Data Management Platform (DMP) Administrator's Guide

S–2327–B

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Introduction [1]

The Cray Data Management Platform (DMP) integrates Cray XC30, or Cray XE and Cray XK systems into a customer user environment using 1U and 2U commodity rack-mounted service nodes. DMP nodes run a combination of commercial off-the-shelf Linux™ software and Cray proprietary software to replicate the Cray Linux Environment (CLE) for application development and testing. These specialized *external* login and service nodes expand the role of the Cray system *internal* login nodes and provide a development platform for shared externalized file systems, data movers, or high-availability configurations. A Cray Integrated Management Services (CIMS) node runs the commercially available Bright Cluster Manager® software (Bright). Bright software enables administrators to manage many DMP nodes using the Bright CMDaemon (`cmd`), cluster management shell (`cmsh`) or the cluster management GUI (`cmgui`).

> **Note:** External shared file systems remain accessible to Cray DMP nodes, regardless of the state of the Cray system.

An overview of the Bright software and how it is used to manage a Cray DMP system is discussed in Chapter 2, Bright Cluster Manager® on page 35.

1.1 Scope of the Manual

This document provides procedures and common administration tasks that target Cray's implementation of Bright to manage a DMP system. Cray DMP systems are designed to function as special purpose service nodes for a Cray system, and are not designed as compute clusters. Note that Cray's implementation of Bright leverages its capability to manage Cray's specialized service nodes and not a traditional compute cluster. It follows that some features of Bright (such as *cloudbursting*) are not implemented in Cray DMP systems.

Refer to the Bright Cluster Manager 6.0 Administrator Manual and Bright User Manuals that are stored on the CIMS in `/cm/shared/docs/cm`. These documents provide detailed information about the Bright software, and describe how to use the user interface (`cmgui`) and management shell (`cmsh`) to perform common administrative tasks.

1.2 Related Publications

The following documents contain additional information that may be helpful:

- *Installing Cray Integrated Management Services (CIMS) Software* (S–2522)
- *Installing Cray Development and Login (CDL) Software* (S–2520)
- *Installing Lustre File System by Cray (CLFS) Software* (S–2521)
- *Installing CLE Support Package on a Cray Development and Login (CDL) Node* (S–2528)
- *Managing System Software for the Cray Linux Environment* (S–2393), which is provided with your CLE release package
- *Managing Lustre for the Cray Linux Environment (CLE)* (S–0010), which is provided with your Cray Linux Environment (CLE) operating system release package
- Bright Cluster Manager 6.0 Administrator Manual. PDFs are stored on the CIMS in `/cm/shared/docs/cm`
- DELL™ R620, R720, R820, and R815 *Hardware Owners Guides*, available from

1.3 External Services Node Name Changes

The Cray® External Services product line has been re-branded to Cray Data Management Platform (DMP). The node names in Bright Cluster Manager® (Bright) `esms`, `esfs`, and `eslogin` will continue to be used throughout the documentation examples as long as these node names are consistent with the installation and management software. The new nomenclature is used when nodes are described in a generic sense.

Table 1. Data Management Platform Node Name Changes

Old Name	New Name	Description
esMS node	CIMS node	A Cray Integrated Management Services (CIMS) node is the centralized management node that aggregates data and manages slave node power, provisioning, reporting, health, and software images.
esLogin node	CDL node	A Cray Development and Login (CDL) node is a secure multi-user application development platform with access to the same shared file system as internal Cray login nodes.
esFS node	CLFS node	A Cray Lustre® File System (CLFS) node is a customized Lustre storage node that provides connectivity to DataDirect™ Networks (DDN) or NetApp™ storage devices. CLFS nodes are typically configured as MGS, MDS, OSS nodes.

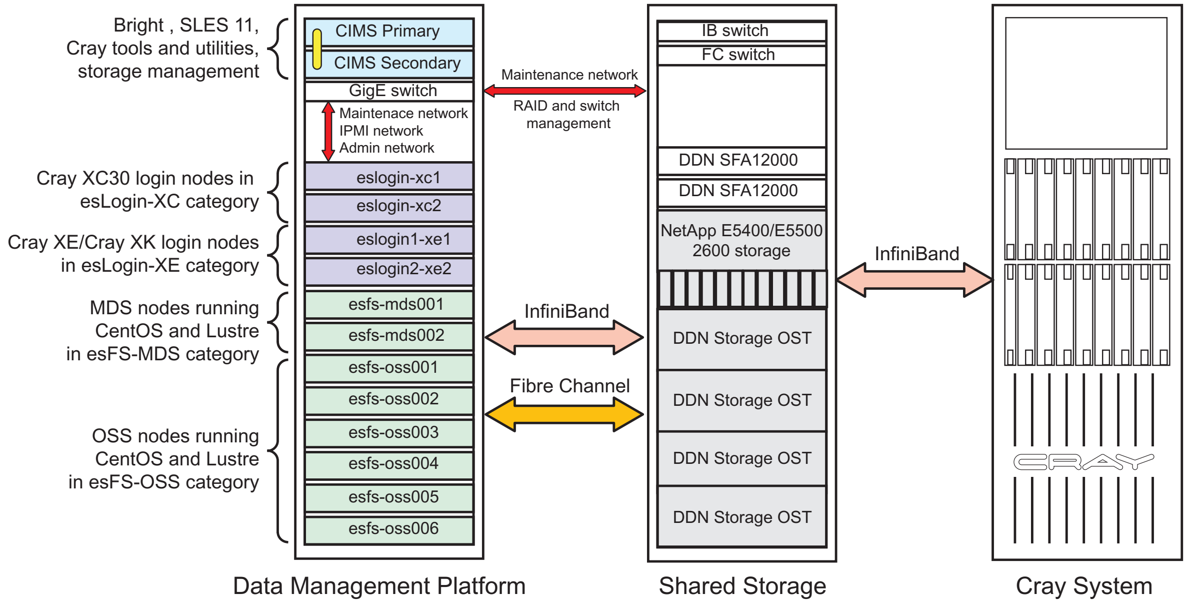
1.4 System Overview

Cray Data Management Platform (DMP) systems expand the role of Cray internal login nodes by providing a software development platform and shared storage for users. In order to expand the role of Cray system *internal* login nodes, a Cray DMP system must provide a software login and development platform for two distinct software environments (Cray XE and Cray XC30 systems), provide high-performance shared file systems that are accessible to both the Cray DMP system and Cray system. It follows, that to simulate the software development environment for both Cray XE and Cray XC30 systems, two DMP Cray Development and Login (CDL) node types must exist: one for Cray XE series systems and one for Cray XC30 series systems. The Cray Linux Environment (CLE) and Cray Developer Toolkit software for either a Cray XE or Cray XC30 system is installed on the CDL nodes, along with other commands and utilities to emulate the software development environment that exists on a Cray internal login node.

DMP systems support Cray Lustre® file system (CLFS) nodes that are configured to support a shared Lustre file system for the Cray system and each CDL node. This file system remains available to developers on the DMP system regardless of the operational state of the Cray system.

Cray DMP systems use Bright software on a Cray Integrated Management Services (CIMS) node to manage all of the nodes, software images, and networks in the system. Two CIMS nodes can be configured for high-availability (HA) configurations. Bright enables a system administrator to create custom categories and groups for system objects such as nodes, networks, software images, and other system entities, and manage them all from a single location. Using the Bright GUI (`cmgui`) or Bright command-line shell (`cmsh`), you can manage a very large system with many different node types, software images, networks, and hardware configurations from a single interface.

Figure 1. DMP System Hardware Overview



1.5 Software Components

Each node type is supported by a separate software release that includes an operating system and custom Cray software to support its role in the DMP system.

- Cray CIMS software (ESM), SLES, Bright Cluster Manager® software (Bright)
- Cray CDL software (ESL) and SLES
- Cray CLFS software (ESF) and Community Enterprise Operating System (CentOS)™
- Cray CDE and CADE

1.5.1 Determining the Current Software Releases

The current ESM, ESF, or ESL software release installed is stored in `/etc/opt/cray/release/`. For example, the contents of `/etc/opt/cray/release/ESMrelease` file would contain `ESM-XX-2.1.0-201310100612`. Refer to Distribution Media on page 20 for a description of the release naming nomenclature.

