



Installation Requirements

This chapter describes what is required to install Prime Optical, the components that come with Prime Optical, and how to calculate the total number of Oracle Named User Plus licenses required for your Prime Optical server and client installations. It contains the following topics:

- [Prime Optical Server and Database Requirements, page 2-1](#)
 - [Server Specifications, page 2-3](#)
 - [Disk Space and Partition Specifications, page 2-4](#)
 - [VMware Support, page 2-8](#)
 - [Ports and Protocols, page 2-9](#)
 - [TCP Ports for SOCKS Proxy Server, page 2-16](#)
- [Prime Optical Client Requirements, page 2-17](#)
 - [Remote Application Software with the Prime Optical Client, page 2-18](#)
- [Oracle Licensing for Prime Optical, page 2-19](#)
 - [Oracle Enterprise Edition, page 2-22](#)
- [Prime Optical-Supported Third-Party Tools, page 2-22](#)



Note

Although Cisco makes every attempt to ensure the availability of third-party hardware and software platforms specified for Prime Optical, Cisco reserves the right to change or modify system requirements due to third-party vendor product availability or changes that are beyond Cisco's control.

Prime Optical Server and Database Requirements

The Prime Optical server runs on any of the platforms listed in [Table 2-1](#).



Note

The Prime Optical server must run on a dedicated workstation. Any application that is not explicitly listed in this section as being required or supported by Prime Optical, cannot be installed on the dedicated Prime Optical server workstation.

Table 2-1 Supported Platforms and Operating Systems

Platform	Operating System
Cisco Unified Computing System (UCS) B series ¹	Red Hat Enterprise Linux (RHEL) 6.5, 6.6 and 7.1, server 64-bit (with or without VMware ESXi version 5.5 and 6.0)
Cisco UCS C series ¹	

1. Refer to the appropriate [UCS compatibility matrix](#) to verify which RHEL release is supported by each platform.

**Note**

- Prime Optical is not validated against required file systems (/oracle, /db01, /db02, /db03, /db04, /db05) of the Network File System (NFS) type.
- If you are installing Prime Optical with Prime Central, Domain Name System (DNS) must be enabled on the Prime Optical server.

[Table 2-2](#) lists the items required to install the Prime Optical server.

Table 2-2 Items Required to Install the Prime Optical Server

Requirement	Notes
Prime Optical installation USB drive or ISO images	—
Red Hat Enterprise Linux (RHEL) 6.5, 6.6 and 7.1 64-bit ¹	<p>To install Prime Optical on RHEL server, the yum command must be properly configured and the yum repository must be available. See, Configuring yum Commands on the Server, page 3-2 and RHEL Documentation for more information.</p> <p>Note Enable the IPV6 networking option to install Linux.</p> <p>Note Ensure that the system must be registered on Red Hat Network (RHN) or RHEL DVD must be available to configure yum repository properly.</p>
Sun Microsystems Java Development Kit (JDK) Standard Edition version 1.7.0_80	<ul style="list-style-type: none"> • JDK is installed automatically for the Prime Optical server and Prime Optical GateWay/CORBA.
Oracle 12c software For Linux: 10404530	<ul style="list-style-type: none"> • The Oracle product is available on CD or in .cpio file format. • Oracle patches are available in .zip file format. • See, Downloading and Installing the Required Oracle 12c Patches for Linux Platforms, page 4-5.
Oracle 12c licenses	Oracle licenses can be purchased either for the server processor or for named users. For more information on Oracle named users, see Oracle Licensing for Prime Optical , page 2-19.
GNU tar	Prime Optical uses GNU tar to extract files from archives. GNU must be installed on the Prime Optical server workstation. The Prime Optical server supports the latest version of GNU tar.

1. Refer to the appropriate [UCS compatibility matrix](#) to verify which RHEL release is supported by each platform.

Server Specifications

The following tables show recommended hardware specifications for installing the Prime Optical server, and the resulting maximum number of Network Elements (NEs) the server manages for each configuration.

If the Prime Optical server and Oracle database are installed on separate workstations, both workstations must meet the hardware requirements shown in the following tables. [Table 2-3](#) lists the minimum processor requirements.



Note

It is possible to use and configure disk arrays for database storage with any type of Redundant Array of Inexpensive Disks (RAID) layout. You can do so only if the disk throughput is equal to or higher than the throughput calculated for internal disks.

Table 2-3 Minimum Processor Requirements

Network Size	UCS B or C Series ¹
Small	2 x Intel Xeon 5620
Medium	2 x Intel Xeon 5620
Large	2 x Intel Xeon 5620
High end	2 x Intel Xeon 5640

1. Prime Optical has been tested on a UCS C210 M2 system.

Cisco tests the simulated network configurations listed in [Table 2-4](#). Your setup and performance might vary depending on the size of your network and the usage pattern of management tasks.

Table 2-4 Minimum Memory Requirements for the Prime Optical Server Installation

Network Size	Oracle Database Type	RAM	No. of Network Partitions ¹	Maximum No. of NEs ²
Small	Enterprise Edition	8 GB Note 8 GB of RAM is required for the small size, but Cisco recommends 16 GB.	1	200
Medium	Enterprise Edition	16 GB	1	500
Large	Enterprise Edition	32 GB	4	2000
High end	Enterprise Edition	96 GB	8	5000

1. In Prime Optical 10.5, a single NE service (or a single network partition) can support up to 750 nodes.

A high-end network supports any combination of up to 5000 nodes, 8 network partitions, and 750 nodes per network partition. For example, 6 NE services with 750 nodes + 1 NE service with 500 nodes ((6 x 750) + (1 x 500) = 5000).

A large network supports any combination of up to 2000 nodes, 4 network partitions, and 750 nodes per network partition. For example, 4 NE services with 500 nodes (4 x 500), 2 NE services with 750 nodes + 1 NE service with 500 nodes ((2 x 750) + (1 x 500) = 2000).

