow the steps in the section “Install the Server Top Cover”, which is near the start of the chapter referenced in step 8.
8	Return the server to its normal rack position, and then reconnect all data cables and power cords.	Consult the Service Manual for your server model: • Refer to the chapter “Returning the Server to Operation” in the Oracle Server X5-2 Service Manual (part no. E48320). • Refer to the chapter “Returning the Server to Operation” in the Sun Server X4-2 Service Manual (part no. E38041). • Refer to the chapter “Returning the Server to Operation” in the Sun Server X3-2 Service Manual (part no. E22313).
9	Power on the server. When it comes back online, take the compute node out of maintenance mode and verify that it resumes all normal operations in the server pool.	Refer to the applicable section in the Oracle Private Cloud Appliance Administrator's Guide: • Powering Down Oracle Server X5-2 for Service (When Required) • Powering Down Sun Server X4-2 for Service (When Required) • Powering Down Sun Server X3-2 for Service (When Required) The steps in this procedure are identical to placing the compute node in maintenance mode, except that you must clear the check box you selected previously.

7.4 Configuring the System Software to Use Additional Memory

Caution

This section applies **only** to systems running **software release 2.0.5 or earlier**.

The Oracle PCA Release 2.1 software automatically reconfigures the system software when changes in RAM are detected. You no longer need to execute the procedures in this section. If the instructions in this section were applied to a system with a previous software release, those changes are overwritten when the node reboots after the software upgrade.

Once the memory upgrade is installed you must apply specific configuration changes to make optimal use of the additional RAM and ensure correct provisioning functionality. The following changes are required:

- reconfiguring the bootloader (GRUB) on the compute node with the memory upgrade
- updating the PXE template for compute node (re-)provisioning

Reconfiguring GRUB on a Compute Node with Memory Extension

Warning

This configuration change is not persistent in the current Oracle PCA release. Reprovisioning the compute node results in the changes being overwritten, so you will be required to execute the same procedure afterwards.

1. Start the compute node after RAM installation.
2. Using SSH and an account with superuser privileges, log into the compute node.
3. Edit the file `/etc/grub.conf` and change the `dom0_mem` value from the default *5888M* to the correct amount of RAM installed. The entries are highlighted in the example below.

Note

If the total amount of RAM is now 512GB, set dom0 memory to *11264M*.

If the total amount of RAM is now 768GB, set dom0 memory to *16512M*.

```
root@ovcacn07r1 ~]# cat /etc/grub.conf
# grub.conf generated by anaconda
#
# Note that you do not have to rerun grub after making changes to this file
# NOTICE:  You have a /boot partition.  This means that
#          all kernel and initrd paths are relative to /boot/, eg.
#          root (hd0,0)
#          kernel /vmlinuz-version ro root=/dev/sda2
#          initrd /initrd-version.img
#boot=/dev/sda
default=0
timeout=5
title Oracle VM Server (2.6.39-400.249.3.el5uek)
        root (hd0,0)
        kernel /xen.gz console=com1,vga com1=9600,8n1 dom0_mem=5888M dom0_vcpus_pin dom0_max_vcpus=16 a
        module /vmlinuz-2.6.39-400.249.3.el5uek ro root=UUID=f8b8e26c-532a-464f-ad0a-f535f8b70cea  cons
        module /initrd-2.6.39-400.249.3.el5uek.img
title Oracle VM Server-ovs (xen-4.1.3 2.6.39-300.32.5.el5uek)
        root (hd0,0)
        kernel /xen.gz dom0_mem=5888M dom0_vcpus_pin dom0_max_vcpus=16 allowsuperpage  crashkernel=256M
```

```
        module /vmlinuz-2.6.39-300.32.5.el5uek ro root=UUID=f8b8e26c-532a-464f-ad0a-f535f8b70cea console=tt
        module /initrd-2.6.39-300.32.5.el5uek.img
title Oracle VM Server-ovs serial console (xen-4.1.3 2.6.39-300.32.5.el5uek)
        root (hd0,0)
        kernel /xen.gz console=com1,vga com1=9600,8n1 dom0_mem=5888M dom0_vcpus_pin dom0_max_vcpus=16 allow
        module /vmlinuz-2.6.39-300.32.5.el5uek ro root=UUID=f8b8e26c-532a-464f-ad0a-f535f8b70cea  console=h
        module /initrd-2.6.39-300.32.5.el5uek.img
```

4. Save the changes to `grub.conf` and reboot the compute node to allow these changes to take effect.

5. If you installed memory extension kits in multiple compute nodes, repeat these steps on each of those nodes.

Editing the PXE Template for Compute Node Provisioning

Warning

This configuration change is not persistent in the current Oracle PCA release. An update of the appliance controller software will overwrite the change, so you will be required to execute the same procedure afterwards.

1. Using SSH and an account with superuser privileges, log into the active management node.

2. Edit the file `pxelinux_cfg_OVM_template` located on the shared storage and make sure the `APPEND` line contains `dom0_mem=5888M` as highlighted in the example below.

```
[root@ovcamn05r1 ~]# cat /nfs/shared_storage/pxe_templates/pxelinux_cfg_OVM_template
default OVCA-COMPUTE-OVM-1
LABEL OVCA-COMPUTE-OVM-1
        KERNEL OVM/mboot.c32
        APPEND OVM/xen.gz dom0_mem=5888M --- OVM/vmlinuz ks=nfs:XXXNFS_IPXXX:/export/MGMT_ROOT/kickstart/XX
        ksdevice=eth0 linksleep=50 --- OVM/initrd.img
```

   This value works for all supported RAM configurations. Compute node (re)provisioning will function as expected.

Chapter 8 Extending Oracle Private Cloud Appliance - External Storage

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Extending the Oracle Private Cloud Appliance (PCA) by connecting and configuring additional external storage can enhance the product by providing the disk space required for large repositories, for backup and recovery storage, and to provision virtual machines with virtual disks beyond the capacity already available on the appliance. This process does not require that the system is powered down, but cabling and configuration must match the exact requirements set out in this section.

The Oracle PCA can support additional Fibre Channel or InfiniBand storage devices connected to the Fabric Interconnects, depending on the technology required. This chapter describes how to extend the appliance for each of these different technologies.

8.1 Extending Storage Capacity Task Map

Table 8.1 describes the steps for extending the Oracle PCA at your site by installing additional compute nodes within the rack.

Table 8.1 Steps for Extending Oracle Private Cloud Appliance By Adding Compute Nodes

Step	Description	Links
1	Review safety guidelines and site checklists.	Section 6.2, “Review Safety Guidelines”
2	Identify the type of external storage you are installing: • Fibre Channel storage hardware • InfiniBand storage hardware	Section 8.2, “Adding External Fibre Channel Storage” Section 8.3, “Adding External InfiniBand Storage”
3	Connect the external storage to the appliance. This involves physical cabling and automated configuration resulting from it.	Fibre Channel: • Section 8.2.1, “Creation of Virtual Host Bus Adaptors (vHBAs)”

Step	Description	Links
		• Section 8.2.3, “Connecting Fibre Channel Hardware” InfiniBand: • Section 8.3.1, “Connecting InfiniBand Storage Hardware” • Section 8.3.2, “IP Address Allocation”
4	Configure the external storage for use with Oracle Private Cloud Appliance. This refers to software configuration on the storage hardware connected to the Oracle PCA.	Fibre Channel: • Section 8.2.4, “Zone Configuration” • Section 8.2.5, “Configuring Your Storage Appliance” InfiniBand: • Section 8.3.3, “Configuring the ZFS Storage Appliance”
5	Configure Oracle Private Cloud Appliance to enable the external storage. This refers to configuration in Oracle VM Manager to enable connectivity with the storage hardware connected to the Oracle PCA.	Fibre Channel: • Section 8.2.6, “Updating Physical Disks in Oracle VM Manager” InfiniBand: • Section 8.3.4, “Enabling External IPoIB Storage in Oracle VM Manager”

8.2 Adding External Fibre Channel Storage

Fibre Channel (FC) can be used to connect additional FC-capable storage devices to the Oracle Private Cloud Appliance (PCA) using the FC ports available on the Fabric Interconnects. The Oracle PCA automatically creates virtual Host Bus Adaptors (vHBAs) on each server in the Oracle PCA rack. The World Wide Port Names (WWPNs) defined for these vHBAs can be used to define Initiator Groups on your storage appliance to facilitate access to the LUNs that you wish to make available to your compute and management nodes.

Oracle PCA introduces the concept of "storage clouds" that group together the FC ports used to connect the Fabric Interconnects to your own FC switch or switches. Two FC ports on each of the Fabric Interconnects are assigned to a cloud. A vHBA is created on each server for each storage cloud. A total of four storage clouds are defined when the Oracle PCA is provisioned, resulting in four vHBAs on each of the compute and management nodes.

Storage clouds allow you to cable and configure your external storage in such a way as to improve overall throughput or to build a fully HA enabled infrastructure. The storage clouds are created and configured automatically, so that all you need to do is choose the type of HA configuration that you wish to use and then cable accordingly. The design of the storage cloud configuration reduces complexity in configuration and allows the greatest possible flexibility in terms of your HA requirements.

At bare minimum, a single cloud can be used to access storage on each of your compute nodes or on your management nodes. However a simple HA configuration is recommended. To achieve this, you should use at least two clouds cross-cabled from each of the Fabric Interconnects. For a fully HA-enabled

environment, you can use all four clouds cross-cabled between the Fabric Interconnects and two of your own FC switches.

If you do not require HA, you can use multiple clouds to increase overall throughput. In this configuration, you can cable three clouds into separate switches and connect them to the same storage. If one cloud should fail, you are able to bring up the fourth cloud to take over its function and to maintain the same level of throughput.

Each of these configurations is achieved entirely through the different ways in which your FC switch or switches are patched into the Fabric Interconnects. These approaches are described in more detail in Section 8.2.3, “Connecting Fibre Channel Hardware”.

Since storage clouds map directly to the vHBAs on each server, it is possible to configure zones on your FC switch or switches to securely separate traffic for each storage cloud. This gives you the opportunity to use separate clouds for different purposes using secured channels to facilitate communication between servers and the LUNs on your storage. This is described in Section 8.2.4, “Zone Configuration”.

To use Fibre Channel with the Oracle PCA , you must supply your own NPIV-capable FC switch or switches. It is not possible to simply patch your FC-capable storage directly into the FC ports on the Fabric Interconnects. This is because the Fabric Interconnects use NPIV to map the port nodes to the World Wide Node Names (WWNNs) of the vHBAs that are created on each server. Software required to translate WWPNs to WWNNs does not exist on the storage heads of most FC storage devices, so directly attaching the storage device would prevent registration of the WWPNs for the vHBAs available on each server.

8.2.1 Creation of Virtual Host Bus Adaptors (vHBAs)

Each server in the Oracle PCA is connected to the Fabric Interconnects via an InfiniBand (IB) connection. The Fabric Interconnects are capable of translating connections on their Fibre Channel ports to reroute them over these IB connections. To facilitate this, vHBAs must be defined on each server to map to a storage cloud defined on the Fabric Interconnects. The storage cloud that these vHBAs map to, determine which FC ports they relate to on the Fabric Interconnects.

During the initial configuration of the management nodes, each of the storage clouds is configured automatically on the Fabric Interconnects and vHBAs for each cloud are created on each of the management nodes. WWNNs and WWPNs are generated for the vHBAs on the management nodes. When you cable for a storage cloud and connect your storage appliance, you can add these WWPNs to a storage initiator group and export the LUNs that you wish to make available to your management nodes. These disks can then be mounted on the management nodes as needed. Management nodes are configured with vHBAs to allow them to connect to the different storage clouds so that it is possible to use externally connected storage to store backup and log data, if required.

Tip

It is important to distinguish between WWNNs and WWPNs. A WWNN is used to identify a device or node such as an HBA, while a WWPN is used to identify a port that is accessible via that same device. Since some devices can have multiple ports, a device may have a single WWNN and multiple WWPNs.

In the case of the vHBAs that are generated on each compute node, there is a single WWNN and a single WWPN for each vHBA. While these may look almost identical, the fourth hexadecimal octet that makes up the WWN differs. This is illustrated as follows:

WWPN	WWNN
50:01:39:*70*:00:4F:91:00	50:01:39:*71*:00:4F:91:00

When configuring storage initiators and initiator groups, you should ensure that you are configuring these for the WWPN for each vHBA. If you use the WWNN for any vHBA within an initiator group, that initiator group may not function as expected.

Compute nodes are configured similarly, although the process takes place during compute node provisioning, so that compute nodes are configured as they are provisioned. This means that if you add a compute node to the rack, it is automatically configured so that it is ready to access any externally attached storage. Creation and configuration of vHBAs has also been built into the upgrade process, so that external FC storage can be used with existing environments. Once you have cabled for your storage and have configured the initiator groups on your storage, you can view the LUNs that you make available to your compute nodes directly in Oracle VM Manager.

If you purchased an Oracle PCA with factory-installed Fibre Channel I/O modules, then these processes are entirely automated and do not require any intervention.

If you purchased an Oracle PCA without Fibre Channel I/O modules, and you need to install the optional modules into the Fabric Interconnects first, then carefully follow the instructions in Section 8.2.2, “Installing Optional Fibre Channel I/O Modules”.

8.2.2 Installing Optional Fibre Channel I/O Modules

The X5-2 base rack with Oracle PCA Release 2.0.3 software marks the first configuration that can be ordered with or without fibre channel I/O modules. In an Oracle PCA without fibre channel connectivity, slots 3 and 12 of the two Fabric Interconnects are empty. As a consequence, the Software Clouds and vHBAs for Fibre Channel connectivity are not created during provisioning.

If you decide to add Fibre Channel connectivity at a later time, you must order and install the optional Fibre Channel I/O modules, upgrade the controller software and configure the necessary storage clouds and vHBAs.

Adding Fibre Channel Connectivity to a Provisioned Appliance

1. If your Oracle PCA has no factory-installed Fibre Channel I/O modules you must first make sure that the appliance controller software is Release 2.1.1 or newer. The update process typically takes at least 2.5 hours.

   For detailed software update instructions, see Update in the *Oracle Private Cloud Appliance Administrator's Guide*.

2. When the controller software update has completed successfully, install a total of four Fibre Channel I/O modules in slots 3 and 12 of each Oracle Fabric Interconnect F1-15. You can install the new modules without powering down the Fabric Interconnect.

   a. Ensure that the module's component side is facing towards the right edge of the chassis. Also, ensure that the module's top and bottom edges are correctly aligned with the upper and lower tracks at the left edge of each module slot.

   b. Secure the module in the slot by tightening the securing screw located at the bottom edge of the module's rear panel.

   Caution

   Tighten the screws so that they are lightly snug. If you overtighten the screws they can break.

3. When all four Fibre Channel I/O modules have been installed, configure the storage clouds and vHBAs by running the appropriate commands from the Oracle PCA Command Line Interface (CLI).

a. Configure the vHBAs on both management nodes.

```
PCA> configure vhbas ovcamn05r1 ovcamn06r1

Compute_Node         Status
------------         ------
ovcamn05r1           Succeeded
ovcamn06r1           Succeeded
----------------
2 rows displayed

Status: Success
```

b. Verify that the clouds have been configured.

```
PCA> list storage-network

Network_Name              Description
------------              -----------
Cloud_A                   Default Storage Cloud ru22 port1 - Do not delete or modify
Cloud_B                   Default Storage Cloud ru22 port2 - Do not delete or modify
Cloud_C                   Default Storage Cloud ru15 port1 - Do not delete or modify
Cloud_D                   Default Storage Cloud ru15 port2 - Do not delete or modify
----------------
4 rows displayed

Status: Success
```

c. If the 4 storage clouds have been configured correctly, configure the vHBAs on all compute nodes.

```
PCA> configure vhbas ALL

Compute_Node         Status
------------         ------
ovcacn07r1           Succeeded
ovcacn08r1           Succeeded
[...]
ovcacn36r1           Succeeded
ovcacn37r1           Succeeded
----------------
20 rows displayed

Status: Success
```

These steps provide only an overview of the procedure. For detailed instructions, see Enabling Fibre Channel Connectivity on a Provisioned Appliance in the *Oracle Private Cloud Appliance Administrator's Guide*.