1.5.2 Bright Cluster Manager Software Overview

The Bright Cluster Manager® software (Bright) manages the hardware and software for every device or node in system as well as other objects such as node categories and networks. Bright is discussed in detail in Chapter 2, Bright Cluster Manager® on page 35.

1.5.3 Cray Integrated Management Services (CIMS) Software Overview

Cray ESM software (ESM) includes SUSE Linux Enterprise Server 11 Service Pack 2 (SLES 11, SP2) and Bright 6.0. ESM software releases also include Cray tools and utilities, distributed replicated block device (DRBD), and parallel distributed shell (PDsh) software. Bright software is discussed in detail in Chapter 2, Bright Cluster Manager® on page 35. Refer to DMP Tools and Utilities on page 22 for a description of Cray DMP tools and utilities.

1.5.4 CDL Software Overview

The Cray Development and Login (CDL) software (ESL) supports the development environment for both Cray XE and Cray XC30 systems. The Cray `eswrap` utility enables users on CDL nodes to run a subset of Cray internal login node commands. Refer to `eswrap` on page 22 for more information about the `eswrap` command.

1.5.4.1 Cray XE and Cray XK CDL Software

Cray XE and Cray XK software releases provide SLES 11, SP1 as a base operating system and Lustre client software to support Lustre file systems. OpenFabrics Enterprise Distribution (OFED) is passed through directly from Novell. Cray Linux Environment (CLE) 4.x support package and the Cray Application Developer Environment (CADE) are installed to support the Cray XE and Cray XK software development environment. Cray XE and Cray XK ESL releases are tied to specific CLE releases.

1.5.4.2 Cray XC30 CDL Software

The Cray XC30 ESL software release provides SLES 11, SP2 as a base operating system. Lustre client software is installed to support Lustre file systems. OFED is built by Cray from CLE and OFED. The Cray Linux Environment (CLE) 5.x support package and the Cray Developer Toolkit (CDT) software is installed to support the Cray XC30 software development environment. Cray XC30 ESL releases are tied to specific Cray CLE releases.

1.5.5 Cray Lustre File System (CLFS) Software

The Cray ESF software release includes Community Enterprise Operating System (CentOS) 6 and Lustre software obtained directly from Wamcloud. Cray builds the Linux kernel and OFED package.

1.5.6 CLE, CDT, and CADE

The Cray Linux Environment (CLE) is installed on CDL nodes for user application development and testing.

Cray Developer Toolkit (CDT) supports Cray XC30 systems, and the Cray Application Developer Environment (CADE) supports Cray XE and Cray XK systems. This software is installed from the Cray Linux Environment (CLE) Support Package software distribution.

> **Note:** All of the Lustre software components for a DMP system are currently provided with the CLE software.

Refer to *Installing CLE Support Package on a Cray Development and Login (CDL) Node* for more information about the CLE4.x and CLE5.x releases for managed or unmanaged CDL nodes.

1.5.7 Installing DMP Software

All Cray DMP software is installed from Cray DVD media or ISO file images. Software installation procedures are documented for each type of DMP node. Refer to the installation documentation listed in Related Publications on page 15.

1.5.7.1 Distribution Media

The following release media is available for DMP system nodes:

ESM Release Media (CIMS Nodes)

- The Bright release media contains the Bright software and the SLES 11, SP2 operating system for the CIMS node. This item is available as the ISO `bright6.0-sles11sp2.iso`.

  > **Note:** An initial installation requires both the ISO and the bootable DVD created from this ISO. The DVD is used to boot the CIMS and install the Bright software during an initial installation.

- The Cray ESM release media also contains SLES security updates and CIMS software and tools. This item is available as an ISO such as `ESM-XX-`*N.N.N*`-`*DatestampVer*`.iso`.

  > **Note:** Cray uses the following convention for ISO file names:
  >
  > *PROD*-*ARCH*-*N.N.N*-*DatestampVer*`.iso`

PROD	Product name, such as `ESM`
ARCH	Supported architecture: `XX` for all architectures, `XC` for Cray XC30 systems, and `XE` for Cray XE and XK systems
N.N.N	Release number, such as `2.1.0` for ESM XX-2.1.0
Datestamp	Unique date stamp in the ISO name, in the format *YYYYMMDDHHmm* (such as `201309042055`)
Ver	Installer version, such as `a12`

ESL Release Media

- The Cray ESL release media contains the CDL node software and tools for either the Cray XE, Cray XK, or Cray XC30 systems.

  For ESL XC-*N.N.N*, this item is available as the ISO such as `ESL XC-1.3.0-`*DatestampVer*`.iso`

  For ESL XE-*N.N.N*, this item is available as the ISO such as `ESL XE-2.1.0-`*DatestampVer*`.iso`

- Also on the ESL release media is the SUSE Linux Enterprise Server operating system for either the Intel® or AMD® platforms.

  For ESL XC-*N.N.N* software releases (Intel platform), this item is available as an ISO such as : `SLES-11-SP2-DVD-x86_64-GM-DVD1.iso`

  For ESL XE-*N.N.N* software releases (AMD platform), this item is available as an ISO such as : `SLES-11-SP1-DVD-x86_64-GMC3-DVD1.iso`

- CLE release media, which contains the CLE Support Package required for the Cray developer environment:

- SUSE Linux Enterprise Software Development Kit (SDK)

  For ESL XC-*N.N.N*, this item is available as the ISO: `SLE-11-SP2-SDK-DVD-x86_64-GM-DVD1.iso`

  For ESL-XE-*N.N.N*, this item is available as the ISO: `SLE-11-SP1-SDK-DVD-x86_64-GMC3-DVD1.iso`

- The Cray Developer Toolkit (CDT) or Cray Application Developer Environment (CADE):

  – For ESL XC-*N.N.N*, use the Cray Developer Toolkit (CDT) release media.

  – For ESL XE-*N.N.N*, use the Cray Application Developer's Environment (CADE) release media.

ESF Release Media (CLFS Nodes)

- The Cray ESF software release media contains CLFS software and CentOS 6.4.

  For ESF XX-*N.N.N*, this item is available as an ISO such as `ESF-XX-2.1.0-`*DatestampVer*`.iso`

1.5.8 DMP Tools and Utilities

Refer to the UNIX® man pages for each of the utilities in this section for command line options.

1.5.8.1 esdumpsys

The esdumpsys command performs a dump of the specified CLFS and/or CDL in a Cray DMP system.

esdumpsys can optionally generates a system memory dump if kdump is configured on the specified system(s). Refer to Configuring Kdump on CDL Nodes (SLES) on page 148 to configure kdump for SLES. Refer to Configuring Kdump on CentOS™ (Optional) on page 181 to configure kdump for CentOS. If kdump is not configured, the nodes will crash and reboot, but no memory dump will be generated. Information prints to the console in either case.

The esdumpsys command uses ssh and scp to gather information from the specified systems. Password-less ssh is used to connect to the specified systems.

1.5.8.2 ESMupdateimage

The ESMupdateimage command updates slave node images from the ESM media. Whenever you update your ESM software, and not your slave nodes, always run ESMupdateimage to update slave node RPMs.

Refer to the man page or Updating Slave Node RPMs from ESM Media on page 59 for more information about the ESMupdateimage command.

1.5.8.3 eswrap

The eswrap utility is a wrapper that lets users access a subset of Cray Linux Environment (CLE) and Programming Environment (PE) commands from a CDL node. eswrap uses Secure Shell (ssh) to launch the wrapped command on the Cray system, then displays the output on the CDL node so that it appears to the user that the wrapped command is actually running on a Cray internal login node.

The CDL installation process creates a symbolic link for each wrapped command in the directory /opt/cray/eslogin/eswrap/default/bin. Each symbolic link points to the eswrap command, so that running a wrapped command (such as apstat) actually runs eswrap with the wrapped command as an argument. eswrap uses ssh to run the command on the specified node of the Cray system (by default, the internal login node with the host name login, unless the $ESWRAP_LOGIN environment variable specifies a different node). Refer to the man page for eswrap on the CDL for more information.