- These numbers assume you are using fully equipped ONS 15454 MSPP nodes (for example, 12 OC-48, 2 TCC, and 1 XC10G with up to 2 links and 48 SONET cross-connections per node). Note that these numbers should be used as a guideline, and vary depending on the software and hardware configuration of your NEs.

The following list describes the server configuration parameters and the effect of changes in each parameter on the maximum number of NEs the server can manage:

- Network Size**—If the network size increases, more resources are reserved for the higher number of NEs to be managed.
- RAM**—The server can manage more NEs as the RAM increases. The server can manage fewer NEs as the RAM decreases.
- Number of Network Partitions**—For each network partition, the server reserves resources for the higher number of NEs to be managed. The server can manage more NEs as the number of network partitions increases. The server can manage fewer NEs as the number of network partitions decreases.

Disk Space and Partition Specifications

The following tables show disk space and partition requirements for optical NEs based on network size and performance management (PM) data collection status.

- The minimum disk space is the total space required for /, swap, /cisco, /oracle, /db01, /db02, /db03, /db04, and /db05. (The minimum disk space does not include /ctm_backup or the optional partitions /db01_rd and /db02_rd.)
- The maximum disk space is the total space required for /, swap, /cisco, /oracle, /db01, /db02, /db03, /db04, /db05, /db01_rd, /db02_rd, and /ctm_backup.



Note

- We recommend that you use the partition sizes described in this section. Prime Optical performance degrades if you do not use the recommended partition sizes.
- To improve database performance and maximize data input/output, configure a dedicated disk array with the following setup:
 - Dynamic multipathing (DMP) to parallelize the file system access.
 - Raid 0 (striping) to optimize the disk input data.
- Prime Optical is a high-transaction application, which causes high I/O throughput for Oracle redo logs. We recommend that you reserve dedicated system controllers for file systems—including the optional /db01_rd and /db02_rd file systems—that manage redo logs.



Caution

For large and high-end networks, if you do not follow the preceding disk striping recommendations, the I/O might create a critical bottleneck and cause an unexpected Prime Optical shutdown.

Table 2-5 Disk Space and Partition Requirements for Installing the Prime Optical Server and Oracle on the Same Workstation—PM Collection Enabled

Network Size	Disk Space	/	swap ¹	/cisco ²	/oracle	/db01	/db02	/db03	/db04	/db05 ³	/db01_rd (optional)	/db02_rd (optional)	/ctm_backup
Small	150 GB (min)	12 GB	12 GB	20 GB	10 GB	12 GB	6 GB	40 GB	30 GB	8 GB	1 GB	1 GB	101 GB
	253 GB (max)												
Medium	268 GB (min)	12 GB	24 GB	20 GB	10 GB	16 GB	16 GB	90 GB	70 GB	10 GB	2 GB	2 GB	208 GB
	480 GB (max)												
Large	478 GB (min)	12 GB	48 GB	20 GB	10 GB	20 GB	26 GB	190 GB	140 GB	12 GB	3 GB	3 GB	394 GB
	878 GB (max)												
High end	890 GB (min)	12 GB	96 GB	20 GB	10 GB	24 GB	50 GB	360 GB	300 GB	18 GB	4 GB	4 GB	758 GB
	1656 GB (max)												

1. Use swap when creating the partition. Do not use /swap.
2. 10 GB is required for /cisco, but 20 GB is strongly recommended.
3. Do not increase the recommended size for /db05. Doing so can severely impact Prime Optical performance.

Table 2-6 Disk Space and Partition Requirements for Installing the Prime Optical Server and Oracle on the Same Workstation—PM Collection Disabled

Network Size	Disk Space	/	swap ¹	/cisco ²	/oracle	/db01	/db02	/db03	/db04	/db05 ³	/db01_rd (optional)	/db02_rd (optional)	/ctm_backup
Small	95 GB (min)	12 GB	12 GB	20 GB	10 GB	12 GB	6 GB	8 GB	7 GB	8 GB	1 GB	1 GB	40 GB
	137 GB (max)												
Medium	130 GB (min)	12 GB	24 GB	20 GB	10 GB	16 GB	16 GB	12 GB	10 GB	10 GB	2 GB	2 GB	62 GB
	196 GB (max)												
Large	186 GB (min)	12 GB	48 GB	20 GB	10 GB	20 GB	26 GB	20 GB	18 GB	12 GB	3 GB	3 GB	90 GB
	282 GB (max)												

Table 2-6 *Disk Space and Partition Requirements for Installing the Prime Optical Server and Oracle on the Same Workstation—PM Collection Disabled (continued)*

Network Size	Disk Space	/	swap ¹	/cisco ²	/oracle	/db01	/db02	/db03	/db04	/db05 ³	/db01_rd (optional)	/db02_rd (optional)	/ctm_backup
High end	282 GB (min)	12 GB	96 GB	20 GB	10 GB	24 GB	50 GB	28 GB	24 GB	18 GB	4 GB	4 GB	136 GB
	426 GB (max)												

1. Use swap when creating the partition. Do not use /swap.
2. 10 GB is required for /cisco, but 20 GB is strongly recommended.
3. Do not increase the recommended size for /db05. Doing so can severely impact Prime Optical performance.

Table 2-7 *Disk Space and Partition Requirements for the Prime Optical Server when Installing the Prime Optical Server and Oracle on Separate Workstations*

Network Size	Total Disk Space	/	swap ¹	/cisco ²
Small	44 GB	12 GB	12 GB	20 GB
Medium	56 GB	12 GB	24 GB	20 GB
Large	80 GB	12 GB	48 GB	20 GB
High end	128 GB	12 GB	96 GB	20 GB

1. Use swap when creating the partition. Do not use /swap.
2. 10 GB is required for /cisco, but 20 GB is strongly recommended.