8.2.3 Connecting Fibre Channel Hardware

Cabling requirements to attach external FC-capable storage to the Oracle PCA are very specific due to the grouping of FC ports for storage clouds on the Fabric Interconnects. You must ensure that when cabling for a storage cloud, both ports defined for the storage cloud are cabled into your FC switch. Ideally, you should cable all four FC ports on each of the Fabric Interconnects within the rack for a total of eight cables, at the same time. These should either connect to a single Fibre Channel switch outside of the rack, or should be cross-connected to two Fibre Channel switches outside of the rack to improve redundancy. The following table describes how ports are grouped to create each cloud:

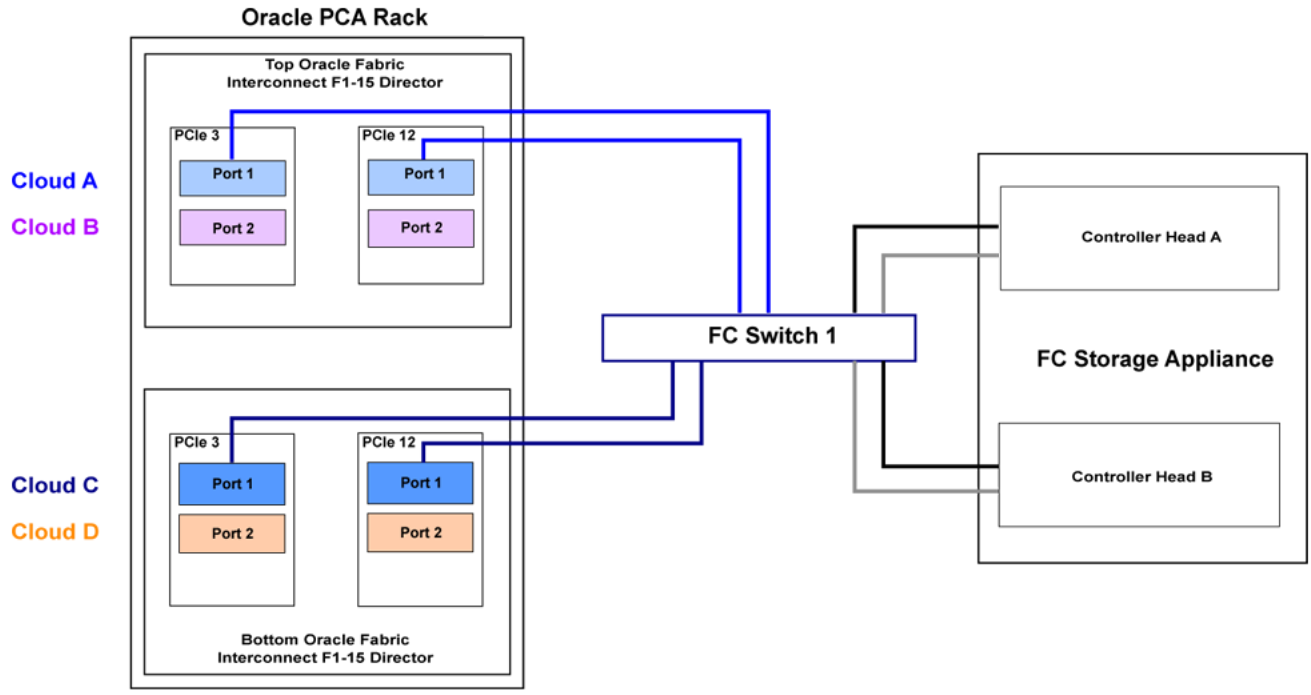
Table 8.2 Fibre Channel Port and Cloud Mappings

	Top Oracle Fabric Interconnect F1-15 (RU 22-25):		Bottom Oracle Fabric Interconnect F1-15 (RU 15-18):	
Cloud Name	**I/O Module 3**	**I/O Module 12**	**I/O Module 3**	**I/O Module 12**
A	Port 1	Port 1		
B	Port 2	Port 2		
C			Port 1	Port 1
D			Port 2	Port 2

For a bare minimum configuration, you can use two cables to connect your FC switch to cloud A. This would require that you connect cables to the top Fabric Interconnect in the rack, using I/O Module 3 Port 1 and I/O Module 12 Port 1. Connect each controller head on your FC storage appliance to your FC switch. Typically you would use two cables for each controller head.

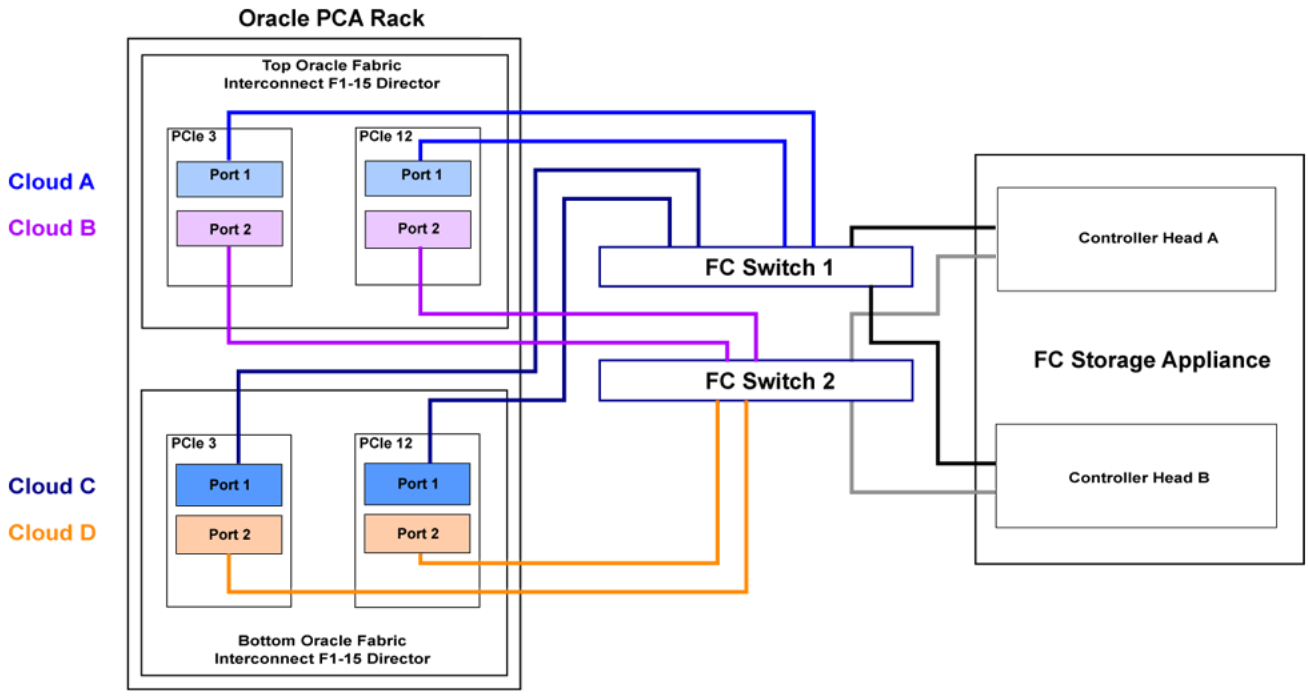
For a basic HA configuration, you should cable for cloud A and cloud C. This allows you to use both of the Fabric Interconnects in the rack to improve redundancy. This is the recommended default minimum configuration. It is important that cloud A and cloud C are cabled to the same FC switch.

Figure 8.1 Minimum HA FC Storage Cabling Configuration



To maximize an HA configuration, by using an additional FC switch, you can cable cloud B and cloud D into the second FC switch. In this situation you should cross-cable the controller heads on your FC storage appliance, so that each controller head is connected to each of your FC switches.

Figure 8.2 Full HA FC Storage Cabling Configuration



Other cabling possibilities exist, such as the aforementioned configuration where clouds are each connected to independent FC switches to maximize throughput or to achieve physical traffic separation. Usually, in this configuration, one cloud is left disconnected in standby so that in the event that one of the other clouds fails for some reason, it is possible to connect the standby cloud to take over the function of the failed cloud. In this situation, you would need to configure so that the WWPNs for the standby cloud are substituted for the failed cloud in the initiator groups on your storage appliance.

The most important points to remember when cabling are as follows:

- Clouds are comprised of two equivalent ports on alternate I/O Modules on the same Fabric Interconnect. For instance, cloud A on the top Fabric Interconnect in the rack is comprised of Port 1 on I/O Module 3 and Port 1 on I/O Module 12; while cloud D on the bottom Fabric Interconnect in the rack is comprised of Port 2 on I/O Module 3 and Port 2 on I/O Module 12.
- Although not required, you should cable both ports that belong to a cloud to provide redundancy and to allow better throughput.
- Unless you have defined zones that span more than one FC switch, the ports that belong to a cloud must be cabled to connect to the same FC switch.
- For HA configurations, clouds on alternate Fabric Interconnects should be connected to the same FC switch. For instance, cloud A and cloud C should be connected to the same FC switch; while cloud B and cloud D can be connected to an alternate switch.

You can connect FC cabling at any time, and no system shutdown is required, allowing you to hot-add storage or improve redundancy as required.

8.2.4 Zone Configuration

The Oracle PCA requires that FibreChannel Zoning is configured on the external FC switches to control and limit the amount of traffic on the storage network for efficient LUN discovery and to maximize stability within the environment.

FC Zoning is also used to enhance security by providing an extra layer of traffic separation on the storage network. Even if you are using storage initiator groups to perform LUN masking, it is generally considered good practice to also configure FC zones to limit the exposure of LUNs and unrestricted use of this network medium. Zone configuration is very useful in the situation where the FC switch or switches are shared with other devices apart from the Oracle PCA.

The Oracle PCA supports single initiator pWWN zoning, in line with industry best-practice. It is highly recommended that you configure single initiator pWWN zoning for all FibreChannel connections to the rack. This requires a FibreChannel switch that supports NPIV.

A minimum of one zone per WWPN on each compute node should be created, although multiple zones may be created for each WWPN depending on your cabling. Therefore, a minimum of four zones should exist on the switch for each compute node. You can obtain a listing of the WWPNs for the compute nodes by running the `pca-admin list wwpn-info` command.

The configuration of FibreChannel single initiator pWWN zones is *not* optional. If you had previously attempted to extend your storage using FibreChannel and did not configure any zones on your FC switch, you should do so now. Furthermore, if you previously configured D,P zones, it is important that you rezone your switches to use single initiator pWWN zones.

Please refer to the documentation of your switch vendor for more information on the configuration steps that you must perform to configure single initiator pWWN zoning.

8.2.5 Configuring Your Storage Appliance

Some initial configuration steps may be required on your appliance before you are able to access storage directly within Oracle VM Manager. Typically these steps involve configuring some form of 'LUN masking' achieved by mapping LUNs to particular initiator groups that ultimately define the servers and clouds that have access to each LUN. These steps are outlined as follows:

1. Create the initiators that you intend to use to identify the different servers in each cloud within your storage appliance. This is achieved by registering the World Wide Port Names (WWPNs) that were created for the vHBAs on each server in the Oracle PCA rack with your appliance and assigning them aliases so that they can be easily identified as belonging to a particular server and cloud. Most appliances should be able to see the WWPNs presented by the Fabric Interconnects and you can use the Oracle PCA command line interface to identify matching WWPNs and match them with the recommended aliases that you should use when creating each initiator. This is achieved by running the `pca-admin list wwpn-info` command:

```
PCA> list wwpn-info

WWPN                    vHBA     Cloud_Name    Server       Type  Alias
-------------           ----     ------------  ---------    ----  --------------
50:01:39:70:00:4F:91:00   vhba01   Cloud_A       ovcamn05r1   MN    ovcamn05r1-Cloud_A
50:01:39:70:00:4F:91:02   vhba01   Cloud_A       ovcamn06r1   MN    ovcamn06r1-Cloud_A
50:01:39:70:00:4F:91:04   vhba01   Cloud_A       ovcacn07r1   CN    ovcacn07r1-Cloud_A
50:01:39:70:00:4F:91:06   vhba01   Cloud_A       ovcacn08r1   CN    ovcacn08r1-Cloud_A
50:01:39:70:00:4F:91:01   vhba02   Cloud_B       ovcamn05r1   MN    ovcamn05r1-Cloud_B
50:01:39:70:00:4F:91:03   vhba02   Cloud_B       ovcamn06r1   MN    ovcamn06r1-Cloud_B
50:01:39:70:00:4F:91:05   vhba02   Cloud_B       ovcacn07r1   CN    ovcacn07r1-Cloud_B
50:01:39:70:00:4F:91:07   vhba02   Cloud_B       ovcacn08r1   CN    ovcacn08r1-Cloud_B
50:01:39:70:00:4F:F1:06   vhba03   Cloud_C       ovcacn08r1   CN    ovcacn08r1-Cloud_C
50:01:39:70:00:4F:F1:04   vhba03   Cloud_C       ovcacn07r1   CN    ovcacn07r1-Cloud_C
```

```
50:01:39:70:00:4F:F1:02   vhba03   Cloud_C       ovcamn06r1   MN    ovcamn06r1-Cloud_C
50:01:39:70:00:4F:F1:00   vhba03   Cloud_C       ovcamn05r1   MN    ovcamn05r1-Cloud_C
50:01:39:70:00:4F:F1:07   vhba04   Cloud_D       ovcacn08r1   CN    ovcacn08r1-Cloud_D
50:01:39:70:00:4F:F1:05   vhba04   Cloud_D       ovcacn07r1   CN    ovcacn07r1-Cloud_D
50:01:39:70:00:4F:F1:03   vhba04   Cloud_D       ovcamn06r1   MN    ovcamn06r1-Cloud_D
50:01:39:70:00:4F:F1:01   vhba04   Cloud_D       ovcamn05r1   MN    ovcamn05r1-Cloud_D
-----------------
16 rows displayed

Status: Success
```

Note the Alias column in the example output. Use the values presented in this column for each matching WWPN when you configure the initiators on your appliance. The Oracle PCA CLI is discussed in more detail in the section entitled "The Oracle Private Cloud Appliance Command Line Interface (CLI)" in the *Oracle Private Cloud Appliance Administrator's Guide*.

2. Create initiator groups that define how your storage should be presented to the different compute nodes and virtual machines within your environment. This step is very dependent on your own storage requirements and should be carefully planned for before you start using the storage appliance in conjunction with the Oracle PCA.

   Remember that there is a WWPN for each vHBA on each compute node, representing each storage cloud defined on the Fabric Interconnects. In an HA configuration, you attach the WWPNs for the different storage clouds to the same initiator group. Using this approach, if a storage cloud fails, the LUNs that are exposed for the initiator group are still available to each compute node via an alternate vHBA. Alternatively, you can sacrifice high availability for a more flexible configuration where the WWPN for each vHBA on each compute node is used independently across different initiator groups. This type of configuration may make more sense where you intend to separate out storage for different functions, such as storage that might be provided to virtual machines and storage that might be used for repositories and server related functions.

3. Map LUNs that you have created on your storage appliance to the initiator groups you have just created. You should only map LUNs to the initiator groups that you intend to use for those LUNs. Although remapping LUNs is possible, you should remember that remapping a LUN once it is in use by Oracle VM is not recommended and may cause unexpected behavior within Oracle VM. Therefore, it is important to carefully plan this step around your requirements before proceeding with this configuration.

   Caution

   A maximum of 256 LUNs per host applies.

To perform these steps, you should refer to the appropriate documentation for your appliance or contact your vendor for assistance with these steps. An example is provided in Example 8.1, "Configuring an Oracle Storage Appliance ZS3-4" to show you how you can configure an Oracle Storage Appliance ZS3-4 correctly for this purpose.

Example 8.1 Configuring an Oracle Storage Appliance ZS3-4

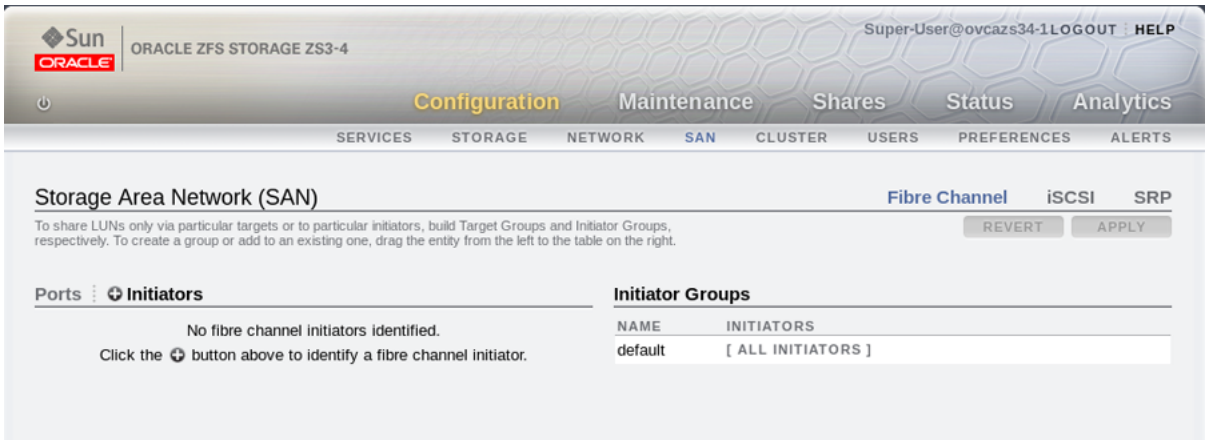
It is possible to configure an Oracle Storage Appliance ZS3-4 either using the web-based user interface or the command line interface. These instructions presume that you are using the web-based user interface, since the interface shows all of the WWPNs that it can actually detect.

1. Log into the web-based user interface as either root or a user with adequate permissions to create initiator groups and LUNs.

2. Click on the `Configuration` link, then click on the `SAN` link. If `Fibre Channel` is not already selected, click on the `Fibre Channel` link. The SAN Summary page is displayed.

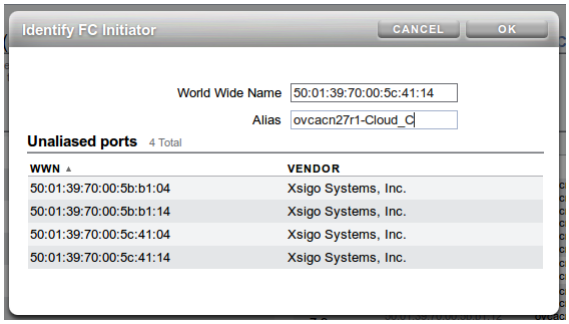
3. Click on the `+ Initiators` link as indicated in the image below:

Figure 8.3 Click on the `+ Initiators` link.