1.5.8.4 cray-esfs-catman

The cray-esfs-catman utility is a script that helps change the Bright category settings for multiple CLFS nodes at the same time. cray-esfs-catman creates and runs the necessary Bright cmsh commands to change a category setting for either metadata server (MDS) or object storage server (OSS) nodes in the specified Lustre file system.

1.5.8.5 esfsmon_failback

The esfsmon_failback command returns a failed CLFS node to operational status. When a CLFS node has been failed over to its backup node, the failed node is automatically powered down and placed into a failed node category. After the failed CLFS node has been repaired, the administrator must use esfsmon_failback to return the node to service. Refer to the esfsmon_failback man page on the CIMS for more information.

Note: You must be root user to run the esfsmon_failback command. Refer to Configuring CLFS Failover (esfsmon) on page 165 for more information.

1.5.8.6 update_excludelist

The update_excludelist script changes a Bright exclude list for all slave nodes in the specified category or categories. An exclude list controls which files in a slave image are retained or excluded during image synchronization, such as when a slave node is rebooted. update_excludelist composes and issues the necessary cmsh commands to change all nodes in a category at the same time. Refer to the man page on the CIMS for more information.

1.6 DMP Networks Overview

Cray DMP software uses *internal* and *external* designations to classify networks. The esmain-net, ipmi-net, for example are internal networks accessible only to the CIMS. External networks in a DMP system are site-user-net, and site-admin-net, which enable users from outside the system to gain access.

Refer to Network Settings on page 91 for common network configuration tasks.

Figure 2 shows an overview of the hardware components and networks used in a Cray DMP system. The list below describes the primary networks used in a DMP system. The Bright software provides built-in classifications for the various networks in a system, and a Cray DMP system uses primarily the internal, external, and management classifications. There are other network classifications within Bright, such as cloud and global, but these are not used. There may be additional networks defined, depending on the requirements of the system.

`esmaint-net`

An internal management network that connects the CIMS server with the slave nodes, switches, and RAID controllers. This network enables Bright to manage and provision the slave nodes and other devices in the DMP system. When using the Bright GUI (`cmgui`) or Cluster Management Shell (`cmsh`) this network is classified as the internal management network.

`ipmi-net` Internal Intelligent Platform Management Interface (IPMI) or DELL™ Remote Access Controller (DRAC) network that provides remote console and power management of the slave nodes from the CIMS.

`site-admin-net`

External administration network used by site administrators to log in to the CIMS server (typically on the same network as the Cray SMW). The name and IP address of this network are customized during installation.

Note: The CIMS IPMI interface (DRAC) may also be on this network to provide remote console and power management of the CIMS server.

`site-user-net`

External user (site) network used by the slave nodes. On CDL nodes, this network provides user access and authentication services such as LDAP. On CLFS MDS nodes, this network connects to the site LDAP for file ownership authentication. The name and IP address of this network are customized during installation.

Note: Connections to additional site-specific networks are optional.

`wlm-net` External user (site) network used by CDL nodes to access Cray SDB node or Cray internal login nodes.

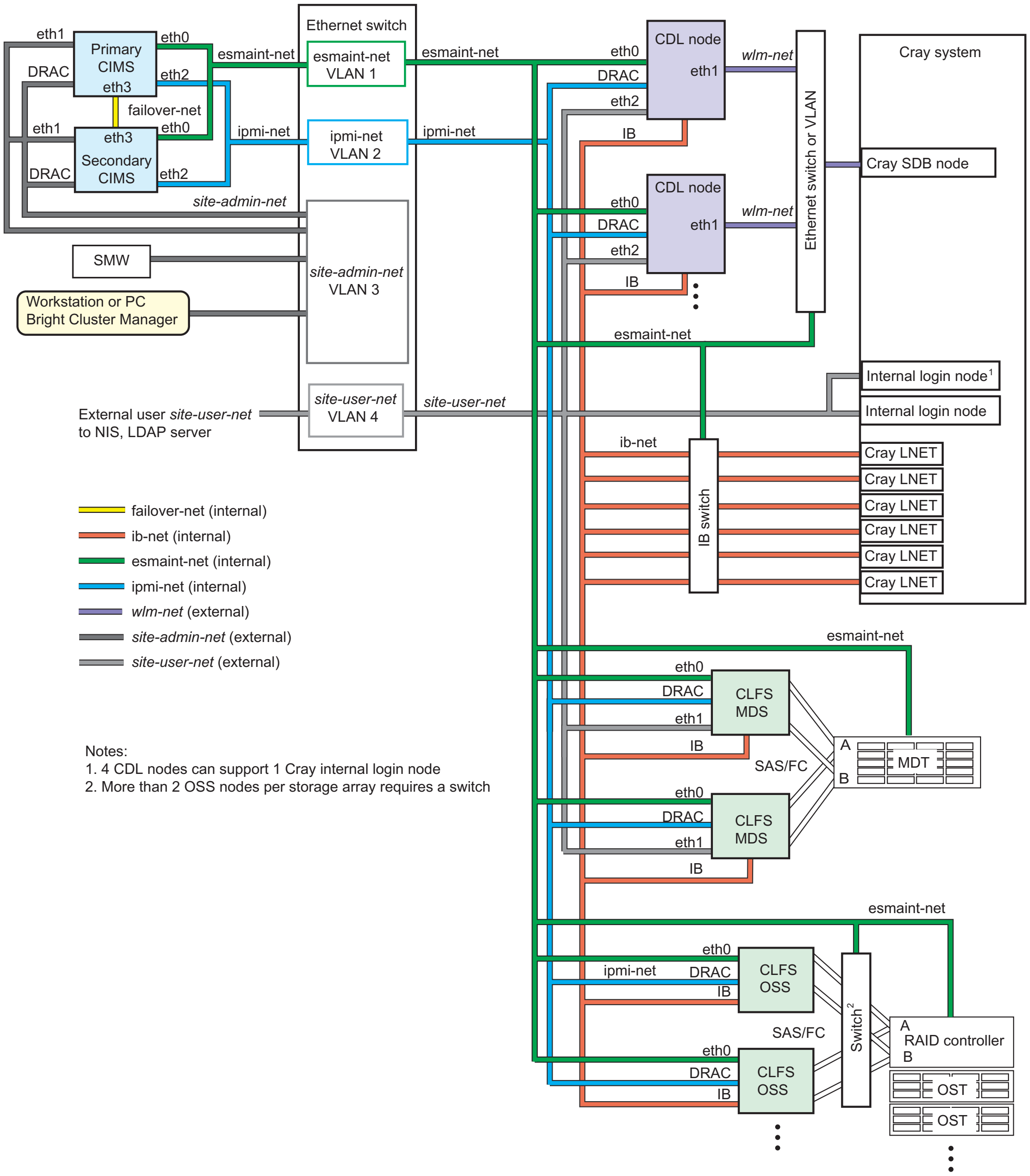
`ib-net` Internal InfiniBand® network used by the slave nodes for Lustre LNET traffic.

`failover-net`

Internal failover network used between two CIMS servers in an HA configuration for heartbeats between the active/passive CIMS nodes. This network does not connect to a managed switch.

Note: Depending on system configuration, additional networks may be required.

Figure 2. DMP Hardware and Networks Overview



1.6.1 CIMS Network Configuration

The CIMS node requires the network interfaces shown in Figure 3 and listed in Table 2. Depending on the system-specific network configuration, additional interfaces may be required. The `esmaint-net` (`eth0` interface) is a private network that connects all the managed devices in a DMP system and is defined as 10.141.*x.x*. The primary function of `esmaint-net` is to enable node provisioning and management. It may be helpful to follow the IP addressing scheme shown in Figure 3 to enable you to managed the various devices on the 10.141 network. The `ipmi-net` (`eth2` interface) is a private network enables power control and remote console for all of the slave nodes in the system. The `site-admin-net` (`eth1` interface) is the site administration network. The CIMS IPMI interface (DRAC) may also be on this network to provide remote console and power management of the CIMS node. The `failover-net` (`eth3` interface) is a private network used to direct heartbeats between CIMS nodes in an HA configuration.