Table 2-8 *Disk Space and Partition Requirements for the Oracle Database Server when Installing the Prime Optical Server and Oracle on Separate Workstations—PM Collection Enabled*

Network Size	Disk Space	/	swap ¹	/cisco	/oracle	/db01	/db02	/db03	/db04	/db05	/db01_rd (optional)	/db02_rd (optional)	/ctm_backup
Small	150 GB (min)	12 GB	12 GB	20 GB	10 GB	12 GB	6 GB	40 GB	30 GB	8 GB	1 GB	1 GB	101 GB
	253 GB (max)												
Medium	268 GB (min)	12 GB	24 GB	20 GB	10 GB	16 GB	16 GB	90 GB	70 GB	10 GB	2 GB	2 GB	208 GB
	480 GB (max)												
Large	478 GB (min)	12 GB	48 GB	20 GB	10 GB	20 GB	26 GB	190 GB	140 GB	12 GB	3 GB	3 GB	394 GB
	878 GB (max)												
High end	890 GB (min)	12 GB	96 GB	20 GB	10 GB	24 GB	50 GB	360 GB	300 GB	18 GB	4 GB	4 GB	758 GB
	1656 GB (max)												

1. Use swap when creating the partition. Do not use /swap.

Table 2-9 Disk Space and Partition Requirements for the Oracle Database Server when Installing the Prime Optical Server and Oracle on Separate Workstations—PM Collection Disabled

Network Size	Disk Space	/	swap ¹	/cisco ²	/oracle	/db01	/db02	/db03	/db04	/db05	/db01_rd (optional)	/db02_rd (optional)	/ctm_backup
Small	95 GB (min)	12 GB	12 GB	20 GB	10 GB	12 GB	6 GB	8 GB	7 GB	8 GB	1 GB	1 GB	40 GB
	137 GB (max)												
Medium	130 GB (min)	12 GB	24 GB	20 GB	10 GB	16 GB	16 GB	12 GB	10 GB	10 GB	2 GB	2 GB	62 GB
	196 GB (max)												
Large	186 GB (min)	12 GB	48 GB	20 GB	10 GB	20 GB	26 GB	20 GB	18 GB	12 GB	3 GB	3 GB	90 GB
	282 GB (max)												
High end	282 GB (min)	12 GB	96 GB	20 GB	10 GB	24 GB	50 GB	28 GB	24 GB	18 GB	4 GB	4 GB	136 GB
	426 GB (max)												

1. Use swap when creating the partition. Do not use /swap.
2. 10 GB is required for /cisco, but 20 GB is strongly recommended.

Note the following PM assumptions for optical NEs:

- In a small network, PM data collection assumes 30 days of storage for PM data collected across 200 NEs, assuming an average of 200 interfaces per NE, up to a maximum of 40,000 interfaces (includes logical and physical interfaces).
- In a medium network, PM data collection assumes 30 days of storage for PM data collected across 500 NEs, assuming an average of 100 interfaces per NE, up to a maximum of 40,000 interfaces (includes logical and physical interfaces).
- In a large network, PM data collection assumes 30 days of storage for PM data collected across 2000 NEs, assuming an average of 100 interfaces per NE, up to a maximum of 200,000 interfaces (includes logical and physical interfaces).
- In a high-end network, PM data collection assumes 30 days of storage for PM data collected across 5000 NEs, assuming an average of 100 interfaces per NE, up to a maximum of 500,000 interfaces (includes logical and physical interfaces).

Ctm_backup Directory Size

The ctm_backup directory is a repository used by the **oracle** user to back up the following categories of information:

- Prime Optical database backup and export dump.

- Configuration files.
- Database ARCHIVELOG files.

The **oracle** user must have read/write permissions to avoid a database backup failure. The database could block if ARCHIVELOG files are not moved to the `/ctm_backup` directory.

We recommend that the `/ctm_backup` size be equivalent to the sum of the single database partitions (that is, the sum of `/oracle`, `/db01`, `/db02`, `/db03`, `/db04`, `/db05`, and—if configured—`/db01_rd` and `/db02_rd`).


Note

- The final `/ctm_backup` size is also related to the ARCHIVELOG files.
- The `/ctm_backup` directory can be a symbolic link to a user-defined directory and must have read/write permissions.

VMware Support

Prime Optical can run on a virtual machine (VM) on VMware vSphere version 5.5 or 6.0. VM RAM, disk and partitioning requirements must comply with the same requirements for a nonvirtualized setup based on system size.

Prime Optical is also delivered as a virtual appliance for medium size installation. See [Installing the Prime Optical Virtual Appliance, page 9-1](#) for more information.


Note

VM performance can be affected if there are multiple VMs running on the same host. Consult your system administrator on the VMware configuration and requirements needed for your Prime Optical installation. Depending on the load, it may require a dedicated server or a virtualized one. See the VMware vSphere documentation for performance guidelines.

When installing Prime Optical on a virtual machine, do the following:

-
- Step 1** Assign RAM as listed in [Table 2-4](#).
 - Step 2** Follow disk space and partition requirements as listed in [Disk Space and Partition Specifications, page 2-4](#).
 - Step 3** Configure VM vCPU settings. Refer to VMware vSphere documentation for performance guidelines on vCPU settings.

As a general guideline, we suggest you configure two vCPUs for every 500 nodes. This is based on a UCS C210 M2 machine, with a dual-socket, multicore 2.93GHz processor in a medium network Prime Optical setup during Cisco internal validation.

- Step 4** Confirm that the `/etc/hosts` file exists inside the guest OS of the VM and that the hostname (with and without a domain) is associated to the proper IP address and not to the loopback IP 127.0.0.0.

Example of a correct entry in the `/etc/hosts` file:

```
127.0.0.1 localhost.localdomain localhost
::1 localhost6.localdomain6 localhost6
10.58.65.195 vm-rh-01.cisco.com vm-rh-01
```

Example of an incorrect entry in the `/etc/hosts` file:

```
127.0.0.1 vm-rh-01 localhost.localdomain localhost
```



```
:::1 localhost6.localdomain6 localhost6
```

where the hostname `vm-rh-01` is associated to the loopback address `127.0.0.1`.