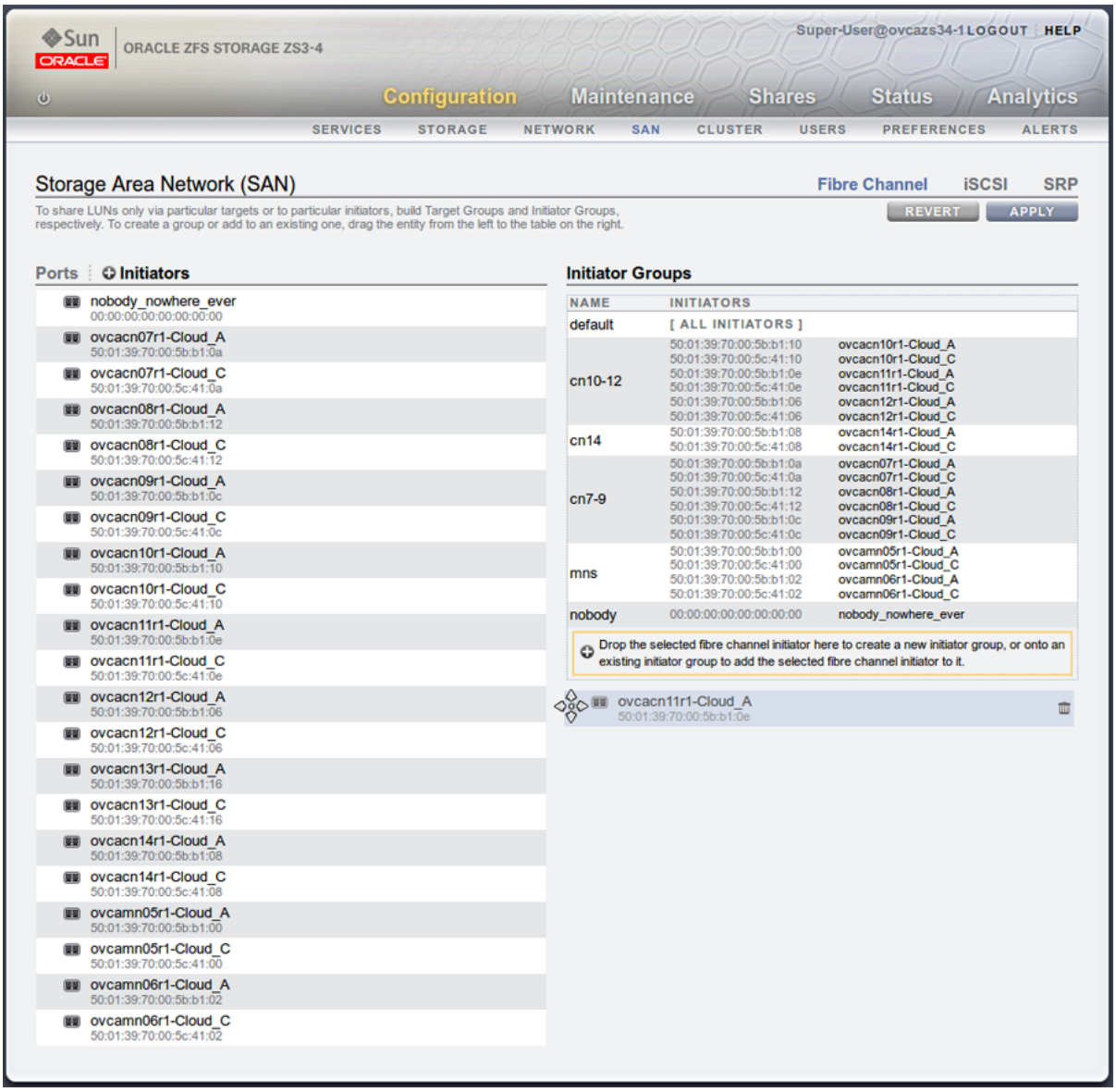
4. The `Identify FC Initiator` dialog opens and lists the WWPNs that the ZS3-4 is able to detect. You should create a user-friendly alias for each WWPN listed so that it is easy to identify how these map onto the nodes and clouds configured within the Oracle PCA. Use the Oracle PCA command line interface on the master management node to obtain a listing of all of these WWPNs and the recommended aliases that you should use. You can do this by running the `pca-admin list wwpn-info` command. Find the matching WWPN in the `Identify FC Initiator` dialog and click on it to enter the recommended alias in the Alias field. Repeat this action for every WWPN. This step is illustrated in the figure below:

Figure 8.4 Use the `Identify FC Initiator` dialog to define user-friendly aliases for the WWPNs.



5. When you have finished creating aliases for each WWPN, you can start to create the storage initiator groups where LUNs are presented later in the configuration. To create a new storage initiator group in the SAN Summary view, move your mouse over the left hand side of the WWN name until you see the `move` icon appear, then drag it to the right hand side of the screen and drop it in the `Create New Initiator Group` box that appears. This step is illustrated in the figure below:

Figure 8.5 Use the `SAN Summary` page to create a new storage initiator group by dragging an initiator across the page.



You can create as many initiator groups as you like. In most cases, if your storage is not used outside of the Oracle PCA and you do not need to segregate storage within the Oracle PCA, you can simply use the default initiator group. However, if your storage is shared with appliances outside of the Oracle PCA, you must, at least create an initiator group for all of the initiators that belong to nodes within the Oracle PCA. If you need to segregate storage further, you can create initiator groups that only include the initiators for particular compute nodes, as is illustrated in the screenshot.

6. Once you have created a new initiator group, you can roll over it using your mouse and then click on the edit icon that appears in the form of a pencil. A dialog appears where you are able to edit the initiator name to change it to something more appropriate. You can also select the rest of the initiators that you wish to include in the initiator group. Click **OK** when you have finished editing the initiator group.

7. When you have finished creating and editing initiator groups, it is important that you click on the **Apply** button on the SAN Summary page to save the changes that you have made.

8. You can now define how LUNs map to your initiator groups depending on your requirements. This is achieved by clicking on the `Shares` link in the navigation bar at the top of the page. On the `Project Summary` page, you can view any storage pools that you have defined and the LUNs associated with those pools. You can also create new LUNs for each storage pool as required. On this page, you can click to edit a LUN and edit the storage initiator groups that it is exposed to. In this view, you can make a LUN accessible to any of the storage initiators that you defined in the previous steps.

8.2.6 Updating Physical Disks in Oracle VM Manager

Since vHBAs are created on each compute node during the provisioning or upgrade process, the storage should be automatically refreshed within Oracle VM Manager as part of this process and the physical disks should be visible within Oracle VM Manager immediately. However, in the case that a disk is not displayed within Oracle VM Manager after the initial server discovery is performed, it is possible that you may need to rediscover the compute nodes so that Oracle VM Manager sees the vHBAs and the LUNs that are accessible to them. The following steps describe actions that should be performed in Oracle VM Manager to start making use of your newly attached FC storage in the case where these disks do not appear automatically within Oracle VM Manager.

Caution

Reprovisioning restores a compute node to a clean state. If a compute node with active connections to external storage repositories is reprovisioned, the external storage connections need to be configured again after reprovisioning.

1. Log into the Oracle VM Manager web-interface on the Oracle PCA.

2. Click on the `Servers and VMs` tab and select all of your compute node servers.

3. Click on the `Rediscover Servers` icon to rediscover all of your servers.

4. After you have finished rediscovery, check that there are four new vHBAs for each server by clicking on the server in the navigation pane and then changing the perspective to `Storage Initiators`.

5. Click on the `Storage` tab.

6. Expand the `SAN Servers` item in the navigation pane and select the `Unmanaged Fibre Channel Storage Array`.

7. Click on the `Edit` icon and navigate to the `Admin Servers` tab in the dialog that appears.

8. Add all of the compute node servers as admin servers for the storage array and click **OK** to close the dialog.

9. Click on the `Refresh SAN Server` icon and click **OK** on the confirmation dialog.

10. Wait for all of your servers to be updated. This operation can take several minutes to complete.

11. The LUNs display in the `Physical Disks` perspective for the `Unmanaged Fibre Channel Storage Array`.

12. You can check that the LUNs are also available to your servers on the `Servers and VMs` tab by clicking on a server and changing the perspective to the `Physical Disks` view.

8.3 Adding External InfiniBand Storage

InfiniBand can be used to connect additional ZFS Storage Appliances to the Oracle Private Cloud Appliance (PCA) using the available ports on the Fabric Interconnects. Since ZFS Storage Appliances are dual-headed, each ZFS Controller head has its own InfiniBand connection to each of the Fabric Interconnects, providing redundancy both on the side of the ZFS Storage Appliance and on the side of the Oracle PCA.

8.3.1 Connecting InfiniBand Storage Hardware

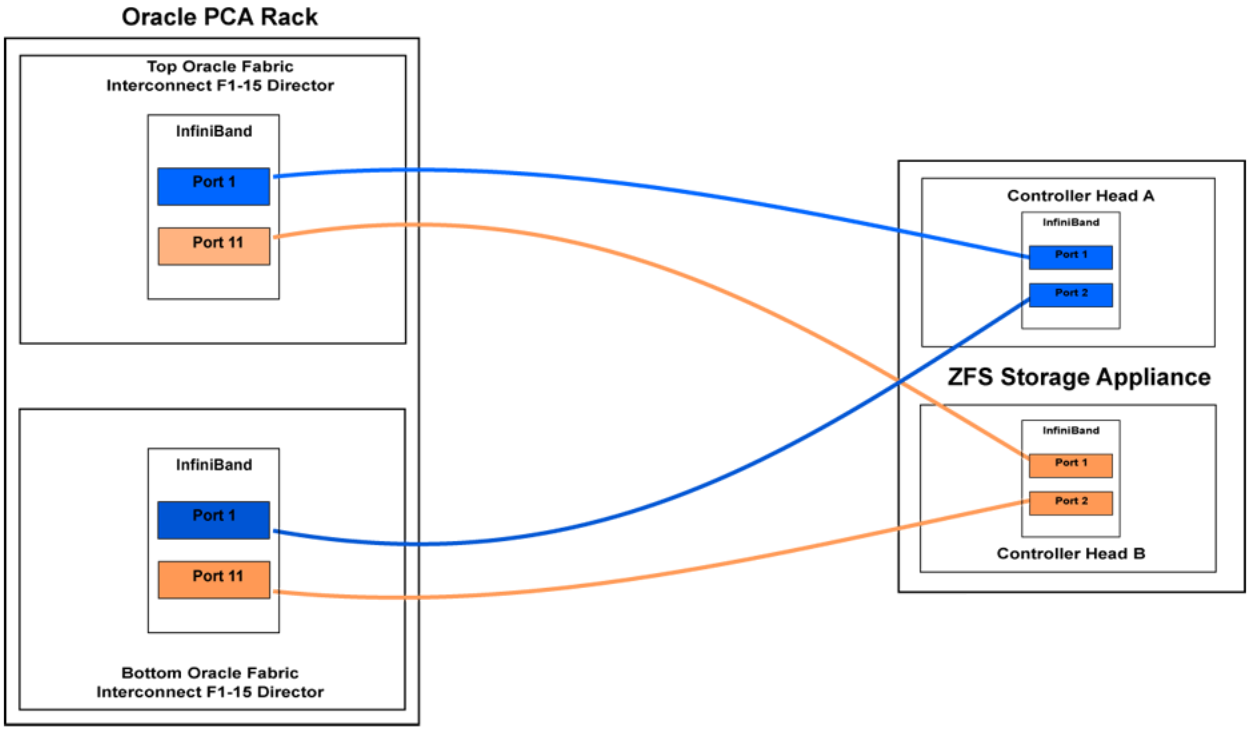
The recommended cabling configuration that should be implemented to connect the ZFS appliance to the Oracle PCA cross-connects each controller head to each of the Fabric Interconnects for a total of four connections. This configuration maximizes redundancy and throughput. The following table describes how the cabling should be connected between the Fabric Interconnects on the Oracle PCA and the ZFS Storage Appliance.

Table 8.3 InfiniBand Cabling to Attach a ZFS Storage Appliance

Top Oracle Fabric Interconnect F1-15 (RU 22-25):	Bottom Oracle Fabric Interconnect F1-15 (RU 15-18):	ZFS Storage Appliance Controller Head 1	ZFS Storage Appliance Controller Head 2
IB Port 1		IB Port 1 (ibp0)	
IB Port 11			IB Port 1 (ibp0)
	IB Port 1	IB Port 2 (ibp1)	
	IB Port 11		IB Port 2 (ibp1)

This cabling layout is illustrated in the following figure, titled Figure 8.6, “IPoIB Storage Cabling Configuration”.

Figure 8.6 IPoIB Storage Cabling Configuration



8.3.2 IP Address Allocation

The following IP address blocks have been reserved for use by a ZFS Storage Appliance external to the Oracle PCA rack:

- 192.168.40.242
- 192.168.40.243
- 192.168.40.244
- 192.168.40.245
- 192.168.40.246
- 192.168.40.247
- 192.168.40.248
- 192.168.40.249

8.3.3 Configuring the ZFS Storage Appliance

This section describes the configuration steps that you must perform on the ZFS Storage Appliance to use IPoIB in conjunction with the Oracle PCA. The description provided here assumes a typical configuration with an active-passive management cluster, using iSCSI to serve LUNs to compute nodes or virtual machines as physical disks. The ZFS Storage Appliance supports a standard NFS configuration as well.

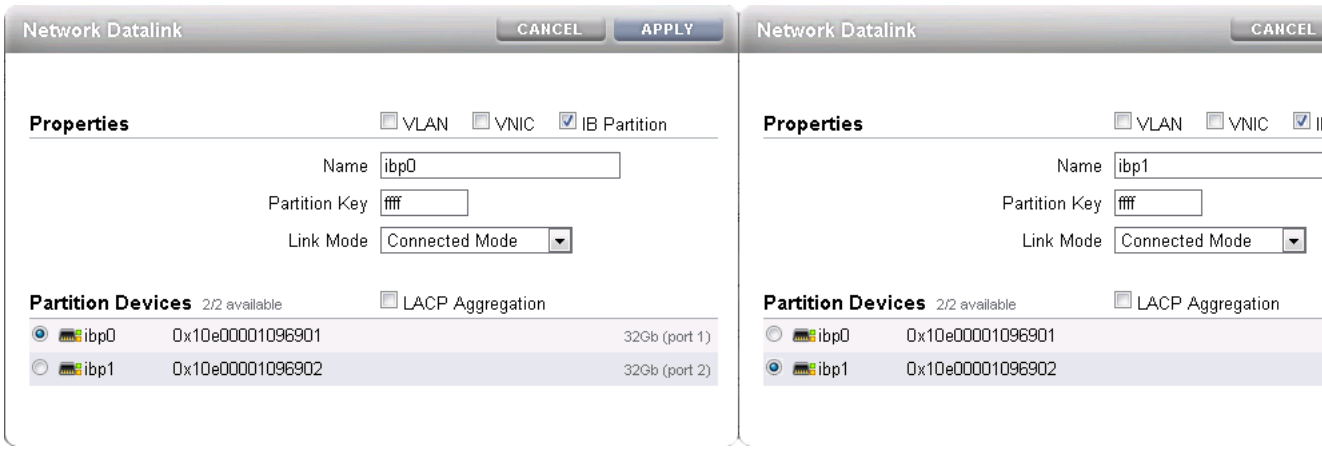
Creating a Basic IPoIB Configuration on a ZFS Storage Appliance

1. **Create Datalinks**

Log on to management user interface on the controller head you intend to use as the master. Go to **Configuration** and then to **Network**. If you have cabled correctly, two active devices are listed that map onto the cabled IB ports.

Drag each of these across to the Datalink menu to create a new datalink for each device. Edit each of these datalinks to provide a datalink name and partition key.

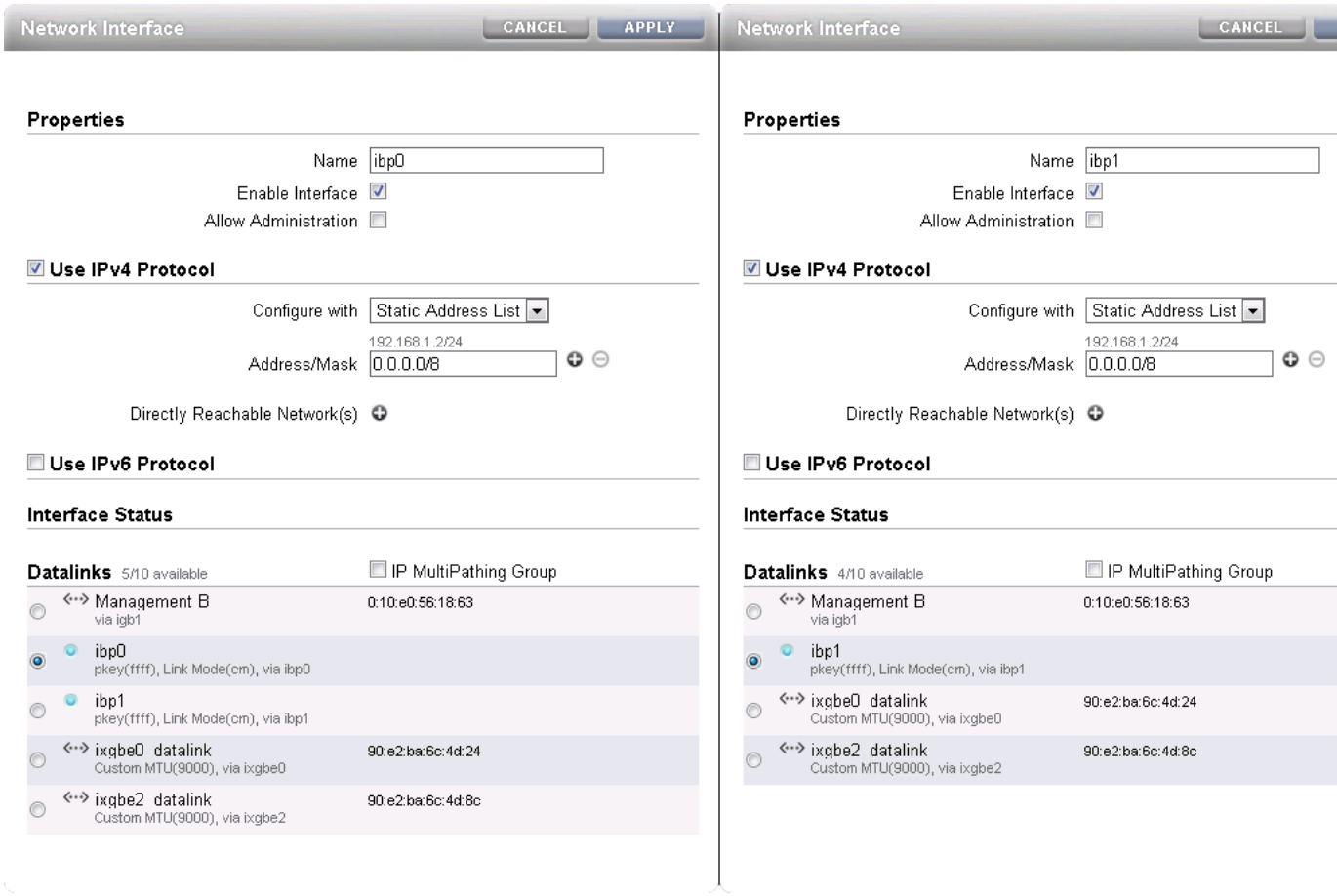
Figure 8.7 Datalink Configuration



2. **Create Interfaces**

   Drag each configured datalink across into the Interface menu to create an interface for each datalink that you have defined. Edit each interface to provide a value for the Name field that makes it easy to identify the interface. Add the netmask 0.0.0.0/8 to each interface to prevent the system from probing and testing the routing details behind the network connection. Leave the IP MultiPathing Group unchecked. Do not configure an IP address at this stage.