Figure 3. CIMS Network Interfaces and Default Addresses

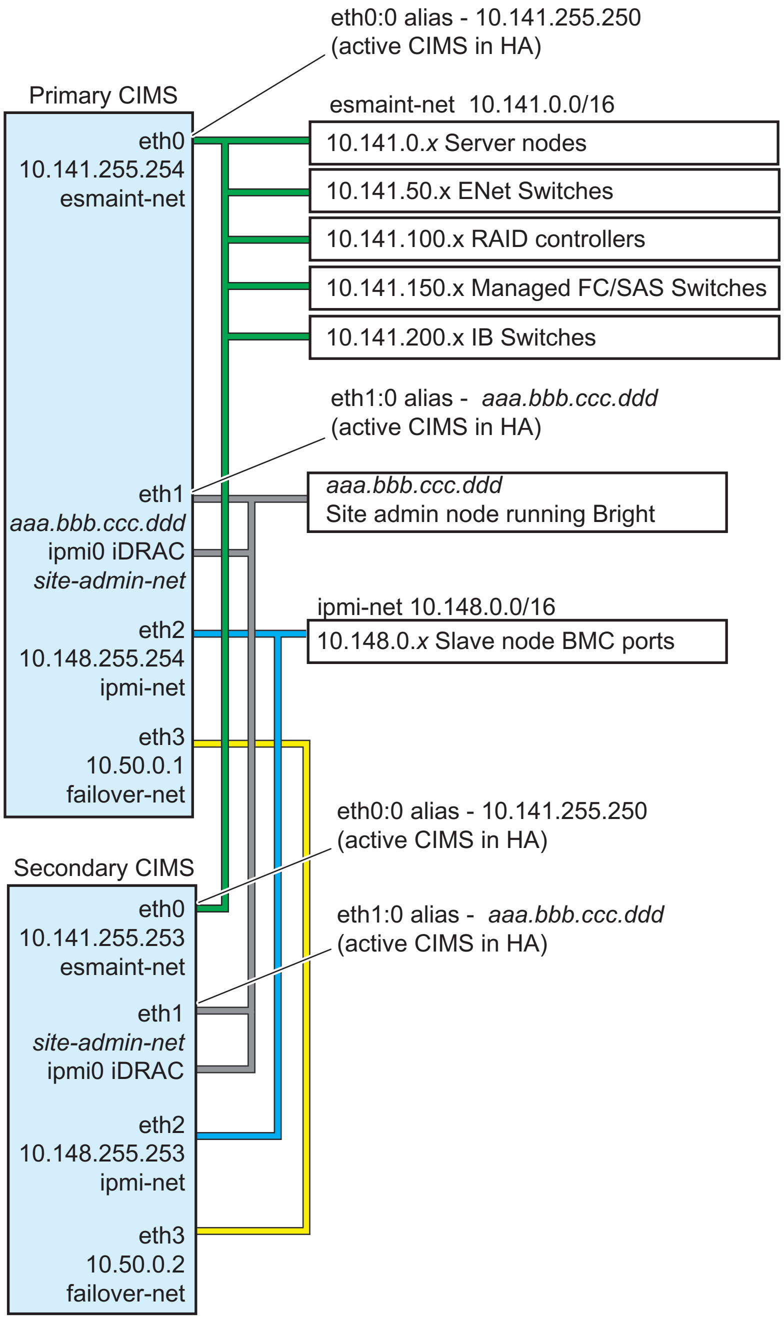


Table 2. CIMS Network Interfaces

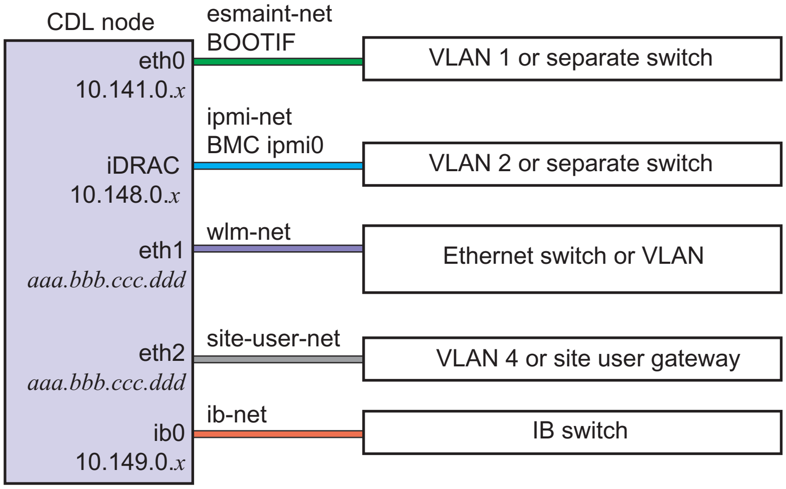
Interface	Network	Description
`eth0`	`esmaint-net`	Interface to the internal management network for maintenance and provisioning. The IP address for this network is set to 10.141.0.0/16. Other items on this network have the following IP addresses: 10.141.0.*x* Server node addresses. 10.141.50.*x* Managed Ethernet switch addresses. **Note:** The switch management IP assignments start at 10.141.50.1. 10.141.100.*x* Storage array controller addresses. 10.141.150.*x* Fibre Channel (FC) or serial attached SCSI (SAS) switches. 10.141.200.*x* InfiniBand® (IB) switches. On a system with two CIMS nodes in an HA configuration, the following IP addresses are used for `eth0`: 10.141.255.254 Primary CIMS 10.141.255.253 Secondary CIMS 10.141.255.250 `eth0:0` on both CIMS servers in HA configuration.
`eth1`	`site-admin-net`	Interface to the administration network for the CIMS node (typically on the same network that the SMW is on). In an HA configuration, the alias `eth1:0` is configured to connect to the active CIMS node.
`eth2`	`ipmi-net`	Interface to the remote console and power management network. Its IP address is set to 10.148.0.0/16.

Interface	Network	Description
		10.148.255.254 Primary CIMS 10.148.255.253 Secondary CIMS
`eth3`	`failover-net`	Interface to the internal failover network for CIMS nodes in an HA configuration. The following IP addresses are assigned: 10.50.0.1 Primary CIMS 10.50.0.2 secondary CIMS
`ipmi0` (DRAC port)	`site-admin-net`	Remote console and power management of the CIMS (typically on the same network that the SMW is on).

1.6.2 CDL Network Configuration

Note: `BOOTIF` is a special name for the `eth0` interface. The node installer automatically translates `BOOTIF` into the name of the device (such as `eth0`), used for network booting. There can be only one interface configured as `BOOTIF`.