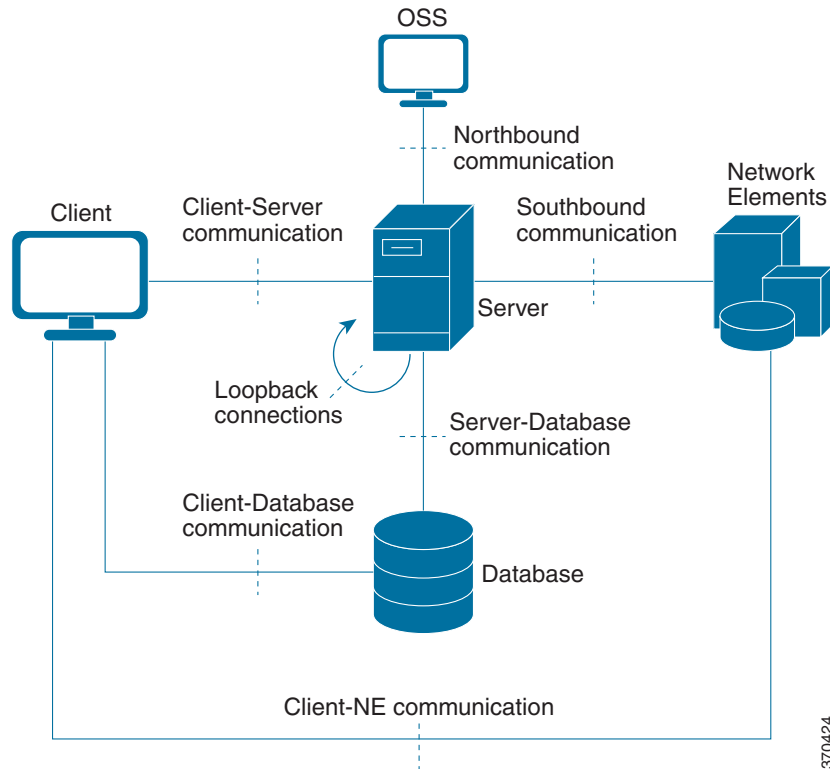


Note The file can be wrong if the VM OS was installed without network connectivity.

Ports and Protocols

Figure 2-1 illustrates the classification of communication ports and protocols used in Prime Optical.

Figure 2-1 Classification of Prime Optical Communications



See Table 2-10 for a description of each type of communication port and protocol.

Table 2-10 Port and Protocol Types

Port and Protocol Type	Description
Client-Server Communication Ports and Protocols	Used for the communication between the Prime Optical clients and the Prime Optical server.
Client-Database Communication Ports and Protocols	Used for the communication between the Prime Optical clients and the Prime Optical database. The database can be installed on the same workstation where the Prime Optical server is installed or on a different workstation.

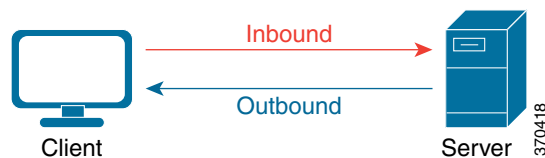
Table 2-10 Port and Protocol Types (continued)

Port and Protocol Type	Description
Client-NE Communication Ports and Protocols	Used for direct communication between the Prime Optical client and the NEs.
OSS CORBA Client Communication (Northbound) Ports and Protocols	Used for communication with the Operational Support System (OSS) Common Object Request Broker Architecture (CORBA) client workstation.
Server-Database Communication Ports and Protocols	Used for the communication between the Prime Optical server and database.
Loopback Connections (Server to Server) Ports and Protocols	Used for connections that originate and end on the Prime Optical server host. Connection on these ports from outside hosts is not enabled.
Southbound Communication Ports and Protocols	Used for Prime Optical server communication with the NEs.
TCP Ports for SOCKS Proxy Server	Used in a SOCKS proxy server configuration.

Client-Server Communication Ports and Protocols

Prime Optical uses the following protocols for client-server communication (Figure 2-2):

- Common Object Request Broker Architecture (CORBA)—Object Management Group’s open, vendor-independent architecture and infrastructure that computer applications use to work together over networks.
- Java Management Object and Configuration Object (JMOCO)—Cisco-proprietary, TCP/IP-based request/response protocol.
- Telnet—A standard Internet protocol that provides terminal emulation using the TCP/IP protocols.

Figure 2-2 Client-Server Communication

Inbound ports are for operations initiated by the Prime Optical client and then directed to the Prime Optical server. Outbound ports are for operations initiated by the Prime Optical server and then directed to the Prime Optical client.

See [Table 2-11](#) for client-server port and protocol information:

Table 2-11 Prime Optical Client to Prime Optical Server Ports

Port	Inbound or Outbound	Transport Protocol	Application Protocol	Service	Notes
80 (configurable)	Inbound	TCP	HTTP	Web Server	Apache HTTP port
443 (configurable)	Inbound	TCP	HTTPS	Web Server	Apache HTTP port

Table 2-11 Prime Optical Client to Prime Optical Server Ports (continued)

Port	Inbound or Outbound	Transport Protocol	Application Protocol	Service	Notes
61626 (configurable)	Inbound	TCP	ActiveMQ	JMS Broker	ActiveMQ broker port
30000	Inbound	TCP	CORBA	SMSservice	Service Manager port
CORBA IIOP Listener Port	Inbound	TCP	CORBA	CTC-Based Network Services	—
10023-10086	Inbound	TCP	Telnet	SMSservice	Telnet port
3000-3200	Outbound	UDP	SNMP	ONS1530x NE Service	ONS 1530x SNMP trap forwarding to Cisco Edge Craft (CEC)
Dynamic (configurable)	Inbound	TCP	CORBA	Orchestration Service	

Client-Database Communication Ports and Protocols

The Prime Optical client establishes connections with the database using Java Database Connectivity (JDBC), the industry standard for database-independent connectivity between Java programming languages and databases. The Prime Optical client uses JDBC to communicate directly with the Prime Optical database, independently from the Prime Optical server.