Figure 8.8 Interface Configuration



3. **Configure Multipathing**

   Click the Plus icon in the Interface menu to create an additional interface. This additional interface enables IPMP across the two interfaces you created in the previous step. Enter a value in the Name field that makes it easy to identify the IPMP interface. Assign an IP address from the list of reserved IPs in the Oracle PCA storage network.

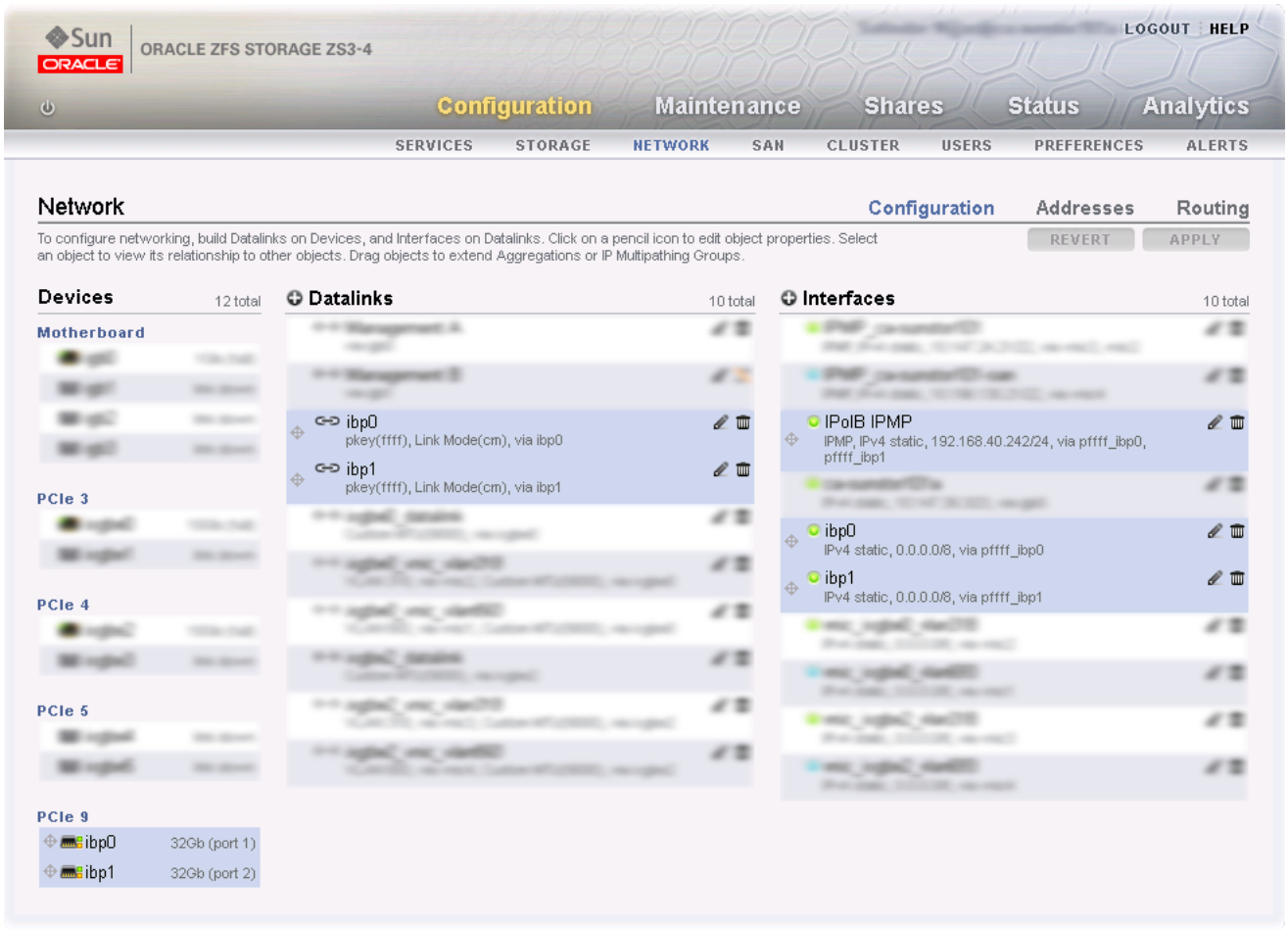
   Near the bottom of the window, select the IP MultiPathing Group check box. Select the two previously configured interfaces, mark the first one as Active and the second one as Standby. The selected IP address will be configured on the active interface until a failover to the standby interface occurs.

Figure 8.9 Multipathing (IPMP) Configuration

4. **Apply Connectivity Configuration**

   Click the Apply button to commit the connectivity configuration you performed up to this point. When you select any device, datalink or interface associated with your configuration, all related items are highlighted in the user interface, as shown in the screenshot below. All other items unrelated to the configuration in this procedure have been blurred out in the image.

Figure 8.10 Final Connectivity Configuration



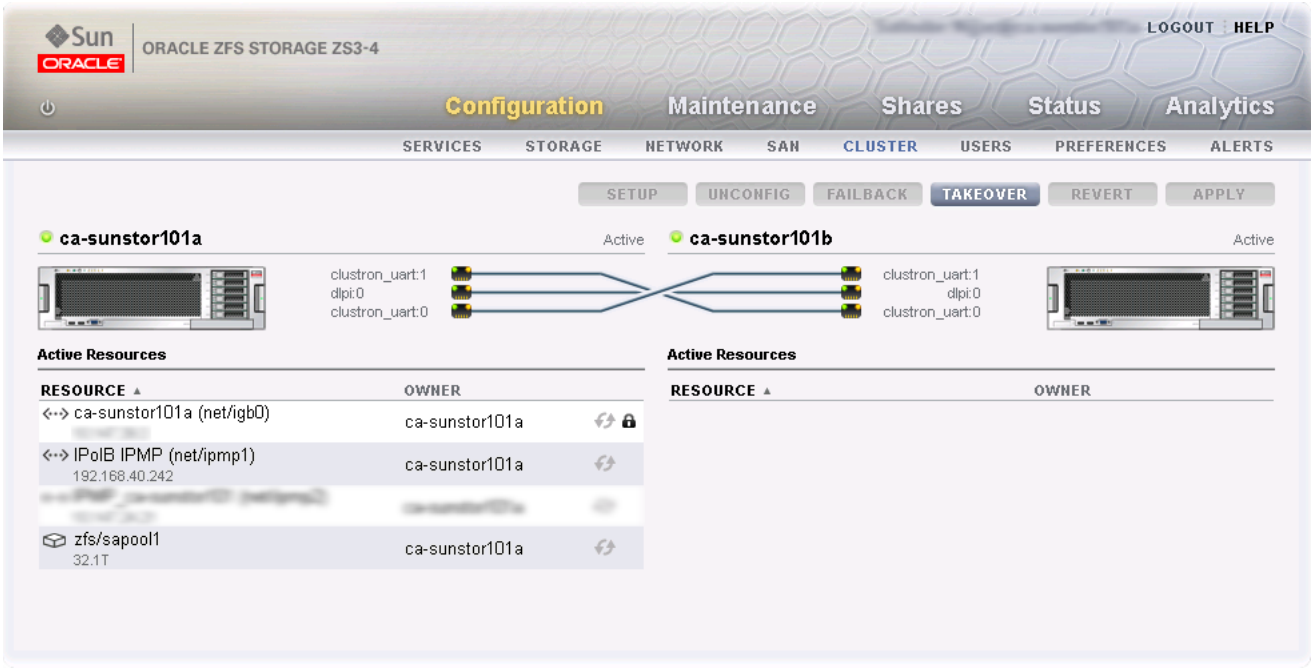
5. **Verify Management Cluster Configuration**

   The external storage setup proposed in this chapter has an active-passive cluster configuration. Consequently all storage resources for Oracle PCA have to be available at one particular IP address at any time. The IP address and the storage resources are owned by the active head in the management cluster, and the standby head is ready to take over the IP address and expose the same storage resources if the active head should fail.

   On the active storage controller, go to **Configuration** and then to **Cluster**. The active-passive cluster configuration is illustrated in the screenshot below. All resources involved in the Oracle PCA external storage setup are owned by the active head: the storage appliance management interface, the IPMP interface configured specifically for Oracle PCA external storage connectivity, and the storage pool where the LUNs will be created.

   In this setup the entire configuration is applied on the active controller and automatically replicated on the standby controller. Since all resources are owned by the active head, there is no need to log on to the standby head and make any configuration changes.

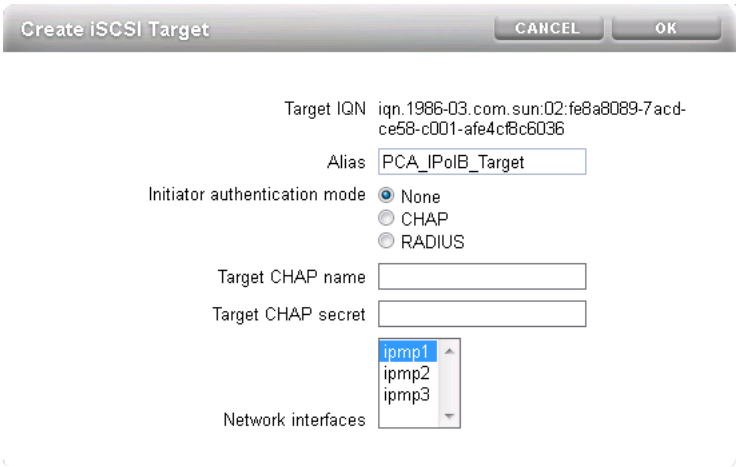
Figure 8.11 Management Cluster Configuration



6. **Configure iSCSI Targets**

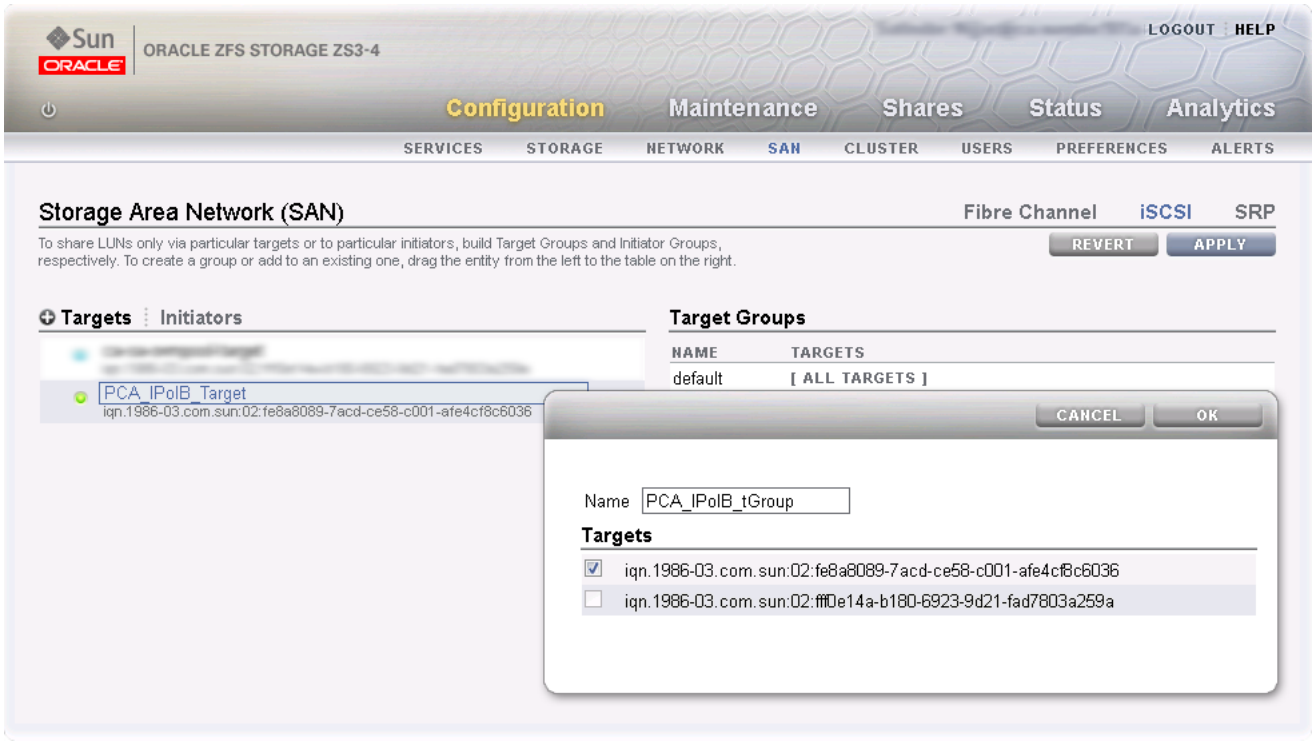
On the active controller, go to **Configuration**, **SAN** and then to **ISCSI**. Click the Plus icon in the Targets menu to create a new iSCSI target. Enter a value in the Alias field that makes it easy to identify the iSCSI target. Select the IPMP interface you configured specifically for Oracle PCA external storage connectivity. Click OK to create the new target.

Figure 8.12 Create iSCSI Target



Drag the iSCSI target that you have created into the Target Group area to create a target group. Edit the target group, give it an appropriate name, and make sure the IQN of the correct iSCSI target is selected. Click OK to save your changes.

Figure 8.13 Create iSCSI Target Group



7. **Configure iSCSI Initiators**

   First, you need to retrieve the IQN of each compute node you wish to grant access to the external storage. Log on to the master management node of your Oracle PCA and proceed as follows:

   a. Using the CLI, list all compute nodes.

```
[root@ovcamn05r1 ~]# pca-admin list compute-node

Compute_Node  IP_Address    Provisioning_Status  ILOM_MAC           Provisioning_State
------------  ----------    -------------------  --------           ------------------
ovcacn09r1    192.168.4.7   RUNNING              00:10:e0:3f:82:75  running
ovcacn13r1    192.168.4.11  RUNNING              00:10:e0:3f:87:73  running
ovcacn26r1    192.168.4.13  RUNNING              00:10:e0:3e:46:db  running
ovcacn12r1    192.168.4.10  RUNNING              00:10:e0:3f:8a:c7  running
ovcacn08r1    192.168.4.6   RUNNING              00:10:e0:3f:84:df  running
ovcacn27r1    192.168.4.14  RUNNING              00:10:e0:3f:9f:13  running
ovcacn07r1    192.168.4.5   RUNNING              00:10:e0:3f:75:73  running
ovcacn11r1    192.168.4.9   RUNNING              00:10:e0:3f:83:23  running
ovcacn10r1    192.168.4.8   RUNNING              00:10:e0:3f:89:83  running
ovcacn14r1    192.168.4.12  RUNNING              00:10:e0:3f:8b:5d  running
-----------------
10 rows displayed

Status: Success
```

   b. SSH into each compute node and display the contents of the file `initiatorname.iscsi`.

```
[root@ovcamn05r1 ~]# ssh ovcacn07r1
root@ovcacn07r1's password:
[root@ovcacn07r1 ~]# cat /etc/iscsi/initiatorname.iscsi
InitiatorName=iqn.1988-12.com.oracle:a72be49151
```

```
[root@ovcacn07r1 ~]# exit
logout
Connection to ovcacn07r1 closed.

[root@ovcamn05r1 ~]#
```

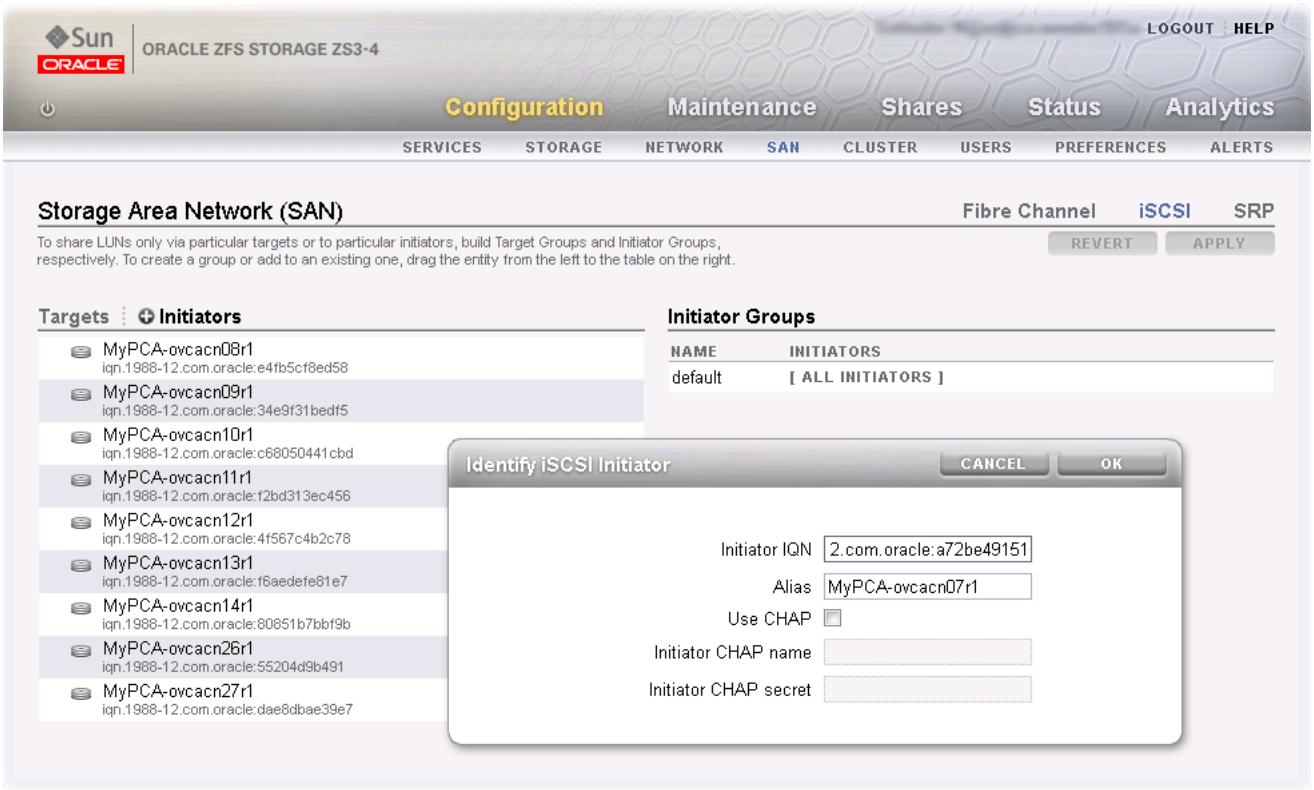
Note

Using SSH to connect to each of the listed compute nodes is the fastest way to obtain the IQNs. However, they can also be copied from the Oracle VM Manager user interface, in the Storage Initiator perspective for each server.

c. Copy the IQN of the compute node and use it to define a corresponding iSCSI initiator in the ZFS Storage Appliance user interface.