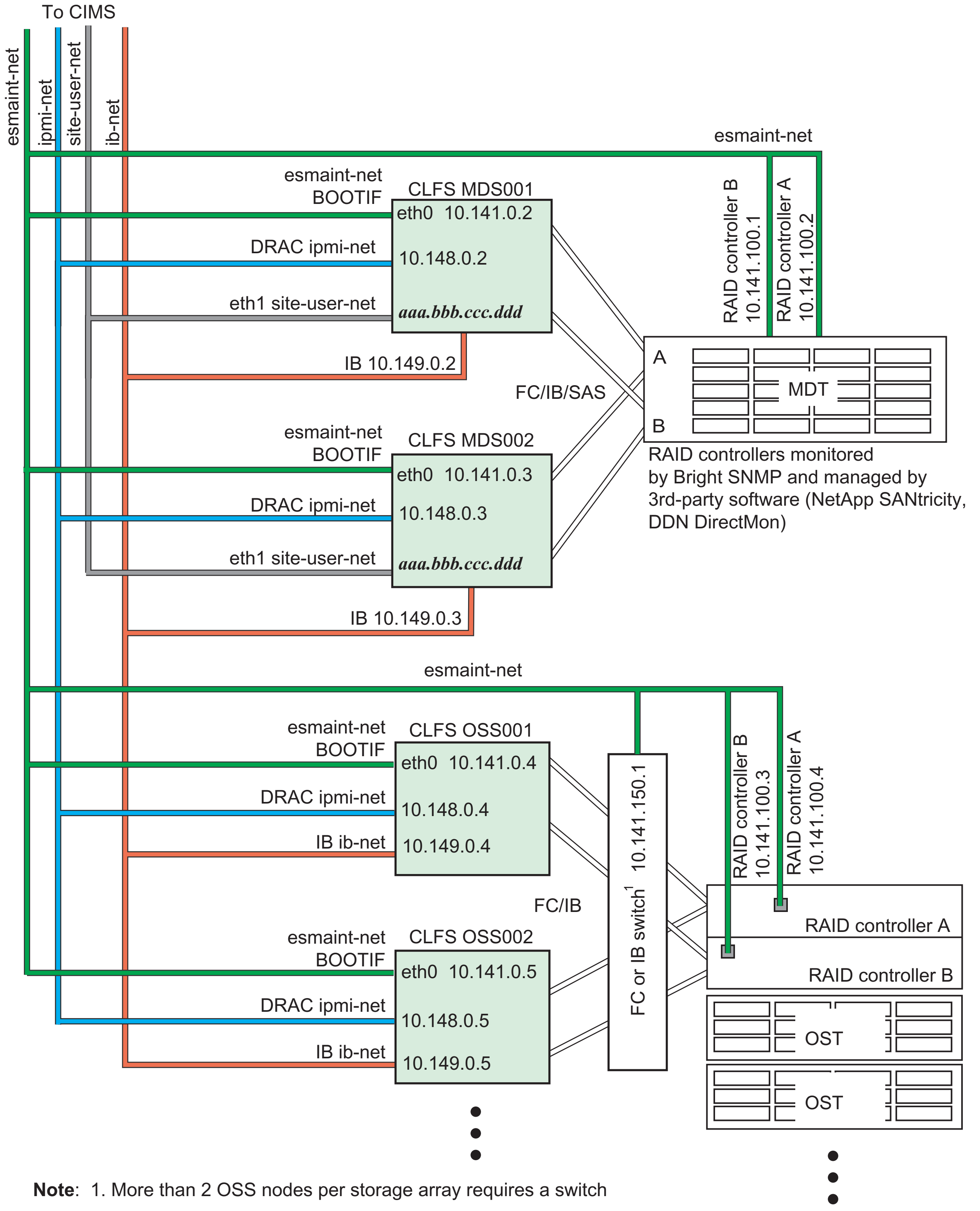
Figure 4. CDL Network Interfaces and Default Addresses



1.6.3 CLFS Network Configuration

Note: `BOOTIF` is a special name for the `eth0` interface. The node installer automatically translates `BOOTIF` into the name of the device (such as `eth0`), used for network booting. There can be only one interface configured as `BOOTIF`.

Figure 5. CLFS Network Interfaces and Default Addresses



Note: 1. More than 2 OSS nodes per storage array requires a switch

1.7 Hardware Components

A DMP system is comprised of specialized service nodes (see Figure 2), network switches, and storage arrays. These devices include, but are not limited to:

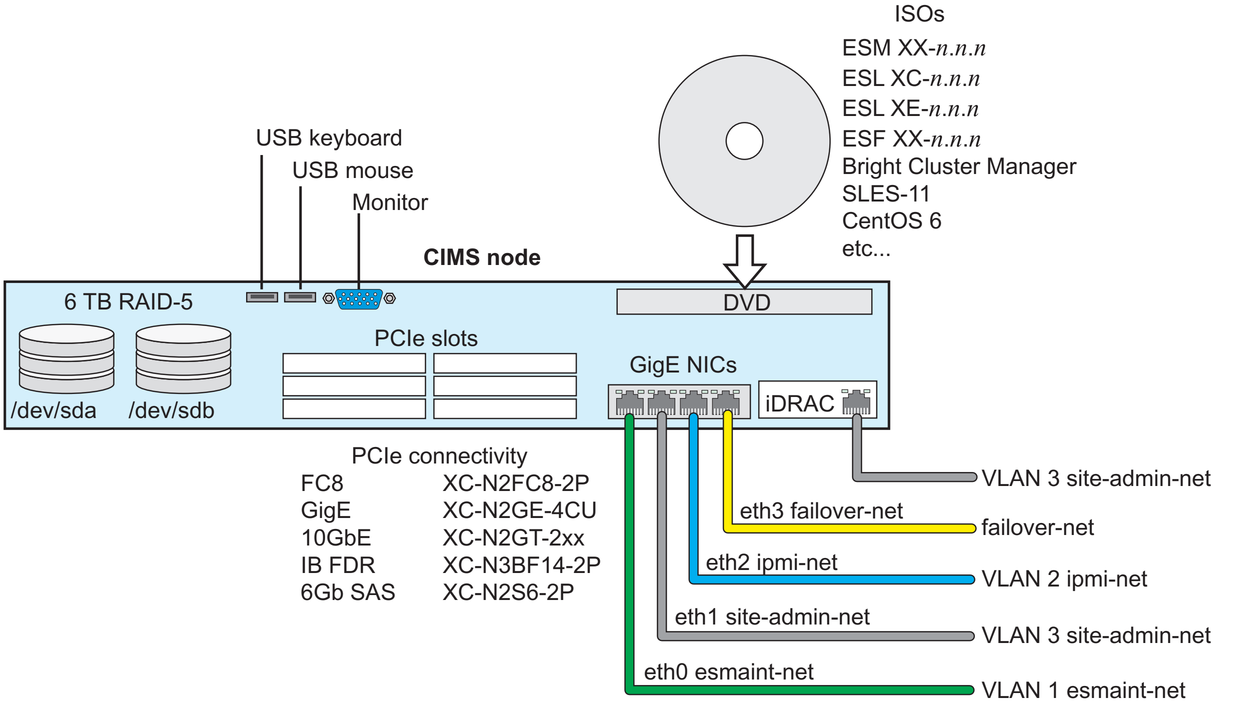
- 1U or 2U rack-mounted servers configured with the necessary hardware and software to perform a specific role in the system, such as a software development platform or file server node
- Ethernet switches to provide connectivity, maintenance access, and zones (VLANs) for each of the networks in the system
- InfiniBand® (IB) switches for high-speed network connectivity
- Fibre Channel (FC) or serial-attached SCSI (SAS) switches typically used for storage networks
- Lustre-based storage arrays
- Uninterruptible power sources or other power management equipment

1.7.1 Cray Management Server (CIMS) Hardware Overview

The CIMS runs the Bright software and provides a centralized platform to manage the system hardware and software. Nodes that are managed by the CIMS are called *slave nodes*. Figure 6 show a generic representation of a 2U CIMS node. A DVD drive provides a method for installing software from DVD release media. All of the Cray Data Management Platform (DMP) system management software, slave node software, and software updates are installed from the CIMS DVD drive.

A CIMS node is typically configured with six 1-TB disks, configured as two RAID-5 virtual disks (`/dev/sda` and `/dev/sdb`). PCIe slots can be used to add IB, FC, SAS, or GigE connectivity to the CIMS. All slaves nodes in a DMP system are managed, monitored, and provisioned by the CIMS over the `esmaint-net` network. An Intelligent Platform Management Interface (IPMI) network (`ipmi-net`) is used to control power and monitor hardware using simple network monitoring protocol (SNMP). Figure 2 shows how the CIMS is connected to other nodes in the system either through a GigE switch divided into VLANs, or via separate GigE switches.