See [Table 2-12](#) for client-database port and protocol information:

Table 2-12 Prime Optical Client to Prime Optical Database Ports

Port	Inbound or Outbound	Transport Protocol	Application Protocol	Service	Notes
1521	Inbound	TCP	JDBC	Oracle Listener	Database listener port

Client-NE Communication Ports and Protocols

The Prime Optical client can launch Cisco Transport Controller (CTC) and Cisco Edge Craft (CEC) as external applications. The ports and protocols used by these application are detailed in their end-user documentation.

OSS CORBA Client Communication (Northbound) Ports and Protocols

[Figure 2-3](#) shows the port and protocol communication between the OSS CORBA Client and Prime Optical server.

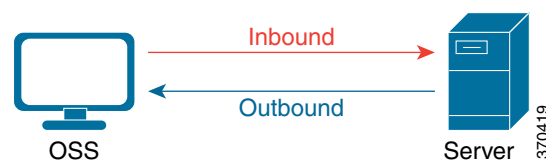
Figure 2-3 Prime Optical Server-OSS CORBA Communication

Table 2-13 lists the ports and protocols used for communication between the Prime Optical server workstation and the OSS CORBA client workstation.

Table 2-13 Prime Optical Server to OSS CORBA Ports

Port	Inbound or Outbound	Transport Protocol	Application Protocol	Service	Notes
Dynamic	Inbound/Outbound	TCP	CORBA	CORBAGWService	CORBA notification: ports are assigned randomly by the operating system; however, the notification service can be configured to specify a pool of ports.
14005	Inbound	TCP	CORBA	Name Service	CORBA naming service
20001	Inbound	TCP	CORBA	Notification Service	CORBA notifications
20100	Inbound	TCP	CORBA	CORBAGWService	EMS session port

Server-Database Communication Ports and Protocols

The Prime Server clients establish database connections using the following protocols (Figure 2-4):

- JDBC—Enables connectivity between Java programming languages and databases.
- SSH—Enables the Prime Optical server to execute commands on the database workstation.

Figure 2-4 Prime Optical Server Client-Database Communication

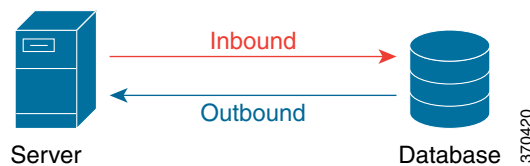


Table 2-14 lists the ports and protocols used for communication between the Prime Optical server and database.

Table 2-14 Prime Optical Server to Prime Optical Database Ports

Port	Inbound or Outbound	Transport Protocol	Application Protocol	Service	Notes
22	Inbound	TCP	SSH	SSH Daemon	Standard SSH port for secure shell
1521	Inbound	TCP	JDBC	Oracle Listener	Database listener port

Loopback Connections (Server to Server) Ports and Protocols

The Prime Optical server establishes the internal connections listed in the following table. Although operating system commands (for example, netstat) show services listening on these ports, they do not need to be opened on a firewall because there is no incoming connection on these ports from other hosts.

The following table lists the ports and protocols used for loopback connections.

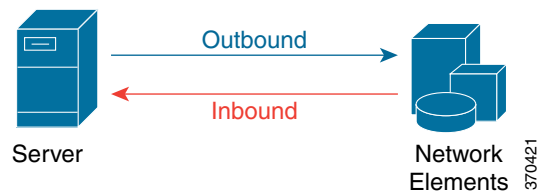
Table 2-15 Loopback Connections

Port	Transport Protocol	Application Protocol	Service	Notes
1099	TCP	Java RMI	Tomcat	Java RMI registry service
2181	TCP	Zookeeper Atomic Broadcast	Zookeeper	—
8005	TCP	Tomcat shutdown	Tomcat	Tomcat shutdown port
8009	TCP	AJP	Apache Web Server, Tomcat	Connection between the web server and Tomcat
9443	TCP	HTTPS	Tomcat	Tomcat SSL connection
27613	TCP	Proprietary	All Services	JMOCO port

Southbound Communication Ports and Protocols

The following tables list the ports that the Prime Optical server uses to communicate with NEs (Figure 2-5).

- [CTC-Based NE Ports \(without ML cards\)](#)
- [CTC-Based NE Ports \(with ML cards\)](#)
- [Cisco ONS 15216 Ports](#)
- [Cisco ONS 15305 Ports \(non-CTC-Based\)](#)
- [Cisco CTC-Based ONS 15305 R3.0 Ports](#)

Figure 2-5 Server-NE Communication

Inbound ports are for operations initiated by the node and then directed to the Prime Optical server. Outbound ports are for operations initiated by the Prime Optical server and then directed to the node.

The following table lists CTC-based NE ports without Multi-Layer (ML) cards.

Table 2-16 CTC-Based NE Ports (without ML cards)

Port	Inbound or Outbound	Transport Protocol	Application Protocol	Service	Notes
57790 (configurable)	Outbound	TCP	CORBA	CTC-Based	CORBA listener port on the NE's control card. Defaults to 57791 if secure mode is enabled on the NE. The port is configurable via NE explorer. For more information, see the section on viewing and changing the network address for CTC-Based NEs in the Cisco Prime Optical user guide.
CORBA listener port on Prime Optical server (callback)	Inbound	TCP	CORBA	CTC-Based	Dynamic To make the port static, see the section on CTC IOP Port configuration in the Cisco Prime Optical user guide.
80	Outbound	TCP	HTTP	CTC-Based	—
161	Outbound	UDP	SNMP	CTC-Based	—
162	Inbound	UDP	SNMP	SNMP Trap Service	—
443	Outbound	TCP	HTTPS	CTC-Based	Port 443, active if configured on the NE. This port is only available in NE release 6.0 and later. Prime Optical tries to communicate on this port regardless of whether the NE supports HTTPS. If this port is blocked, it could cause long NE initialization times.
2361	Outbound	TCP	TL1	CTC-Based	TL1 port on the NE's control card.
3082	Outbound	TCP	TL1	CTC-Based	TL1 port on the NE's control card.
4083	Outbound	TCP	TL1	CTC-Based	TL1 port on the NE's control card.