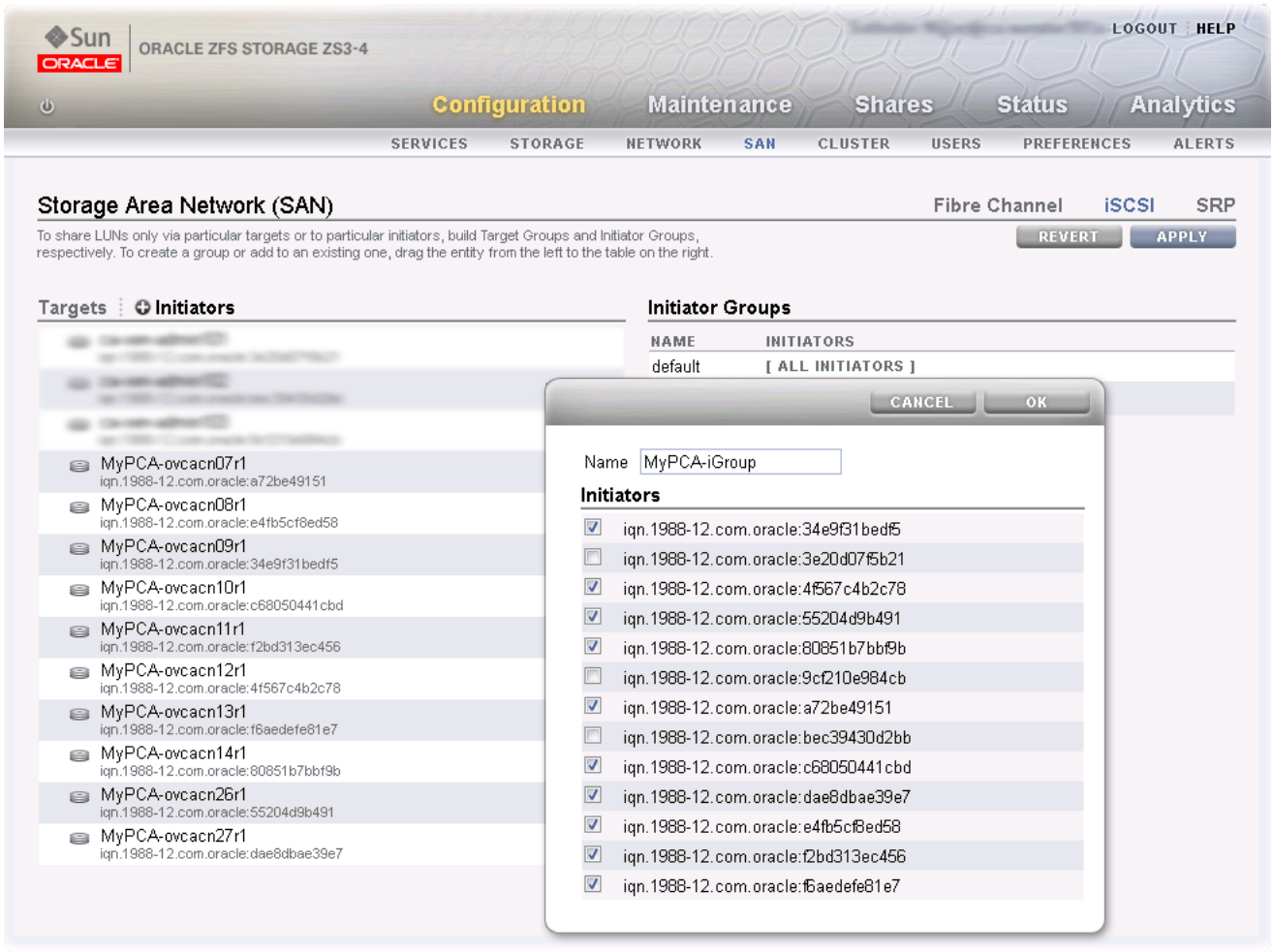
Click on the Initiators link to define the iSCSI initiators for the compute nodes that you wish to expose LUNs to. Click the Plus icon to identify a new iSCSI initiator. Enter the compute node Initiator IQN and an Alias that makes it easy to identify the iSCSI initiator. Repeat this for each compute node so that all initiators appear in the list.

Figure 8.14 Identify iSCSI Initiators



Drag the one of the iSCSI initiators that you have created into the Initiator Group area to create a new initiator group. Edit the initiator group, give it an appropriate name, and make sure that all IQNs of the compute nodes that you want to make a member of this initiator group are selected. Click OK to save your changes.

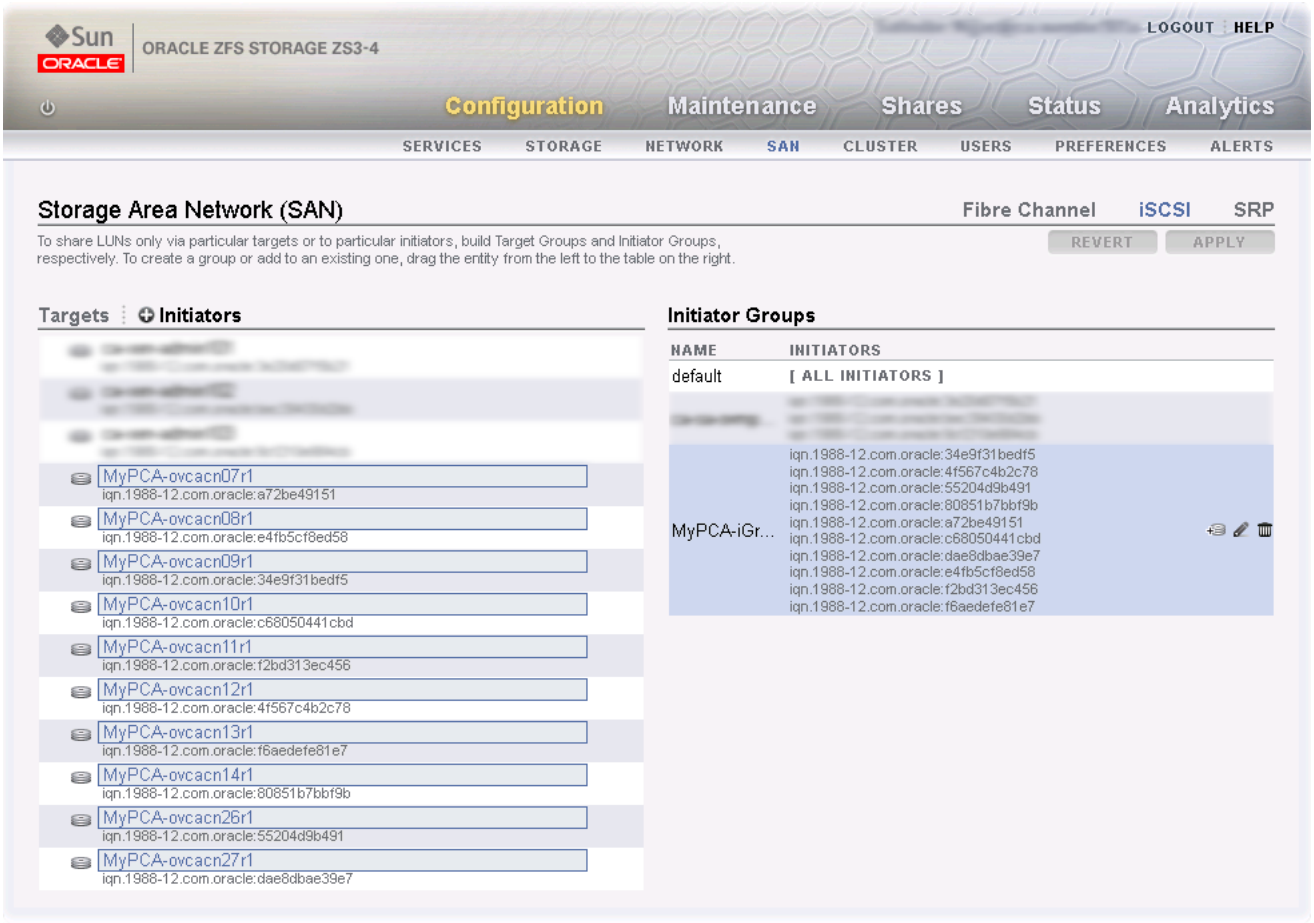
Figure 8.15 Create iSCSI Initiator Group



8. **Apply iSCSI Target and Initiator Configuration**

   Click the Apply button to commit the iSCSI target and initiator configuration you performed up to this point. When you select any initiator or initiator group associated with your configuration, all related items are highlighted in the user interface, as shown in the screenshot below. Other items unrelated to the configuration in this procedure have been blurred out in the image.

Figure 8.16 Final iSCSI Configuration

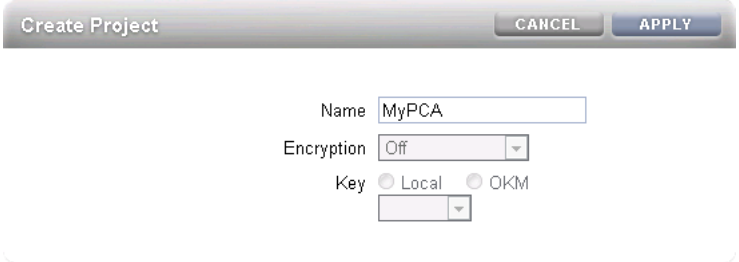


9. **Create a LUN**

For easy management it is good practice to organize storage resources in separate projects. Create a project first for your Oracle PCA external storage, and then add LUNs as you need them.

On the active storage controller, go to **Shares**. On the left hand side, click the Plus icon to create a new Project. In the Create Project dialog box, enter a Name to make it easy to identify the project. Click Apply to save the new project.

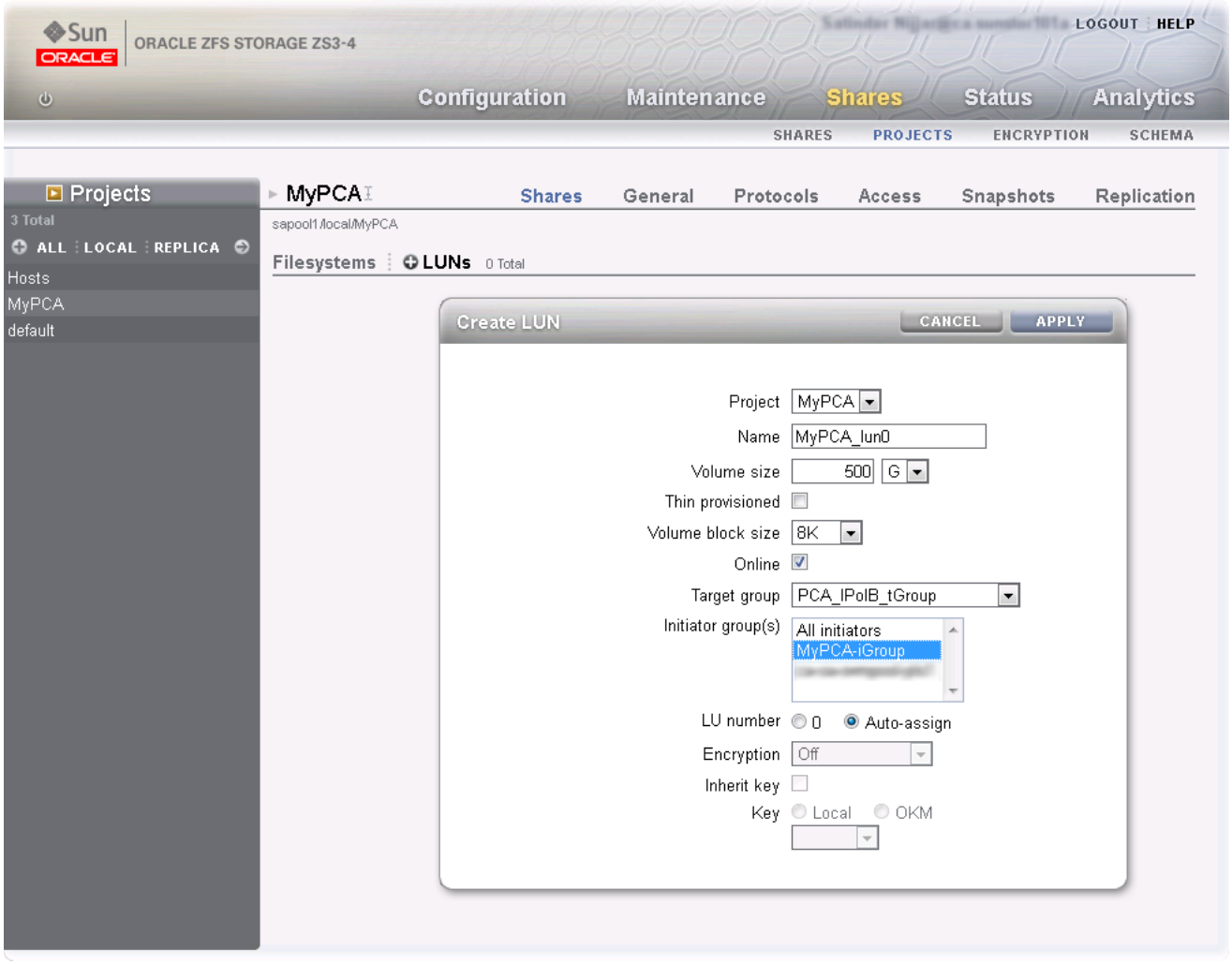
Figure 8.17 Create ZFS Storage Project



In the navigation pane on the left hand side, select the project you just created. In the Shares window, first select LUNs,and then click the Plus icon to create a new LUN as part of this project.

Fill out the LUN properties, select the iSCSI target group and initiator group you created earlier, and enter a Name that makes it easy to identify the LUN. Click Apply to add the LUN to the selected project.

Figure 8.18 Create LUN



Note

The active-passive configuration explained in detail in this section is the basic supported external storage setup. More elaborate setups with multiple storage appliances and active-active configurations are also possible. Bear in mind, however, that these require additional cabling and therefore also an additional pair of redundant InfiniBand switches. Contact your Oracle representative for more information about other external storage options.

If you wish to access these LUNs as physical disks within Oracle VM Manager, you must configure Oracle VM Manager first. Refer to Section 8.3.4.1, “ISCSI Configuration” for more information.

8.3.4 Enabling External IPoIB Storage in Oracle VM Manager

If you intend to use your ZFS appliance to provide storage for use directly by Oracle VM, to host repositories and virtual machines, you must configure the storage within Oracle VM Manager before you

are able to use it. The configuration steps that you must perform depend on whether you have configured iSCSI or NFS on your ZFS Storage Appliance. This section provides a brief outline of the steps that you must perform to configure Oracle VM Manager for each of these technologies. For more detailed information, you should refer to the Oracle VM documentation.

If you only intend to make this storage available to individual virtual machines and do not intend to use the storage for underlying Oracle VM infrastructure, you do not need to perform any of the steps documented in this section, but you will need to configure each virtual machine directly to access the storage either over NFS or iSCSI.

Caution

Reprovisioning restores a compute node to a clean state. If a compute node with active connections to external storage repositories is reprovisioned, the external storage connections need to be configured again after reprovisioning.

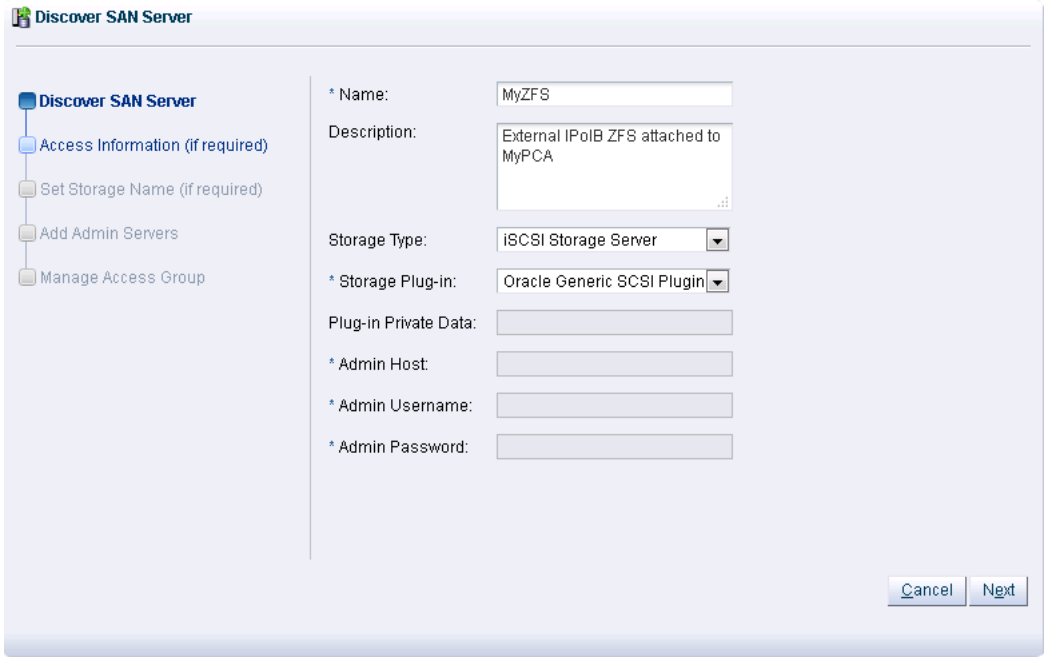
8.3.4.1 ISCSI Configuration

The following configuration steps should be performed in Oracle VM Manager if you have configured your storage appliance for iSCSI. The process to add a File Server in Oracle VM Manager is clearly documented in the Oracle VM User's Guide for Release 3.2 available at:

http://docs.oracle.com/cd/E35328_01/E35332/html/vmusg-storage-manage.html

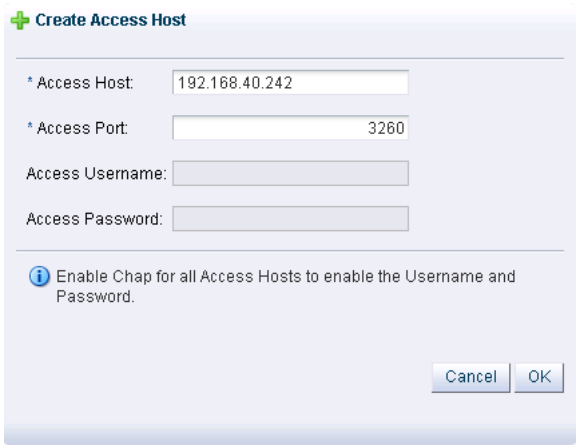
1. Log into Oracle VM Manager on the Oracle PCA
2. Select the `Storage` tab to configure your storage
3. Click on the `Discover SAN Server` icon to load the wizard
4. Enter the DNS name of the storage appliance in the Name field. In the Storage Type field, use the drop-down selector to select `iSCSI Storage Server`. In the Storage Plug-in field, you must select the `Oracle Generic SCSI plugin`. Note that alternate storage plugins are not supported in this configuration. Click **Next**.