Figure 6. CIMS Node Hardware Overview

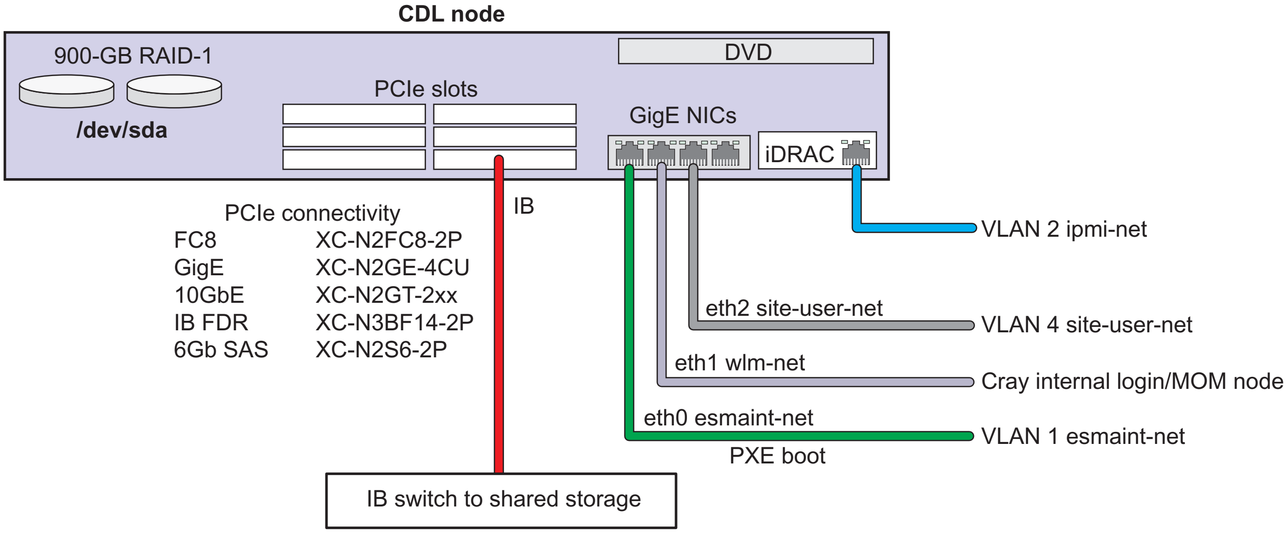


The CIMS disk partitioning is configured differently for a stand-alone CIMS or a high-availability (HA) CIMS during the initial installation procedure of the Bright and ESM software. The HA CIMS configurations make use of Distributed Replicated Block Device (DRBD) shared storage.

1.7.2 Cray Development and Login (CDL) Node Hardware Overview

User development and login (CDL) nodes provide the same programming environment as an internal login node on a Cray system. Each CDL node operates independently of the Cray system and are capable of accessing the same shared file system. The `site-user-network` provides user authentication and user access. The `esmaint-net` network enables the CDL node to use the pre-boot execution environment (PXE), or PXE boot, and together with the `ipmi-net` network, provides the means to manage and control the node.

Figure 7. CDL Node Hardware Overview



The iDRAC port (`ipmi-net`) enables remote console and power management control from the CIMS node.

There are two 900-GB disk drives in a CDL node that are configured as a RAID1.

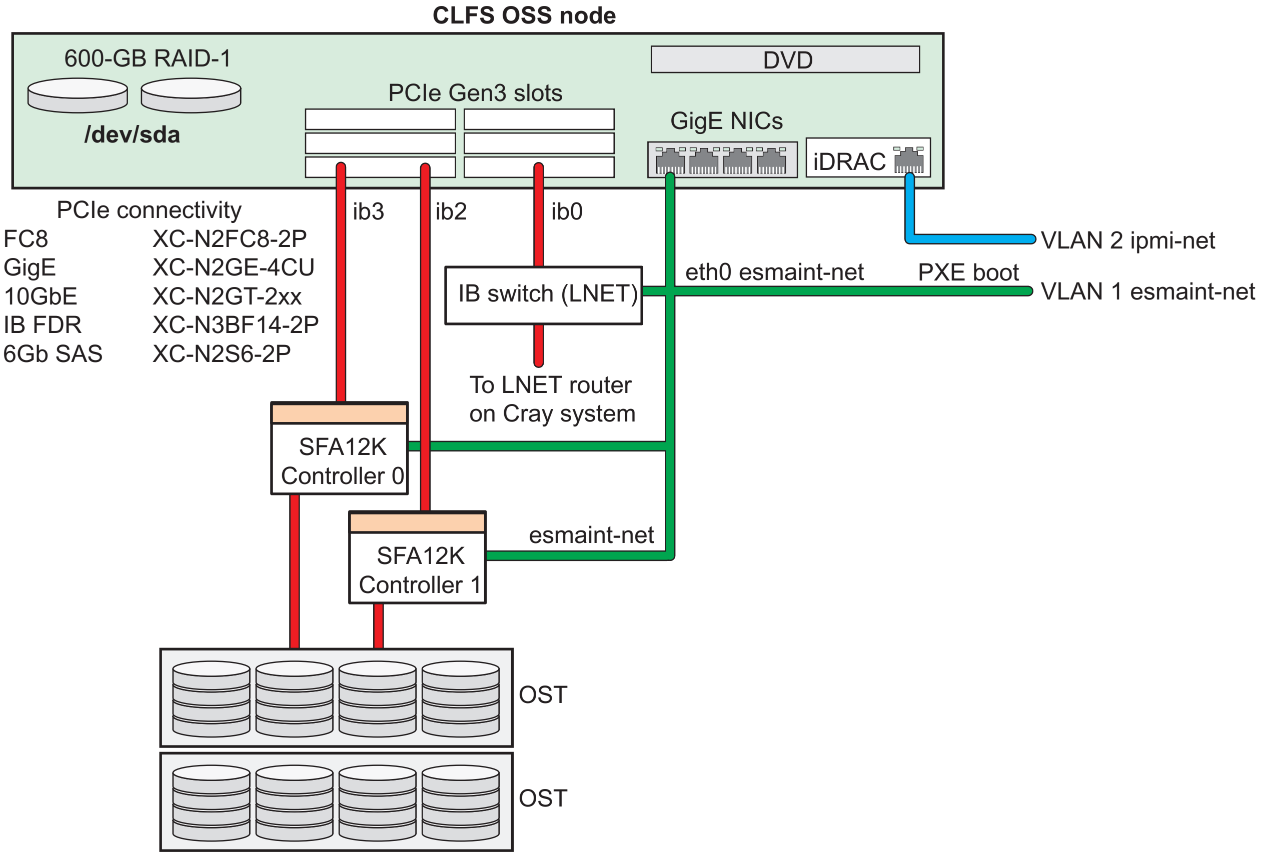
Two file systems `master:/cm/shared` and `master:/home` are NFS® mounted from the CIMS node (`master`). The `master` device can be used as an alias to designate the primary CIMS node.

1.7.3 Lustre® File Server (CLFS) Node Hardware Overview

File system nodes (CLFS) provide a high-performance Lustre shared file system that operates independently of the Cray system. A DMP file system is comprised of metadata server nodes (MDS), object storage servers (OSS) and object storage target (OST) devices from DataDirect™ Networks (DDN) or NetApp™ within an InfiniBand® interconnect. Each CLFS node file system requires its own set of servers and block storage and are always configured with full redundancy in controllers, servers, and cabling for high-availability.

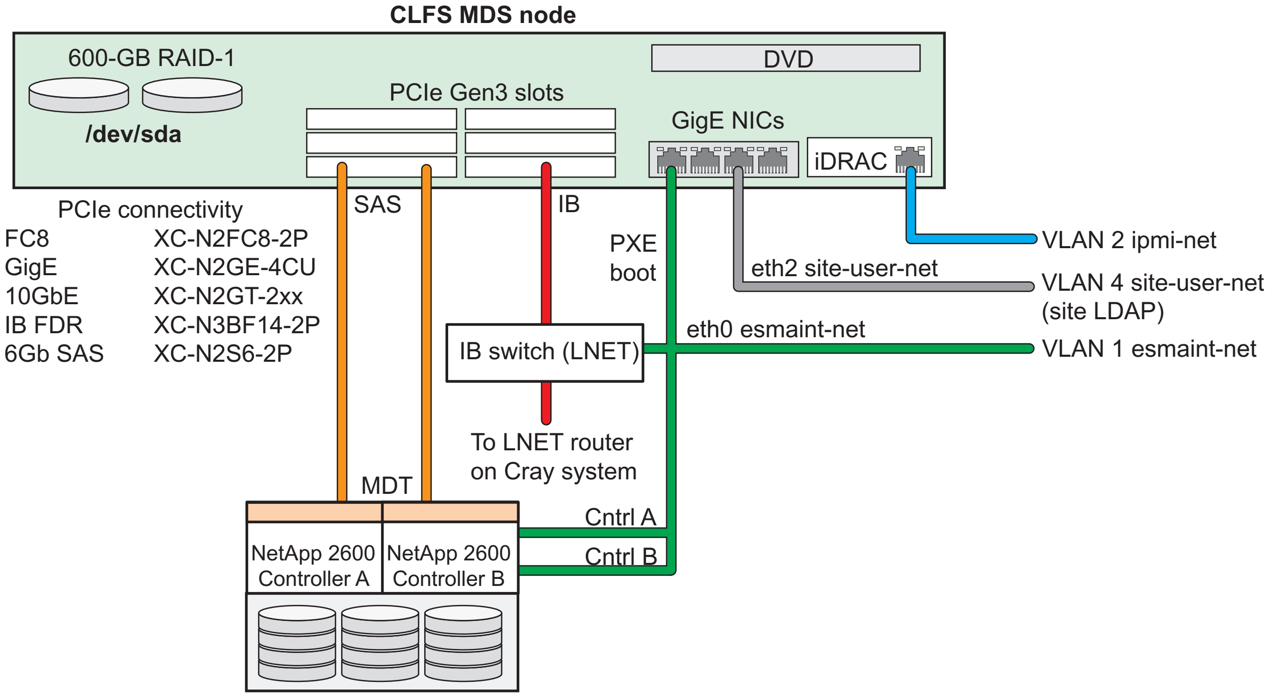
The CLFS OSS servers are typically connected to the DDN or NetApp block storage controllers.