The following table lists CTC-based NE ports with ML cards.



Note The ports and protocols listed in [Table 2-17](#) are used in addition to the ones listed in the previous table.

Table 2-17 *CTC-Based NE Ports (with ML cards)*

Port	Inbound or Outbound	Transport Protocol	Application Protocol	Service	Notes
20xx	Outbound	TCP	Telnet	CTC-Based	ML cards: L2 Service Resync port. From any port on Prime Optical to port 20xx on the NE, where xx is the ML card slot number.
40xx	Outbound	TCP	Telnet	CTC-Based	ML cards: L2 Service Resync port when the shell access is set to secure. From any port on Prime Optical to port 40xx on the NE, where xx is the ML card slot number.
7200	Inbound	UDP	SNMP	CTC-Based	—
7209	Outbound	UDP	SNMP	CTC-Based	—
7210	Inbound	UDP	SNMP	CTC-Based	—

[Table 2-18](#) lists Cisco ONS 15216 ports.

Table 2-18 *Cisco ONS 15216 Ports*

Port	Inbound or Outbound	Transport Protocol	Application Protocol	Service
23	Outbound	TCP	Telnet CLI	Cisco ONS 15216
69	Inbound	UDP	TFTP	Cisco ONS 15216
161	Outbound	UDP	SNMP	Cisco ONS 15216
162	Inbound	UDP	SNMP	SNMP Trap Service
3083	Outbound	TCP	TL1	Cisco ONS 15216
8023	Outbound	TCP	Telnet CLI	Cisco ONS 15216

[Table 2-19](#) lists Cisco ONS 15305 (non-CTC-based) ports.

Table 2-19 *Cisco ONS 15305 Ports (non-CTC-Based)*

Port	Inbound or Outbound	Transport Protocol	Application Protocol	Service
23	Outbound	TCP	Telnet CLI	Cisco ONS 15305
161	Outbound	UDP	SNMP	Cisco ONS 15305
4500-4510	Inbound	TCP	Proprietary	Cisco ONS 15305

[Table 2-20](#) lists Cisco ONS 15305(CTC-based) ports.

Table 2-20 Cisco CTC-Based ONS 15305 R3.0 Ports

Port	Inbound or Outbound	Transport Protocol	Application Protocol	Service
23	Outbound	TCP	Telnet CLI	Cisco ONS 15305 R3.0
80	Outbound	TCP	HTTP	Cisco ONS 15305 R3.0
161	Outbound	UDP	SNMP	Cisco ONS 15305 R3.0
4500-4510	Inbound	TCP	Proprietary	Cisco ONS 15305 R3.0
12345	Outbound	TCP	Proprietary	Cisco ONS 15305 R3.0
17476	Inbound	TCP	Proprietary	Cisco ONS 15305 R3.0

TCP Ports for SOCKS Proxy Server

Table 2-21 lists the TCP ports to use in a sockets network proxy protocol (SOCKS) server configuration. This information is helpful when setting up a firewall routing table.

Table 2-21 TCP Ports to Open in a SOCKS Proxy Server Configuration

Port	Inbound or Outbound	Protocol	Application Protocol	Notes
1080	Inbound on firewall/SOCKS proxy host	TCP	SOCKS v5	The port is configurable and is used for the connection between the Prime Optical client host and the firewall host.
10023–10086	Inbound (Prime Optical server host)	TCP	Telnet	Used for the connection between the Prime Optical client host and the Prime Optical server host.
80	Inbound (Prime Optical server host)	TCP	HTTP	Used for the connection between the Prime Optical client host and the Prime Optical server host.
All CTC ports, for CTC cross-launch	Inbound on the NE that CTC is connected to	TCP	—	Used for the connection between the Prime Optical client host and the subnetwork that contains the NE that CTC is trying to reach.

Prime Optical Client Requirements

To launch the Prime Optical client, you must have a Linux or Windows PC. Memory, CPU, and disk requirements are reported in [Table 2-22](#).

The delta RAM and delta CPU must be counted for each additional launched client.

Table 2-22 Minimum Requirements for the Prime Optical Client

Platform	Delta RAM ^{1,2}	Delta CPU Speed	Disk Space Without CEC ³	Disk Space with CEC	Other ⁴
Linux workstation	512 MB	240 MHz	730 MB	760 MB	<ul style="list-style-type: none"> • RHEL 5.8, 6.5, 6.6 and 7.1 • Mozilla Firefox 17 (for RHEL 5.8, and 6.2) • Mozilla Firefox 31 (for RHEL 6.5 only)
Pentium 4 class PC	512 MB	240 MHz	630 MB	700 MB	<ul style="list-style-type: none"> • Microsoft Windows 7 (32- and 64-bit), Windows 8 with Service Pack 2, or Windows Server 2003 Enterprise Edition with Terminal Services, each with graphics support for 16-bit color or higher. • Microsoft Internet Explorer 9.0 and 10.0 with JavaScript enabled, or Google Chrome 43. • Microsoft Windows 2003 patch number KB928388 for the 2007 Daylight Saving Time.

1. If you plan to run multiple Prime Optical client sessions on a single client workstation, add 512 MB of RAM and 240 MHz CPU for each additional Prime Optical client.
2. Memory requirements are for Prime Optical client software only. For cross-launched applications such as Cisco Transport Controller (CTC) or Cisco Edge Craft (CEC), see the CTC or CEC documentation.
3. Disk space requirements are for Prime Optical and CEC client software only.
4. If you are installing Prime Optical with Prime Central, DNS must be enabled on the machine where Prime Optical is installed. If the machine cannot resolve hostnames into IP addresses through DNS, Prime Optical registration will fail.