Figure 8.19 Discover the SAN Server



5. In the Access Information dialog, click on the icon that allows you to add a new Access Host. This opens the Create Access Host dialog. Enter the IP address that you configured for the IPMP interface of the storage appliance, for example 192.168.40.242. If you have configured your storage appliance with CHAP access, you must also enter the CHAP username and password here. Click **OK** to close the Create Access Host dialog. Click **Next**.

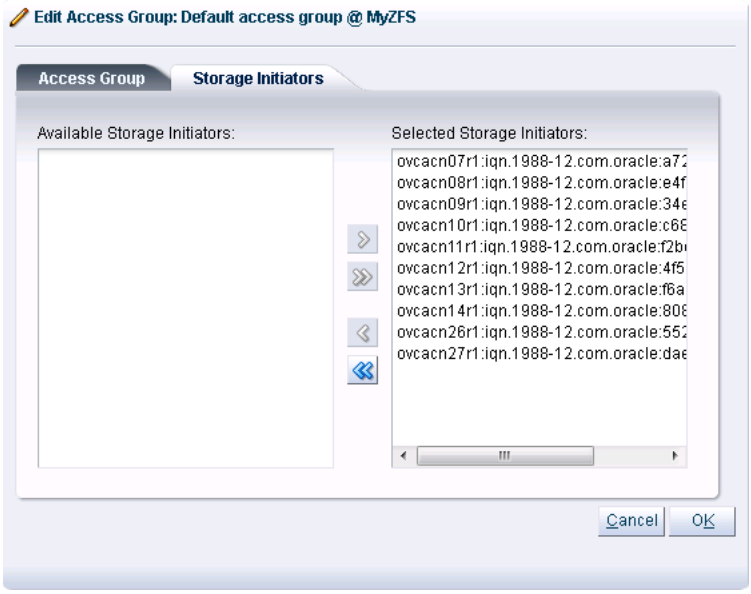
Figure 8.20 Create Access Host



6. In the Add Admin Servers dialog, select all of the servers in the Available Servers frame and move them to the Selected Servers frame. Click **Next**.

7. In the Manage Access Group dialog, click on `Default Access Group` and then click on the Edit icon. The Edit Access Group dialog is opened. Click on the `Storage Initiators` tab. Select the IQN name from all of the initiators that you have configured on the ZFS Storage Appliance and move them into the Selected Storage Initiators pane. Usually it is acceptable to move all of the IQNs across. Click **OK** to save the changes.

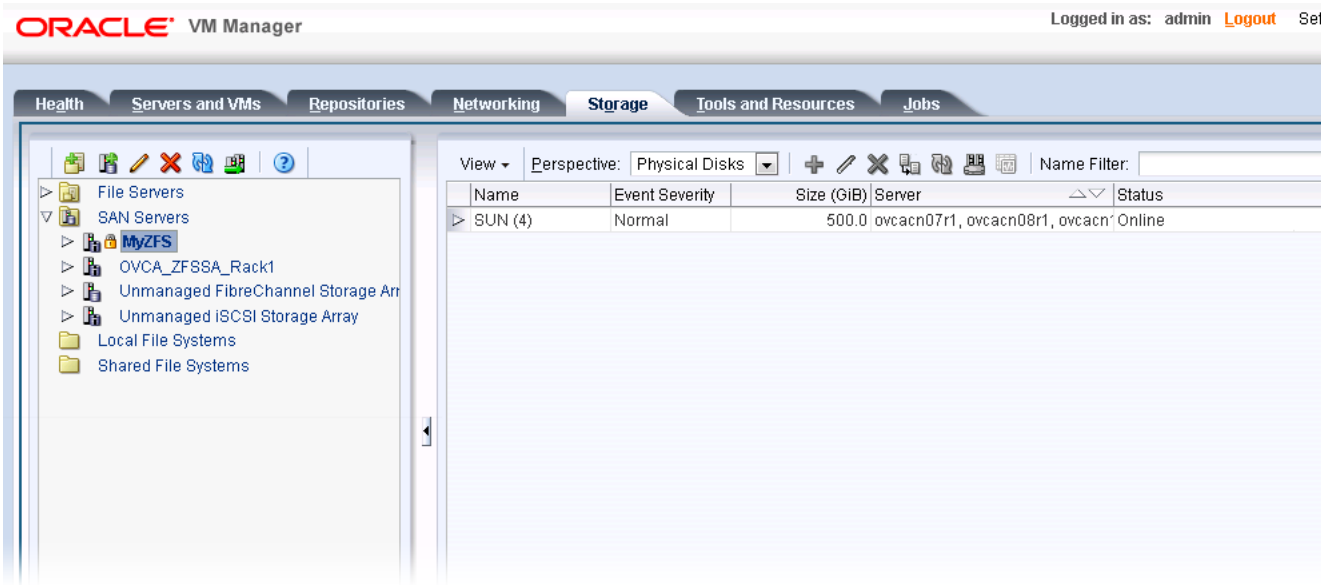
Figure 8.21 Edit Access Group



8. Click the **Finish** button to exit the wizard and to save your changes.

   The iSCSI server appears in the SAN Servers tree in the navigation pane. After storage discovery the LUN appears in the Physical Disks perspective.

Figure 8.22 New Physical Disk Available



8.3.4.2 NFS Configuration

The following configuration steps should be performed in Oracle VM Manager if you have configured your storage appliance for NFS. The process to add a File Server in Oracle VM Manager is clearly documented in the Oracle VM User's Guide for Release 3.2 available at:

http://docs.oracle.com/cd/E35328_01/E35332/html/vmusg-storage-manage.html

1. Log into Oracle VM Manager on the Oracle PCA
2. Select the `Storage` tab to configure your storage
3. Click on the `Discover File Server` icon to load the wizard
4. Enter all required information into the wizard. Use either one of the IP addresses that you configured for the device as the Access Host IP, for example 192.168.40.242.
5. Select all of the compute nodes that should be designated as Admin Servers.
6. Select two or three compute nodes that should be used as Refresh Servers.
7. Select the file systems that you would like to use.
8. Click the `Finish` button.
9. The file server appears in the File Servers tree in the navigation pane.

Appendix A Default IP Addresses

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A.1 Default NET0 IP Addresses 91
A.2 Default Management IP Addresses 92
A.3 Default InfiniBand IP Addresses 94

This appendix lists the default IP addresses assigned to the Oracle PCA components during manufacturing.

A.1 Default NET0 IP Addresses

NET0 is the host Ethernet port 0 IP address for each management node and storage server head.

Table A.1 lists the default NET0 IP addresses assigned to management nodes and other hardware components in an Oracle PCA.

Table A.1 Default NET0 IP Addresses for Oracle Private Cloud Appliance

Unit Number	Rack Component (Front View)	NET0 IP Address Assigned During Manufacturing
42	Compute Node	N/A (DHCP allocation during provisioning)
41	Compute Node	N/A (DHCP allocation during provisioning)
40	Compute Node	N/A (DHCP allocation during provisioning)
39	Compute Node	N/A (DHCP allocation during provisioning)
38	Compute Node	N/A (DHCP allocation during provisioning)
37	Compute Node	N/A (DHCP allocation during provisioning)
36	Compute Node	N/A (DHCP allocation during provisioning)
35	Compute Node	N/A (DHCP allocation during provisioning)
34	Compute Node	N/A (DHCP allocation during provisioning)
33	Compute Node	N/A (DHCP allocation during provisioning)
32	Compute Node	N/A (DHCP allocation during provisioning)
31	Compute Node	N/A (DHCP allocation during provisioning)
30	Compute Node	N/A (DHCP allocation during provisioning)
29	Compute Node	N/A (DHCP allocation during provisioning)
28	Compute Node	N/A (DHCP allocation during provisioning)
27	Compute Node	N/A (DHCP allocation during provisioning)
26	Compute Node	N/A (DHCP allocation during provisioning)
25	Oracle Fabric Interconnect F1-15 (4 rack units)	Not applicable
24		
23		
22		

Unit Number	Rack Component (Front View)	NET0 IP Address Assigned During Manufacturing
21	Oracle Switch ES1-24 (A and B)	Not applicable
20	NM2-36P Sun Datacenter InfiniBand Expansion Switch	Not applicable
19	NM2-36P Sun Datacenter InfiniBand Expansion Switch	Not applicable
18	Oracle Fabric Interconnect F1-15 (4 rack units)	Not applicable
17		
16		
15		
14	Compute Node	N/A (DHCP allocation during provisioning)
13	Compute Node	N/A (DHCP allocation during provisioning)
12	Compute Node	N/A (DHCP allocation during provisioning)
11	Compute Node	N/A (DHCP allocation during provisioning)
10	Compute Node	N/A (DHCP allocation during provisioning)
9	Compute Node	N/A (DHCP allocation during provisioning)
8	Compute Node	N/A (DHCP allocation during provisioning)
7	Compute Node	N/A (DHCP allocation during provisioning)
6	Management Node	`192.168.4.4`
5	Management Node	`192.168.4.3`
4	Oracle ZFS Storage Appliance ZS3-ES (2 rack units)	Not applicable
3		
2	Server Head for Oracle ZFS Storage Appliance ZS3-ES	`192.168.4.2` (+ shared: `192.168.4.100`)
1	Server Head for Oracle ZFS Storage Appliance ZS3-ES	`192.168.4.1` (+ shared `192.168.4.100`)
	PDU-A	Not applicable
	PDU-B	Not applicable

A.2 Default Management IP Addresses

Caution

For hardware management, Oracle PCA uses a network internal to the system. It is not recommended to connect the management ports or the management network switches to the data center network infrastructure. Servers are connected to the internal hardware management network through their `NET0` interface. The `NETMGT` interface is not cabled.

Table A.2 lists the default management IP addresses assigned to servers and other hardware components in an Oracle PCA base configuration rack.

Table A.2 Default Management IP Addresses for Oracle Private Cloud Appliance

Unit Number	Rack Component (Front View)	Management IP Address Assigned During Manufacturing
42	Compute Node	N/A (DHCP allocation during provisioning)
41	Compute Node	N/A (DHCP allocation during provisioning)
40	Compute Node	N/A (DHCP allocation during provisioning)
39	Compute Node	N/A (DHCP allocation during provisioning)
38	Compute Node	N/A (DHCP allocation during provisioning)
37	Compute Node	N/A (DHCP allocation during provisioning)
36	Compute Node	N/A (DHCP allocation during provisioning)
35	Compute Node	N/A (DHCP allocation during provisioning)
34	Compute Node	N/A (DHCP allocation during provisioning)
33	Compute Node	N/A (DHCP allocation during provisioning)
32	Compute Node	N/A (DHCP allocation during provisioning)
31	Compute Node	N/A (DHCP allocation during provisioning)
30	Compute Node	N/A (DHCP allocation during provisioning)
29	Compute Node	N/A (DHCP allocation during provisioning)
28	Compute Node	N/A (DHCP allocation during provisioning)
27	Compute Node	N/A (DHCP allocation during provisioning)
26	Compute Node	N/A (DHCP allocation during provisioning)
25	Oracle Fabric Interconnect F1-15 (4 rack units)	`192.168.4.205`
24		
23		
22		
21	Oracle Switch ES1-24 (A and B)	`192.168.4.200` and `192.168.4.201`
20	NM2-36P Sun Datacenter InfiniBand Expansion Switch	`192.168.4.203`
19	NM2-36P Sun Datacenter InfiniBand Expansion Switch	`192.168.4.202`
18	Oracle Fabric Interconnect F1-15 (4 rack units)	`192.168.4.204`
17		
16		
15		
14	Compute Node	N/A (DHCP allocation during provisioning)
13	Compute Node	N/A (DHCP allocation during provisioning)
12	Compute Node	N/A (DHCP allocation during provisioning)
11	Compute Node	N/A (DHCP allocation during provisioning)
10	Compute Node	N/A (DHCP allocation during provisioning)

Unit Number	Rack Component (Front View)	Management IP Address Assigned During Manufacturing
9	Compute Node	N/A (DHCP allocation during provisioning)
8	Compute Node	N/A (DHCP allocation during provisioning)
7	Compute Node	N/A (DHCP allocation during provisioning)
6	Management Node	192.168.4.104
5	Management Node	192.168.4.103
4	Oracle ZFS Storage Appliance ZS3-ES (2 rack units)	Not applicable
3		
2	Server Head for Oracle ZFS Storage Appliance ZS3-ES	192.168.4.102
1	Server Head for Oracle ZFS Storage Appliance ZS3-ES	192.168.4.101
	PDU-A	192.168.4.210
	PDU-B	192.168.4.211

A.3 Default InfiniBand IP Addresses

Caution

The InfiniBand network is internal to the Oracle PCA. You should not create additional connections to this network.

InfiniBand interfaces are the default channel of communication among compute nodes and storage server heads. If you are connecting the Oracle PCA to existing or additional storage machines on the same InfiniBand fabric, the interface enables communication between the Oracle PCA and the storage machines.

Table A.3 lists the default InfiniBand IP addresses assigned to compute nodes and other hardware components in your Oracle PCA.

Note that some IP addresses within this subnetwork are reserved for the addition of external InfiniBand storage appliances. These IP addresses are described in Section 8.3.1, “Connecting InfiniBand Storage Hardware” in the section Section 8.3, “Adding External InfiniBand Storage”.

Table A.3 Default InfiniBand IP Addresses for Oracle Private Cloud Appliance

Unit Number	Rack Component (Front View)	InfiniBand IP Address Assigned During Manufacturing
42	Compute Node	Not applicable
41	Compute Node	Not applicable
40	Compute Node	Not applicable
39	Compute Node	Not applicable
38	Compute Node	Not applicable
37	Compute Node	Not applicable
36	Compute Node	Not applicable
35	Compute Node	Not applicable
34	Compute Node	Not applicable

Unit Number	Rack Component (Front View)	InfiniBand IP Address Assigned During Manufacturing
33	Compute Node	Not applicable
32	Compute Node	Not applicable
31	Compute Node	Not applicable
30	Compute Node	Not applicable
29	Compute Node	Not applicable
28	Compute Node	Not applicable
27	Compute Node	Not applicable
26	Compute Node	Not applicable
25	Oracle Fabric Interconnect F1-15 (4 rack units)	Not applicable
24		
23		
22		
21	Oracle Switch ES1-24	Not applicable
20	NM2-36P Sun Datacenter InfiniBand Expansion Switch	Not applicable
19	NM2-36P Sun Datacenter InfiniBand Expansion Switch	Not applicable
18	Oracle Fabric Interconnect F1-15 (4 rack units)	Not applicable
17		
16		
15		
14	Compute Node	Not applicable
13	Compute Node	Not applicable
12	Compute Node	Not applicable
11	Compute Node	Not applicable
10	Compute Node	Not applicable
9	Compute Node	Not applicable
8	Compute Node	Not applicable
7	Compute Node	Not applicable
6	Management Node	`192.168.40.4`
5	Management Node	`192.168.40.3`
4	Oracle ZFS Storage Appliance ZS3-ES (2 rack units)	Not applicable
3		
2	Server Head for Oracle ZFS Storage Appliance ZS3-ES	`192.168.40.1` (shared)

Unit Number	Rack Component (Front View)	InfiniBand IP Address Assigned During Manufacturing
1	Server Head for Oracle ZFS Storage Appliance ZS3-ES	`192.168.40.1` (shared)
	PDU-A	Not applicable
	PDU-B	Not applicable

Appendix B Cabling Reference

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This appendix provides cabling reference tables for Oracle PCA.

B.1 Oracle Switch ES1-24 Ethernet Connections

This section lists the cabling connections for Oracle Switch ES1-24.