Figure 8. CLFS OSS Node Hardware Overview



CLFS MDS servers are typically connected to the NetApp block storage controllers via InfiniBand® (IB) and are configured with a Mellanox dual-port InfiniBand (IB) host bus adapters (HBAs) installed in the CLFS node's PCIe GEN3 slot. CLFS MDS servers also connect to Cray XC30 systems through fourteen data rate (FDR) IB connection, and thus, include a Mellanox dual-port FDR IB HCA installed in a PCIe GEN3 slot.

Figure 9. CLFS MDS Hardware Overview



1.7.4 Switches and PDUs

Ethernet, InfiniBand, and Fibre Channel switches communicate with Bright using Simple Network Management Protocol (SNMP) using the device management port, which typically an Ethernet connection to `esmaint-net`.

Other devices such as power distribution units (PDUs) can also be configured and managed by Bright. The SNMP community strings should be configured to public read, and private write access. Other device configuration settings such as administrative password, host name, and IP address should be configured using the device console configuration commands.

Uplink ports (switch ports that are connected to other switches) must be configured in Bright. The CMDaemon (`cmd`) must be told about any switch ports that are uplink ports, or the traffic passing through an uplink port will lead to mistakes in what `cmd` knows about port and MAC correspondence. Uplink ports are thus ports that `cmd` is told to ignore.

Bright Cluster Manager® [2]

2.1 Managing a System with Bright

Refer to the *Bright Cluster Manager 6.0 Administrator Manual* for detailed information about Bright software management. PDF files for the Bright manuals are stored on the CIMS in `/cm/shared/docs/cm`, and linked to from the `/root` directory. This chapter provides and overview of how Cray implements Bright to manage a DMP system.

A CIMS running Bright provides a management interface that is used by:

- Cluster management shell (`cmsh`) — A command line interface to manage and control the system.
- Cluster management user interface (`cmgui`) — A graphical user interface (GUI) to manage and control the system.
- Cluster management daemon (`cmd`) — CMDaemon runs on all nodes in the DMP system.

Either the `cmgui` or `cmsh` can be used to manage the system, and you may find the certain tasks are more easily visualized using `cmgui`, and other tasks are more efficient using the `cmsh`. General information about how to use the `cmgui` are described in Bright GUI on page 49.

2.1.1 Devices and Device Names in Bright

A *device* in a DMP system represents a physical hardware component. A device can be any of the following types:

- Head nodes — Typically named `esms1`, `esms2`.
- Ethernet switches — Typically named according to their function in the cluster such as `switch-esfs1`, `switch-esmaint-net`, `switch-eslogin`.
- InfiniBand® switches — Typically named `switch-ib1-scratch`, `switch-ib2-scratch`.
- Fibre Channel switches — Typically named `fc-switch1`, `fc-switch2`.
- Slave nodes — Typically named according to their function in the cluster, such as `eslogin-xe-001` (login node), `esfs-mds001` (metadata server), `esfs-oss001` (object storage server), `esfs-ost001`, (object storage targets).

- Storage array RAID controllers — Storage controllers are added as a generic device in `cmsh` or under the **Other** resource in the `cmgui`. Typically named by manufacturer model number, rack location or purpose, `netapp5400-cntlA`, `netapp3992-cntlA`, `rack1-ddnsfa12k-cntrl0`.

2.1.2 Node Organization

Cray DMP systems along with Bright software support the concept of *node categories* and *node groups*.

Categories specify a number of parameters that are common to all members. Among these are the management network, as well as the software image and scripts that are run by the node-installer to customize each node's image during provisioning. Category parameters can be overridden on a per node basis, if desired. Slave nodes can belong to several different node groups, and there are no parameters associated with node groups. Node groups are typically used to invoke commands across several nodes simultaneously.

The Bright software configures a separate interface for each node because the IP addresses that Bright uses are specific to each node. Software images are common across multiple nodes, so the Bright interface files must reside in the Bright database and be placed on other nodes at boot time.

The node category defines which software image is provisioned to its member nodes and other management attributes.

Note: A node can belong only to one node category.

Table 3 lists Cray DMP node categories.

Table 3. DMP Slave Node Categories

Category	Description
`esLogin-XE`	Configures the software image and settings for all AMD® platform CDL nodes that run the production CDL image.
`esLogin-XC`	Configures the software image and settings for all Intel® platform CDL nodes that run the production CDL image.
`esFS-MDS`	Configures the software image and settings for all the metadata server (MDS) nodes. This category is created by `ESFinstall` and is not used under `esfsmon`.

Category	Description
`esFS-OSS`	Configures the software image and settings for all the object storage server (OSS) nodes. This category is created by `ESFinstall` and is not used under `esfsmon`.
`esfs-mds-fo-`*filesystem*	Contains the `esfsmon` secondary MDS node for the file system named by *filesystem*.
`esfs-mds-failed-`*filesystem*	Contains any `esfsmon` failed MDS node for the file system named by *filesystem*.
`esfs-oss-even-` *filesystem*	Contains the `esfsmon` even-numbered object storage server (OSS) nodes for the file system named by *filesystem*.
`esfs-oss-odd-`*filesystem*	Contains the `esfsmon` odd-numbered OSS nodes for the file system named by *filesystem*.
`esfs-oss-failed-`*filesystem*	Contains any `esfsmon` failed OSS node for the file system named by *filesystem*.

Most importantly, the node category determines which software image a node runs. Node categories also provide control over several other parameters such as:

`revision` Object revision

`bmcpassword`

Password used to send `ipmi`/`ilo` commands to nodes. The baseboard management controller (BMC or iDRAC) password is inherited from the `base` partition and typically not set for the node category.

`bmcusername`

User name used to send `ipmi`/`ilo` commands to nodes. Inherited from the `base` partition, and typically not set for the category.

`defaultgateway`

Default gateway for the category

`filesystemexports`

Configure the entries placed in `/etc/exports` `filesystemmounts`

Configure the entries placed in `/etc/fstab`

`installbootrecord`

Install boot record on local disk

`installmode`

`installmode` to be used by default, if none is specified in the node

`ipmipowerresetdelay`

Delay used for `ipmi`/`ilo` power reset, default is `0`

`managementnetwork`

Determines what network should be used for management traffic. If not set, partition setting is used.