Note

CPO Login fails to load images sometimes when User logins using Google Chrome Versions later than 43. Reloading or refreshing the page again works.

Java Runtime Engine (JRE) 1.7.0_45 or 10.7.0_51 must be installed on the client machine. If the client does not start, check that the JNLP files (Java Web Start) are associated with the correct javaws executable in the browser.

We strongly recommend that you launch the Prime Optical client on a workstation separate from the Prime Optical server. Launching the Prime Optical client and server on the same workstation consumes server resources and could degrade performance.

Table 2-23 shows the maximum number of simultaneous Prime Optical client sessions.

Table 2-23 Maximum Number of Simultaneous Prime Optical Domain Explorers connected with the server

Network Size	Max. No. of simultaneous Prime Optical Client Sessions
Small	30
Medium	60
Large	100
High end	100

Remote Application Software with the Prime Optical Client

Client launch and operation are supported by the following remote application software:

- Windows Server 2003 Enterprise Edition with Terminal Services.
- Citrix Presentation Server 4.0.

The hardware requirements for the remote application depend on the number of clients that the system must export, calculated with the following formula:

Target RAM = base RAM + (delta RAM \times number of clients)

Target CPU = base CPU + (delta CPU \times number of clients)

where:

- base RAM—Amount of RAM required by the remote application software.
- base CPU—Amount of CPU required by the remote application software.
- delta RAM—Amount of RAM required for each additional client.
- delta CPU—Amount of CPU required for each additional client.

Citrix and Windows Server 2003 Terminal Services

The following figure shows the environment for a remote Citrix Presentation Server or Windows Server 2003 Terminal Server. In this example, the GUI application server and the presentation server reside on the same workstation.

Figure 2-6 Remote Citrix or Windows Server 2003 Terminal Server Environment

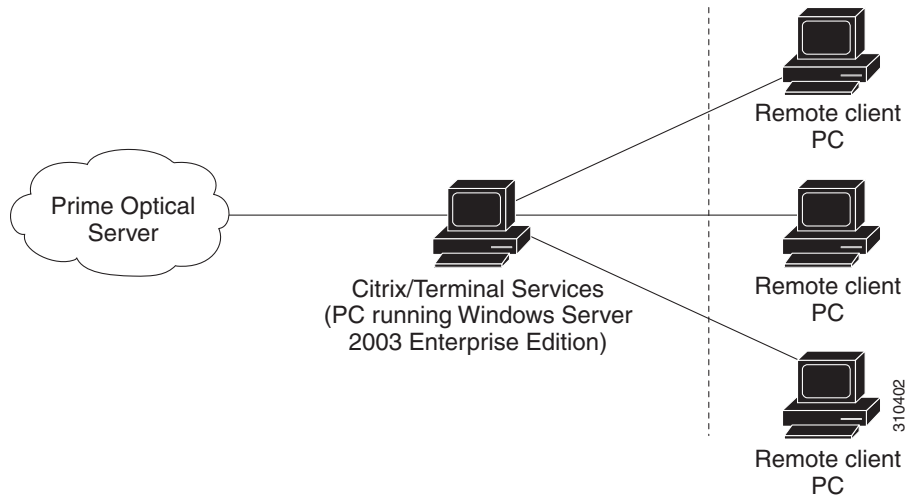


Table 2-24 Requirements for Remote Windows Server 2003 Enterprise Edition and Citrix Presentation Server

Remote Application Software	Delta RAM	Delta CPU
Windows Server 2003 Enterprise Edition with Terminal Services	512 MB	240 MHz
Citrix Presentation Server 4.0	512 MB	240 MHz

In this example, the hardware requirements for 10 clients are:

- CPU = base CPU + (240 MHz x 10)
- RAM = base RAM + (512 MB x 10)



Note

For the base RAM and base CPU requirements, refer to the documentation for:

- Windows Server 2003 Enterprise Edition with Terminal Services
- Citrix Presentation Server 4.0

Oracle Licensing for Prime Optical



Note

Prime Optical comes with an embedded database. If the database is accessed only by Prime Optical, there is no need for licensing. However, if other applications need to access the Oracle database used by Prime Optical, then the database needs to be licensed.

This section explains how to calculate the total number of Oracle Named User Plus licenses required for your Prime Optical server and client installations. This section describes with examples the Oracle Enterprise Edition database edition.

**Note**

See the Oracle website for detailed information about Oracle licensing definitions and requirements.

Oracle's technology products, including the Oracle database required for use with Prime Optical, are licensed using one of two possible metrics: Processor and Named User Plus. Which metric to use normally depends on which will result in a lower price for the database. If for some reason the number of database users cannot be counted, the Processor metric must be used. However, in a Prime Optical environment, database users normally can be counted.

- *Processor*—This metric is defined as the number of processors on the server on which the Oracle database is installed or running. This option must be used in environments in which software users cannot easily be identified or counted (not normally the case in a Prime Optical environment).

**Note**

For the purpose of counting the number of processors, a multicore chip with n cores is determined by multiplying n cores by a core processor licensing factor of 0.75. All cores on all multicore chips for each licensed program for each core processor licensing factor listed above are aggregated before multiplying by the appropriate core processor licensing factor. All fractions of a number are rounded up to the next whole number.