Table B.1 Cabling Connections for Oracle Switch ES1-24

From	Port	To	Port	Color	Notes
N/A	SER MGT	U21-A	Serial Port	1.8m console cable	7061953 cable accessible for Service only
N/A	SER MGT	U21-B	Serial Port	1.8m console cable	7061953 cable accessible for Service only
U42	NET0	U21-A	19	Blue	
U41	NET0	U21-A	18	Blue	
U40	NET0	U21-A	17	Blue	
U39	NET0	U21-A	16	Blue	
U38	NET0	U21-A	15	Blue	
U37	NET0	U21-A	14	Blue	
U36	NET0	U21-A	13	Blue	
U35	NET0	U21-A	12	Blue	
U34	NET0	U21-A	11	Blue	
U33	NET0	U21-B	18	Blue	
U32	NET0	U21-B	17	Blue	
U31	NET0	U21-B	16	Blue	
U30	NET0	U21-B	15	Blue	
U29	NET0	U21-B	14	Blue	
U28	NET0	U21-B	13	Blue	
U27	NET0	U21-B	12	Blue	

From	Port	To	Port	Color	Notes
U26	NET0	U21-B	11	Blue	
U22		U21-A	9	Black	Oracle Fabric Interconnect F1-15
U20		U21-B	10	Black	NM2-36P Sun Datacenter InfiniBand Expansion Switch
U21-A	24	Customer network		Transceiver/ Black Cable	
U21-B	24	Customer network		Transceiver/ Black Cable	
U21-A	22	U21-B	22	SFP+	Switch-to-switch connection within rack
U19		U21-A	10	Black	NM2-36P Sun Datacenter InfiniBand Expansion Switch
U15		U21-B	9	Black	Oracle Fabric Interconnect F1-15
U14	NET0	U21-A	8	Blue	
U13	NET0	U21-A	7	Blue	
U12	NET0	U21-A	6	Blue	
U11	NET0	U21-A	5	Blue	
U10	NET0	U21-A	4	Blue	
U9	NET0	U21-A	3	Blue	
U8	NET0	U21-A	2	Blue	
U7	NET0	U21-A	1	Blue	
U6	NET0	U21-B	8	Blue	
U5	NET0	U21-B	7	Blue	
U2	NET2	U21-B	6	Blue	
U2	NET1	U21-B	5	Blue	
U2	NET0	U21-B	4	Blue	
U1	NET2	U21-B	3	Blue	
U1	NET1	U21-B	2	Blue	
U1	NET0	U21-B (Left switch)	1	Blue	
PDU-A	NETMGT	U21-A	20	White	
PDU-B	NETMGT	U21-B	20	White	

B.2 Storage Head Cluster Interconnects

This section contains cabling connections for the storage head cluster.

Table B.2 Cabling Connections for Storage Head Cluster

From	Port	To	Port	Length	Color	Part Number and Notes
U1	PCIe-1 P0	U2	PCIe-1 P2	2.13m	Yellow	530-4527-01
U1	PCIe-1 P1	U2	PCIe-1 P1	2.13m	Black	530-4436-01
U1	PCIe-1 P2	U2	PCIe-1 P0	2.13m	Green	530-4526-01
U2	PCIe-2 P1	U3	IOM1 (top) SAS Port 1	2m	Black	2m SAS
U1	PCIe-2 P1	U3	IOM1 SAS Port 0	2m	Black	2m SAS
U2	PCIe-2 P0	U3	IOM0 (bottom) SAS Port 1	2m	Black	2m SAS
U1	PCIe-2 P0	U3	IOM0 SAS Port 0	2m	Black	2m SAS

B.3 Connections from NM2-36P Sun Datacenter InfiniBand Expansion Switch to Oracle Fabric Interconnect F1-15

This section contains in-rack cabling connections for the NM2-36P Sun Datacenter InfiniBand Expansion Switch to the Oracle Fabric Interconnect F1-15.

Table B.3 Cabling Connections for NM2-36P IB Switch to Oracle Fabric Interconnect F1-15

From	Name	Port	To	Name	Port	NM2 to F1 Interconnect
U19	NM2-36P IB	9B	U22	F1-15	8	Bottom NM2-36P IB to top F1-15 (Blue Velcro)
U19	NM2-36P IB	10B	U22	F1-15	9	Bottom NM2-36P IB to top F1-15 (Blue Velcro)
U19	NM2-36P IB	11B	U15	F1-15	10	Bottom NM2-36P IB to bottom F1-15 (Blue Velcro)
U19	NM2-36P IB	9A	U15	F1-15	8	Bottom NM2-36P IB to bottom F1-15 (Blue Velcro)
U19	NM2-36P IB	10A	U15	F1-15	9	Bottom NM2-36P IB to bottom F1-15 (Blue Velcro)
U19	NM2-36P IB	11A	U22	F1-15	10	Bottom NM2-36P IB to top F1-15 (Blue Velcro)
U20	NM2-36P IB	9B	U15	F1-15	18	Top NM2-36P IB to bottom F1-15 (Blue Velcro)
U20	NM2-36P IB	10B	U15	F1-15	19	Top NM2-36P IB to bottom F1-15 (Blue Velcro)
U20	NM2-36P IB	11B	U22	F1-15	20	Top NM2-36P IB to top F1-15 (Blue Velcro)
U20	NM2-36P IB	9A	U22	F1-15	18	Top NM2-36P IB to top F1-15 (Blue Velcro)
U20	NM2-36P IB	10A	U22	F1-15	19	Top NM2-36P IB to top F1-15 (Blue Velcro)
U20	NM2-36P IB	11A	U15	F1-15	20	Top NM2-36P IB to bottom F1-15 (Blue Velcro)

B.4 Connections from NM2-36P Sun Datacenter InfiniBand Expansion Switches to Oracle Server X5-2 Compute Nodes

This section contains in-rack cabling connections for the NM2-36P Sun Datacenter InfiniBand Expansion Switches to the Oracle Server X5-2 compute nodes.

B.4.1 NM2-36P (U19) InfiniBand Switch to Oracle Server X5-2 Compute Nodes Connections

The following table contains cabling connections for the NM2-36P (U19) InfiniBand switch to Oracle Server X5-2 compute nodes.

Table B.4 Cabling Connections for NM2-36P (U19) IB Switch to Oracle Server X5-2 Compute Nodes

From	Name	Port	To	Name	Port
U19	NM2-36P IB	0A	U42	Oracle Server X5-2	PCIe-2 P2
U19	NM2-36P IB	0B	U41	Oracle Server X5-2	PCIe-2 P2
U19	NM2-36P IB	1A	U40	Oracle Server X5-2	PCIe-2 P2
U19	NM2-36P IB	1B	U39	Oracle Server X5-2	PCIe-2 P2
U19	NM2-36P IB	2A	U38	Oracle Server X5-2	PCIe-2 P2
U19	NM2-36P IB	2B	U37	Oracle Server X5-2	PCIe-2 P2
U19	NM2-36P IB	3A	U36	Oracle Server X5-2	PCIe-2 P2
U19	NM2-36P IB	3B	U35	Oracle Server X5-2	PCIe-2 P2
U19	NM2-36P IB	4A	U34	Oracle Server X5-2	PCIe-2 P2
U19	NM2-36P IB	4B	U33	Oracle Server X5-2	PCIe-2 P2
U19	NM2-36P IB	5A	U32	Oracle Server X5-2	PCIe-2 P2
U19	NM2-36P IB	5B	U31	Oracle Server X5-2	PCIe-2 P2
U19	NM2-36P IB	6A	U30	Oracle Server X5-2	PCIe-2 P2
U19	NM2-36P IB	6B	U29	Oracle Server X5-2	PCIe-2 P2
U19	NM2-36P IB	7A	U28	Oracle Server X5-2	PCIe-2 P1
U19	NM2-36P IB	7B	U27	Oracle Server X5-2	PCIe-2 P1
U19	NM2-36P IB	8A	U26	Oracle Server X5-2	PCIe-2 P1
U19	NM2-36P IB	12A	U14	Oracle Server X5-2	PCIe-2 P1
U19	NM2-36P IB	12B	U13	Oracle Server X5-2	PCIe-2 P1
U19	NM2-36P IB	13A	U12	Oracle Server X5-2	PCIe-2 P1
U19	NM2-36P IB	13B	U11	Oracle Server X5-2	PCIe-2 P1
U19	NM2-36P IB	14A	U10	Oracle Server X5-2	PCIe-2 P1
U19	NM2-36P IB	14B	U9	Oracle Server X5-2	PCIe-2 P1
U19	NM2-36P IB	15A	U8	Oracle Server X5-2	PCIe-2 P1
U19	NM2-36P IB	15B	U7	Oracle Server X5-2	PCIe-2 P1
U19	NM2-36P IB	16A	U6	Oracle Server X5-2	PCIe-2 P1
U19	NM2-36P IB	16B	U5	Oracle Server X5-2	PCIe-2 P1

From	Name	Port	To	Name	Port
U19	NM2-36P IB	17A	U2	Oracle Server X5-2	PCIe-0 P1
U19	NM2-36P IB	17B	U1	Oracle Server X5-2	PCIe-0 P1

B.4.2 NM2-36P (U20) InfiniBand Switch to Oracle Server X5-2 Compute Nodes Connections

The following table contains cabling connections for the NM2-36P (U20) InfiniBand switch to Oracle Server X5-2 compute nodes.

Table B.5 Cabling Connections for NM2-36P (U20) IB Switch to Oracle Server X5-2 Compute Nodes

From	Name	Port	To	Name	Port
U20	NM2-36P IB	0A	U42	Oracle Server X5-2	PCIe-2 P1
U20	NM2-36P IB	0B	U41	Oracle Server X5-2	PCIe-2 P1
U20	NM2-36P IB	1A	U40	Oracle Server X5-2	PCIe-2 P1
U20	NM2-36P IB	1B	U39	Oracle Server X5-2	PCIe-2 P1
U20	NM2-36P IB	2A	U38	Oracle Server X5-2	PCIe-2 P1
U20	NM2-36P IB	2B	U37	Oracle Server X5-2	PCIe-2 P1
U20	NM2-36P IB	3A	U36	Oracle Server X5-2	PCIe-2 P1
U20	NM2-36P IB	3B	U35	Oracle Server X5-2	PCIe-2 P1
U20	NM2-36P IB	4A	U34	Oracle Server X5-2	PCIe-2 P1
U20	NM2-36P IB	4B	U33	Oracle Server X5-2	PCIe-2 P1
U20	NM2-36P IB	5A	U32	Oracle Server X5-2	PCIe-2 P1
U20	NM2-36P IB	5B	U31	Oracle Server X5-2	PCIe-2 P1
U20	NM2-36P IB	6A	U30	Oracle Server X5-2	PCIe-2 P1
U20	NM2-36P IB	6B	U29	Oracle Server X5-2	PCIe-2 P1
U20	NM2-36P IB	7A	U28	Oracle Server X5-2	PCIe-2 P2
U20	NM2-36P IB	7B	U27	Oracle Server X5-2	PCIe-2 P2
U20	NM2-36P IB	8A	U26	Oracle Server X5-2	PCIe-2 P2
U20	NM2-36P IB	12A	U14	Oracle Server X5-2	PCIe-2 P2
U20	NM2-36P IB	12B	U13	Oracle Server X5-2	PCIe-2 P2
U20	NM2-36P IB	13A	U12	Oracle Server X5-2	PCIe-2 P2
U20	NM2-36P IB	13B	U11	Oracle Server X5-2	PCIe-2 P2
U20	NM2-36P IB	14A	U10	Oracle Server X5-2	PCIe-2 P2
U20	NM2-36P IB	14B	U9	Oracle Server X5-2	PCIe-2 P2
U20	NM2-36P IB	15A	U8	Oracle Server X5-2	PCIe-2 P2
U20	NM2-36P IB	15B	U7	Oracle Server X5-2	PCIe-2 P2
U20	NM2-36P IB	16A	U6	Oracle Server X5-2	PCIe-2 P2
U20	NM2-36P IB	16B	U5	Oracle Server X5-2	PCIe-2 P2
U20	NM2-36P IB	17A	U2	Oracle Server X5-2	PCIe-0 P2
U20	NM2-36P IB	17B	U1	Oracle Server X5-2	PCIe-0 P2

Appendix C Connectivity Diagrams

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This appendix provides visual representations of the main connectivity aspects of Oracle PCA. For a more detailed view, use these diagrams in conjunction with Appendix B, *Cabling Reference* and Appendix A, *Default IP Addresses*.

C.1 External Ethernet Connections

This section shows the external Ethernet connectivity of Oracle PCA.

Figure C.1 External Ethernet Connectivity

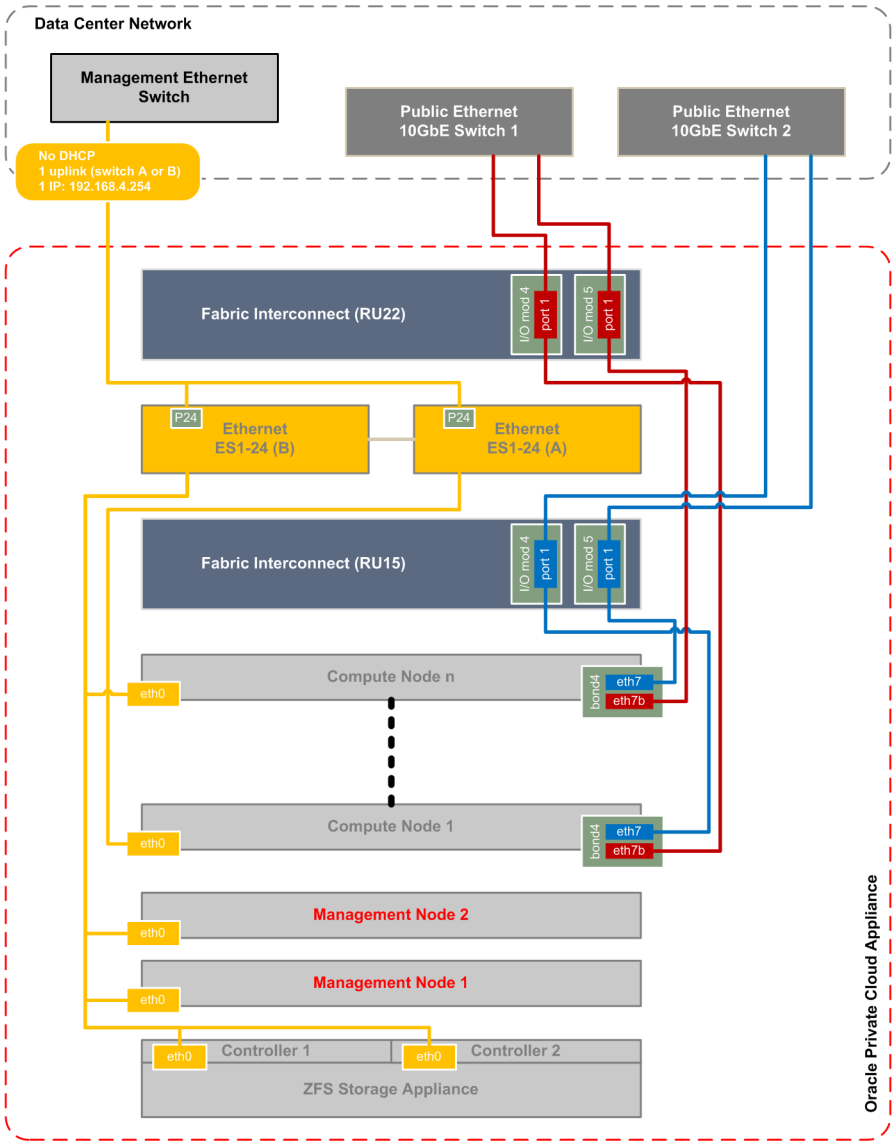

Diagram Notes

- The connections in gold on the left hand side of the diagram correspond with the out-of-band appliance management network `192.168.4.0/24`. These are physical Ethernet ports connected with Ethernet cables to the two internally interconnected Oracle Switch ES1-24 switches. All appliance components and their ILOMs have a reserved IP address in this network. Only one address is available for customer use: `192.168.4.254`.
- You may connect to this management Ethernet network by choosing one of these methods:
  - Connect a workstation with an Ethernet cable plugged directly into the available port 19 in an Oracle Switch ES1-24. Statically assign IP address `192.168.4.254`.
  - Connect port 24 in **one** Oracle Switch ES1-24 – **never both** – to an Ethernet switch in your data center network. Use a workstation connected to the data center network and statically assign the IP

address `192.168.4.254`. Make sure that the management Ethernet switch used in this connection is configured to prevent DHCP leakage to the `192.168.4.0/24` subnet used by Oracle PCA.

- The connections in red and blue on the right hand side of the diagram correspond with the default network `vm_public_vlan`. This is the standard VLAN-enabled network for virtual machine traffic with public access. The compute node connections are bonds of two Ethernet vNICs that terminate on port 1 of the I/O modules 4 and 5 in both Fabric Interconnects. The underlying physical connection consists of redundant InfiniBand cabling. The physical 10GbE ports of the Fabric Interconnects are connected for redundancy to two next-level data center switches.
- The vNIC connections are distributed across the Fabric Interconnects and the I/O modules for maximum availability. If one of the redundant components fails at any level, be it an I/O module, an entire Fabric Interconnect or a next-level switch in the data center, the VMs always maintain an active external connection using either a blue or a red path. The uplinks to the data center switches are deliberately **not** cross-cabled to prevent that half of the compute nodes lose external connectivity if one of those switches fails.
- All custom public networks follow the same principle as the default `vm_public_vlan` shown in this diagram. However, for the custom networks additional bonded vNICs are created on the compute nodes, and additional I/O ports must be configured and cabled.

C.2 Virtual Networking

This section shows how Oracle PCA networking is virtualized and configured through the Fabric Interconnects.