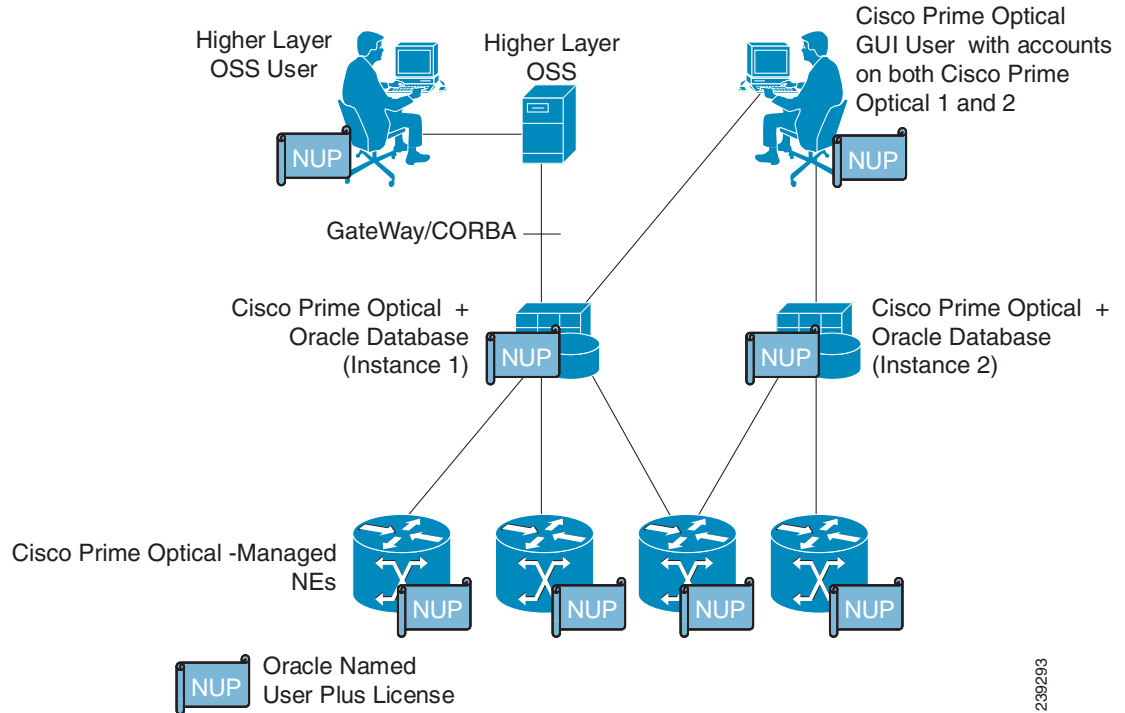
- *Named User Plus*—This metric is used in environments in which users can be identified and counted. Named User Plus includes both human-operated and automated devices. All human-operated and automated devices that access the program must be licensed. A Named User Plus license may access the program on any instances on which it is deployed, provided that the minimum license requirement on each server is met.

In the context of a Prime Optical environment, *human-operated device* means any device operated by a user who has direct or indirect access to Prime Optical. Direct access is gained through a user account on Prime Optical that allows access through the Prime Optical client GUI. Indirect access is possible through a user account on a higher-layer OSS, which in turn communicates with Prime Optical through Prime Optical GateWay/CORBA. Automated users include the NEs managed by Prime Optical and the Prime Optical server itself.

Oracle Enterprise Edition requires a minimum of 25 Named User Plus licenses per processor or the total number of actual users, whichever number is higher.

The following figure shows an example Prime Optical environment to illustrate identifying the human and automated database users that must be counted.

Figure 2-7 Example Prime Optical Environment



In the example shown in [Figure 2-7](#) there are two independent Prime Optical servers and Oracle database instances. There are four NEs, one of which is managed by both Prime Optical servers. There is one direct Prime Optical user and one indirect user. So in this example the total number of Oracle named users is as follows:

Prime Optical servers: 2*

NEs: 4**

Prime Optical users: 1**

Higher-layer OSS users: 1

Total Named User Plus: $8 = 2 + 4 + 1 + 1$

*Because of the *self-monitor feature* of Prime Optical, a Prime Optical server itself is considered an automated user of the database and is therefore counted.

**A Named User Plus license entitles the user to access Oracle on any instances where it is deployed. So if a user has access to multiple Prime Optical servers, only a single license is needed per user. Also, if an NE is managed by multiple Prime Optical servers, only a single license is needed per NE.

This example explains how to count the named users, but the number of named users required is the larger of either 1) the actual count or 2) the required minimum.

Oracle Enterprise Edition

Oracle Database Enterprise Edition (EE) provides improved scalability performance. The two major features in this release are:

- The Oracle partitioning option
- An increased maximum number of supported CPUs



Note

Oracle EE requires a separate license.

Prime Optical with Oracle EE Calculation (Example A)

A service provider has 800 NEs and a data center with 10 Prime Optical client workstations. 100 employees in the data center are authorized to use the Prime Optical client. Some of the employees in the data center share the same Prime Optical account (username/password). Prime Optical is running on a Sun V880 with 8 processors, with only one core and 32 GB of RAM.

- Named User Plus: 1) Minimum = 8 processors x 25 users/processor = 200 or 2) Count = 800 licenses for NEs + 100 licenses for data center personnel + 1 Prime Optical server = 901

Result: 901 Named User Plus licenses are required

- Processor: 8 processor licenses

If the processors are UltraSPARC IV and IV+ (dual core), the calculation for processor licensing is:

- Processor: $(8 \times 2) \times 0.75 = 12$ processor licenses

Prime Optical with Oracle EE Calculation (Example B)

The same service provider as in the previous example decides to enable Prime Optical GateWay/CORBA and connect to a higher-layer OSS that handles inventory management. There are 20 employees in the data center authorized to access the inventory system; 5 of them are also Prime Optical users (that is, they are a subset of the 100 Prime Optical users identified in the previous example). In this case, the total number of users are:

95 Prime Optical-only users + 15 inventory system-only users + 5 Prime Optical/inventory system users or 115 users.

As a result of adding the OSS and related users, the total number of named users increases from 901 to 916.

Prime Optical-Supported Third-Party Tools

See the [Cisco Prime Optical 10.5 Open Source Documentation](#) for a list of third-party components shipped with Prime Optical 10.5.