Figure C.2 Virtual InfiniBand and Ethernet Networks With or Without Public Connectivity

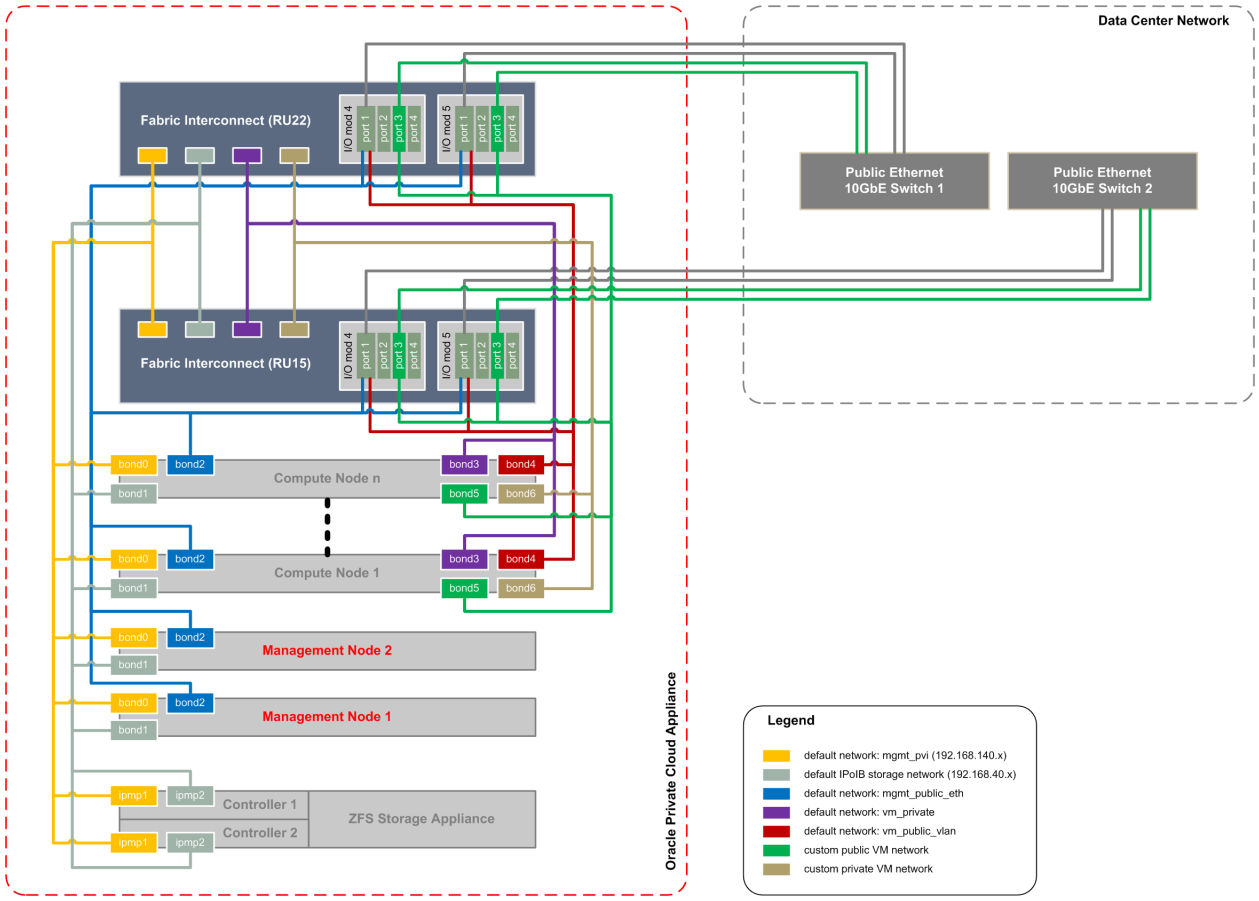

Diagram Notes

- All virtual networks in the diagram connect bonds, consisting of two virtual interfaces on the nodes, to the Fabric Interconnects. Private networks, which provide internal connectivity only, terminate on the Fabric Interconnects and are not routed externally. Public networks terminate on the I/O modules and are routed externally across the 10GbE ports, which are cabled in a redundant configuration to dedicated Ethernet switches in the data center network. Only I/O modules 4 and 5 are shown in this diagram, but each Oracle Fabric Interconnect F1-15 installed in an Oracle PCA rack contains two more I/O modules in slots 10 and 11, with four 10GbE ports each, which can be used in the same way.

  The underlying physical connection of all virtual networking consists of redundant InfiniBand cabling. All internal and external connectivity is managed by the Fabric Interconnects.

- The storage network is an IPoIB network that provides connectivity between the compute nodes, the management nodes and the internal ZFS storage appliance. All connected components use a network bond consisting of two virtual InfiniBand interfaces. The bonds have an IP address in the `192.168.40.0/24` subnet.

- Apart from the storage network, all virtual networks in the diagram are Ethernet networks. All connected components use a network bond consisting of two vNICs. The Ethernet networks intended for both private and public VM connectivity only include the compute nodes. All VM networks are VLAN-enabled.

- The virtual networks connecting the network bonds numbered 0-4 are configured by default on every Oracle PCA. The network connecting all `bond6` interfaces is an example of a custom private VM network. The network connecting all `bond5` interfaces is an example of a custom public VM network. This type of network requires the configuration of additional I/O ports, which must also be cabled to the next-level data center switches for public access.

C.3 External Storage Connections

This section shows how external storage is connected to Oracle PCA.

Figure C.3 Fibre Channel and InfiniBand Connectivity for External Storage

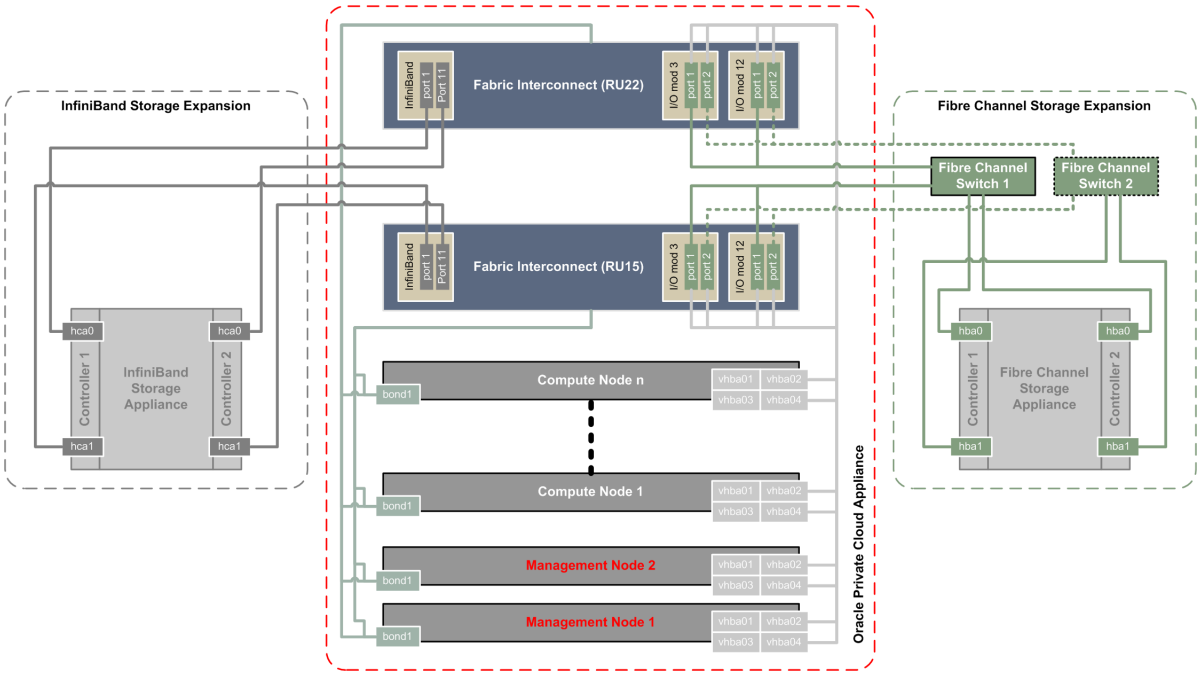

Diagram Notes

- All nodes in the Oracle PCA rack are connected to the IPoIB storage network (`192.168.40.0/24`) through their `bond1` interface, which consists of two virtual InfiniBand interfaces. For Fibre Channel storage connectivity all compute nodes have 4 virtual HBAs that terminate on the Fibre Channel I/O modules of the Fabric Interconnects. The underlying physical connection of all storage traffic consists of redundant InfiniBand cabling. All external storage connectivity is managed by the Fabric Interconnects.
- External InfiniBand storage, shown on the left-hand side of the diagram, is connected directly to InfiniBand ports 1 and 11 of the Fabric Interconnects.
- External Fibre Channel storage, shown on the right-hand side of the diagram, is connected to the I/O modules 3 and 12 of the Fabric Interconnects, but through one or two external Fibre Channel switches.
  - The minimum configuration uses 1 port per FC I/O module for a total of 4 physical connections to one external Fibre Channel switch. In this configuration both HBAs of both storage controllers are connected to the same Fibre Channel switch.
  - The full HA configuration uses both ports in each FC I/O module for a total of 8 physical connections: 4 per external Fibre Channel switch. In this configuration the HBAs of both storage controllers are cross-cabled to the Fibre Channel switches: one HBA is connected to switch 1 and the other HBA is connected to switch 2. The additional connections for the HA configuration are marked with dotted lines in the diagram.
- The vHBAs in the servers and the Fibre Channel ports in the I/O modules of the Fabric Interconnects are connected according to a round-robin scheme for high availability. In a field installation the compute nodes are provisioned in random order. Therefore it is impossible to predict which nodes are connected to which I/O ports. The software does ensure that half the compute nodes follow the connection scheme of management node 1, while the other half follows the connection scheme of management node 2.

  The connection scheme presented in Table C.1 shows that the four vHBAs in each server node are virtually cross-cabled to the Fabric Interconnects and their Fibre Channel I/O modules. To find out exactly how a particular compute node connects to the external FC storage you have to run the CLI command `list wwpn-info`.

  Table C.1 Fibre Channel vHBA, I/O Port and Storage Cloud Mapping

vHBA	Fabric Interconnect	I/O Port	Storage Cloud
vhba01	ovcasw22r1 RU22	3/1 or 12/1	A
vhba02	ovcasw22r1 RU22	3/2 or 12/2	B
vhba03	ovcasw15r1 RU15	3/1 or 12/1	C
vhba04	ovcasw15r1 RU15	3/2 or 12/2	D

Appendix D Site Checklists

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This appendix contains site checklists to help you ensure that your site is prepared for installing the Oracle PCA.

D.1 System Components Checklist

Complete the following checklist to ensure that the systems component considerations have been addressed.

Table D.1 System Component Checklist

System Components Considerations	Yes	No	N/A	Comment
Will more than one base rack be installed?				
Is the rack installation a new system or an addition to an existing system?				
Will the base rack be connected to an expansion rack?				
Are all machine racks adjacent to each other?				
If the connecting racks are not within the specified proximity, then have the following been done: • Purchased approved longer InfiniBand cables from an approved third-party vendor? • Asked Oracle Support Services to provide and schedule the custom multi-rack cabling service with the installation?				

D.2 Data Center Room Checklist

Complete the following checklist to ensure that the data center room requirements are met. For information about the data center requirements, see Section 2.2, “Flooring Requirements”.

Table D.2 Data Center Room Checklist

Data Center Room Considerations	Yes	No	N/A	Comment
Has the Oracle PCA location been allocated?				
Is there a vacant location for the new equipment?				
Does the floor layout meet the equipment maintenance access requirements?				
Is there adequate space available for maintenance?				
Will the equipment be positioned so that the exhaust air of one rack does not enter the air inlet of another rack?				
Have cabinet stabilization measures been considered?				
Does the raised floor satisfy the weight requirements for the new hardware?				
Can floor tiles be removed without permission to accommodate service?				
Are there cable routing channels or cutouts?				
Are you providing any additional hardware?				
Is the hardware you are providing fully compatible with the Oracle PCA?				
Will the new hardware location require any non-standard cable lengths?				
Is the floor to ceiling height a minimum of 3214 mm or 3.2 m (10.5 feet)?				
Is the depth of the raised floor a minimum of 46 cm (18 inches)?				

D.3 Data Center Environmental Checklist

Complete the following checklist to ensure that the data center environment requirements are met. For information, see Section 2.5, “Ventilation and Cooling Requirements”.

Table D.3 Data Center Environmental Checklist

Data Center Environmental Considerations	Yes	No	N/A	Comment
Does the computer room air handling meet temperature and humidity requirements?				
Does the installation floor layout satisfy the ventilation requirements?				
Will the equipment be positioned so the exhaust air of one rack does not enter the air intake of another rack?				
Are the perforated floor tiles each rated at 400 CFM or greater?				
Do the data center air conditioners provide sufficient front to back airflow?				
Is airflow adequate to prevent hot spots?				
Can the data center continuously satisfy environmental requirements?				
Can more vented floor tiles be obtained if required?				

D.4 Access Route Checklist

Complete the following checklist to ensure that the access route requirements are met. For information about preparing your data center access route, see Section 4.2, “Prepare to Install Oracle Private Cloud Appliance”.

Table D.4 Access Route Checklist

Access Route Considerations	Yes	No	N/A	Comment
Has the access route been checked for clearances of the packaged equipment?				
Do all the doors and entry ways conform to the width and height requirements for transportation, including the width of the unpacked unit?				
Do all the doors meet the height requirement of minimum 218 cm (86 inches) for packaged delivery?				
Does the access route provide sufficient space for transport of the packed devices?				
Are there any ramps or thresholds that are of concern? If yes, then provide details.				

Access Route Considerations	Yes	No	N/A	Comment
Are there any stairs or ramps in the path when moving the new hardware?				
Have you confirmed that all route incline angles are within the permitted range?				
Have you confirmed that the access route is free of any obstacles that would expose the device to shock?				
Are all the surfaces acceptable for rolling the new unpacked and packed equipment?				
If a pallet jack is to be used, then have you confirmed the following: • The pallet jack supports the device weight? • The pallet jack tines are compatible with the shipping pallet?				
If there are stairs, then is a loading elevator accessible for the equipment?				
If an elevator is to be used, then have you confirmed the following: • The elevator car is wide enough for the device to be carried into it? • The elevator car is high enough for the device to be carried into it? • The load limit of the elevator is greater than the device weight? • Are elevators available to handle up to 996 kg (2197 lbs) fully-loaded rack capacity? • The elevator door meets the minimum height requirement of 218 cm (86 inches) for packaged rack delivery?				
Does the path from the receiving location to the designated data center area support the weight of the unpacked equipment?				
Is the path onto the raised floor rated for dynamic loading of the				

Access Route Considerations	Yes	No	N/A	Comment
server? Refer to Section 2.2, “Flooring Requirements”.				

D.5 Facility Power Checklist

Complete the following checklist to ensure that the facility power requirements are met. For information about power requirements, see Section 2.3, “Electrical Power Requirements”.

Table D.5 Facility Power Checklist

Facility Power Considerations	Yes	No	N/A	Comment
Do you know the required operating voltage and electric current level of the device and peripherals?				
Will you be using single-phase (low-voltage or high-voltage) or 3-phase (low-voltage or high-voltage) power?				
Are enough power outlets provided within 2 meters (6.5 feet) for each rack?				
Do the power outlets have appropriate socket receptacles for the PDU option ordered? Options are low voltage or high voltage, single-phase or 3-phase.				
Will optional ground cables be attached to the rack?				
Are the circuit breakers for the equipment suitable in terms of voltage and current-carrying capacities?				
Does the power frequency meet the equipment specifications?				
Are power outlets available for the new equipment at the designated location?				
Will system power be delivered from two separate grids?				
Is there a UPS to power the equipment?				
Do you have the minimum required power sources to support the power load for the new hardware? Use kilowatt (kW) /kilovolt (kVA) to express power load.				

D.6 Safety Checklist

Complete the following checklist to ensure that the safety requirements are met. For information about safety, see Section 1.6, “Operational Procedures for Oracle Private Cloud Appliance” and Section 2.5, “Ventilation and Cooling Requirements”.

Table D.6 Safety Checklist

Safety Checklist Considerations	Yes	No	N/A	Comment
Is there an emergency power shut off?				
Is there a fire protection system in the data center room?				
Is the computer room adequately equipped to extinguish a fire?				
Is antistatic flooring installed?				
Is the floor below the raised floor free of obstacles and blockages?				

D.7 Logistics Checklist

Complete the following checklist to ensure that the logistics requirements are met. For information about unpacking and space requirements, see Section 2.1, “Space Requirements”.

Table D.7 Logistics Checklist

Logistics Checklist Considerations	Yes	No	N/A	Comment
Do you have contact information for the data center personnel?				
Is there security or access control for the data center?				
Are there any security background checks or security clearances required for vendor personnel to access the data center? If yes, then do you have a recommended agency?				
How many days in advance must background checks be completed?				
Are there any additional security access issues?				
Is computer room access available for installation personnel?				
Are laptops, cell phones, and cameras allowed in the data center?				
Does the building have a delivery dock?				
Is there a delivery/unpacking/ staging area?				

Logistics Checklist Considerations	Yes	No	N/A	Comment
Is the delivery inside?				
If the delivery is not inside, then is the site prepared for uncrating?				
Is the unpacking/staging area protected from the elements?				
Does the building have adequate receiving space?				
Is the unpacking area air-conditioned to avoid thermal shock for various hardware components?				
Will sufficient moving personnel be available to install the hardware?				
Is union labor required for any part of the delivery or installation?				
Are you prepared for uncrating and trash removal?				
Is uncrating of cabinet and cabinet trash removal required?				
Are there any restrictions on delivery truck length, width, or height?				
Does the customer allow cardboard boxes and other packing material in the computer room? If no, then do ground level deliveries require a truck with a side rail lift?				
Is there a time constraint on dock access? If yes, then provide time constraints.				
Is tail lift required on delivery carrier to unload the equipment at the delivery dock?				
Will any of the following be required to place equipment in computer room? • Stair walkers • Lifters • Ramps • Steel plates • Floor covers				
Does the delivery carrier require any special equipment, such as non-				

Logistics Checklist Considerations	Yes	No	N/A	Comment
floor damaging rollers, transport dollies, pallet jacks, or fork lifts?				

D.8 Network Specification Checklist

Complete the following checklist to ensure that the network specification requirements are met. For information about IP addresses, see Chapter 3, *Network Requirements* and Appendix A, *Default IP Addresses*.

Note

By default, there is one InfiniBand partition at the Oracle PCA level. All compute nodes in the system are members of the default InfiniBand partition. The most common model for application isolation involves multiple IP subnetting, in which the most mission-critical applications are assigned their own IP subnets layered about the default IPoIB link. In this model, some subnets may also contain applications that have less stringent or otherwise different resource requirements.

Table D.8 Network Specification Checklist

Network Specification Considerations	Yes	No	N/A	Comment
Did you complete the networking worksheet, which is included in Section 3.2, “General Network Configuration”?				
Have you received the site-specific installation template from your Oracle technical representative?				
Did you review the installation template and consult with your Oracle technical representative regarding any site-specific changes, if any?				
Did you verify that IP addresses in the installation template are currently not in use?				
Have you performed the required configuration within your network infrastructure to allow the Oracle PCA to use the IP addresses specified in the template?				
Have you registered IP addresses in the installation template with DNS?				
Did you run the required network cables from your network equipment to the location where the Oracle PCA will be installed?				

Network Specification Considerations	Yes	No	N/A	Comment
Did you label the network cables that will connect to the Oracle PCA?				

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