`name` Name of category

`nameservers`

List of name servers the category will use

`newnodeinstallmode`

Default install mode for new nodes

`roles` Assign the roles the node should play

`searchdomain`

Search domains for the category

`services` Manage operating system services

`softwareimage`

Software image the category will use

`timeservers`

List of time servers the category will use

`usernodelogin`

ALWAYS or NEVER allow a user to log in to the node

`disksetup` Disk setup for nodes

`excludelistfullinstall`

Exclude list for full install

`excludelistgrab`

Exclude list for grabbing to an existing image

`excludelistgrabnew`

Exclude list for grabbing to a new image

`excludelistsyncinstall`

Exclude list for sync install

`excludelistupdate`

Exclude list for update

`finalizescript`

Finalize script to be used for category

`initializescript`

Initialize script to be used for category

`notes` Administrator notes

Node groups simplify management and control activities and enable you to perform commands on a group of nodes simultaneously. Table 4 lists typical node groups:

Table 4. Node Groups

Node Group	Description
`login`	All CDL nodes
`oss`	All OSS nodes
`esfs-`*filesystem*	All CLFS nodes for the file system named by *filesystem*

2.1.3 Software Image Management

A software image is a blueprint for the contents of the local file systems on slave nodes. Software images reside in `/cm/images` on the CIMS and contain a full Linux™ file system. When a slave node boots, the node provisioning system configures the node with a copy of its assigned software image determined by the node category. After the node has booted, it is possible to instruct the node to resynchronize its local file systems with the software image. This procedure can be used to distribute changes to the software image without rebooting nodes. It is also possible to lock a software image so that no node is able to pick up the image until the software image is unlocked. Software images can be changed using Linux tools and commands such as `rpm` and `chroot`.

> **Important:** The software images in `/cm/images` should be backed-up regularly, as they are needed in the event you would have to re-install the CIMS software and reload the system configuration. Refer to Save the System Configuration on page 126 for more information about saving the system configuration.

Software images are typically named in a way to be easily identified, beginning with ESM, ESL, or ESF. To list the software images that are installed on the CIMS, use `cmsh` to switch to `softwareimage` mode, and enter `list` to display the images.

Example 1. List Software Images

```
esms1# cmsh
[esms1]% softwareimage
[esms1->softwareimage]% list
Name (key)                 Path                                     Kernel version
-------------------------- ---------------------------------------- ---------------------------
ESF-XX-2.0.0-201302121343  /cm/images/ESF-XX-2.0.0-201302121343     2.6.32-279.14.1.el6.x86_64
ESF-XX-2.0.0-201304181540  /cm/images/ESF-XX-2.0.0-201304181530     2.6.32-279.14.1.el6.x86_64
ESL-TEST-4102013           /cm/images/ESL-TEST-4102013              3.0.38-0.5-default
ESL-XC-1.0.2-201302211318  /cm/images/ESL-XC-1.0.2-201302211318     3.0.38-0.5-default
ESL-XE-1.1.1-201211150916  /cm/images/ESL-XE-1.1.1-201211150916     2.6.32.59-0.7-default
ESL-XE-1.1.1-kdump         /cm/images/ESL-XE-1.1.1-kdump            2.6.32.59-0.7-default
ESL-XE-1.1.1_CLE4.1        /cm/images/ESL-XE-1.1.1_CLE4.1           2.6.32.59-0.7-default
default-image              /cm/images/default-image                 3.0.58-0.6.6-default
default-image.previous     /cm/images/default-image.previous
```

Note that `default-image` and `default-image.previous` are images created by the Cray installer software, `ESMinstall`. The `ESLinstall` and `ESFinstall` installers configure software images for Cray Development and Login (CDL) and Cray Lustre File System (CLFS) nodes. The Cray installer software adds the latest released software and updates to the `/cm/images` directory on the CIMS when the installation completes, and also configures the image in the Bright database. Installed images will use the naming conventions in Distribution Media on page 20.

> **Important:** The default image (named `default-image`) should never be modified. Always clone `default-image` or production image to create a new image for a node. Always keep a functioning image as a backup.

When a node boots, the node provisioning system sets up the node with a copy of the software image that is configured for the node. Software images are assigned to a `category` in Bright. Nodes are also assigned to a `category` in Bright. This enables the administrator more control over what software image is used by a node.

After you have installed and configured an image, use the Bright `clone` command to create an archive of the old image. All software images in `/cm/images` on the CIMS should be backed up routinely.

2.1.4 Node Provisioning

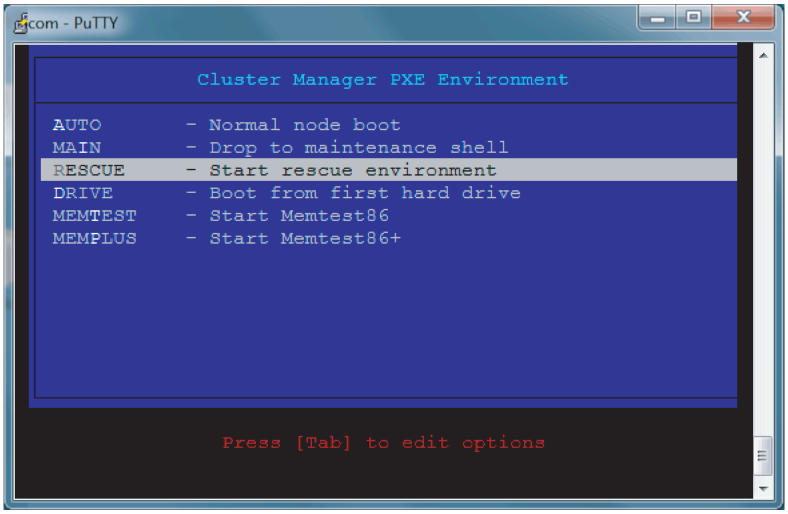
Node provisioning is the process of how nodes obtain a software image and occurs during power-up or when updating a running node.

2.1.4.1 Preboot Execution Environment (PXE) Booting

By default, slave nodes boot from the `esmaint-net` network over the `BOOTIF` interface. Bright controls this network boot or Preboot Execution Environment (PXE) boot. PXE booting is configured in the slave node BIOS setting (Refer to Appendix A, Changing BIOS for a DELL™ R720 Managed CDL Node on page 253 through Appendix C, Changing BIOS for a DELL™ R720 Managed CLFS Node on page 269. The CIMS runs a `tftpd` server process from within `xinetd`, which supplies the boot loader from within the default software image offered to nodes.

The boot loader runs on the node and displays a menu based on loading a menu module within a configuration file. The configuration file is located in the `default-image` software image in the `/cm/images/default-image/boot/pxelinux.cfg/` directory, `default` file.

Figure 10. PXE Boot Menu



```
                 Cluster Manager PXE Environment

AUTO          - Normal node boot
MAIN          - Drop to maintenance shell
RESCUE        - Start rescue environment
DRIVE         - Boot from first hard drive
MEMTEST       - Start Memtest86
MEMPLUS       - Start Memtest86+

                   Press [Tab] to edit options
```

The `MENU DEFAULT` value in the software image `/cm/images/default-image/boot/pxelinux.cfg/default` file is loaded for every node using the software image. To override its application on a per-node basis, the value of `PXE Label` can be set for each node. For example, to set a node to use the `MEMTEST` PXE label using `cmsh`:

Example 2. Set PXE label for a node

```
esms1# cmsh
[esms1]% device use eslogin001
[esms1->device[eslogin001]]% set pxelabel MEMTEST ; commit
```

To use the `MEMTEST` label for all nodes the `esLogin-XE` category use:

```
[esms1->device]% foreach -c esLogin-XE (set pxelabel MEMTEST)
[esms1->device*]% commit
```

Refer to the *Bright Cluster Manager 6.0 Administrator Manual* for more information.

2.1.4.2 Booting From the Hard Drive

In addition to PXE boot, a node can also be provisioned entirely from its local drive, just like a standalone server. Select **Install Boot Record** from the `cmgui` **Node** or **Category** resource, or set `installbootrecord` to `yes` from `cmsh category` mode.

```
esms1# cmsh
[exms1]% category use default
[esms1->category[default]]% set installbootrecord yes
[esms1->category*[default*]]% commit
```

2.1.4.3 The Boot Role

The action of providing a PXE boot image via DHCP and TFTP is known as providing *node booting*.

2.2 Bright License Management

Cray DMP systems are configured with a Bright Cluster Manager license file installed on the CIMS node. The license file includes:

- A `licensee` attribute or the name of the organization, the condition in which the specified organization may use the software; a licensed nodes attribute specifies the maximum number of nodes that the cluster manager may manage. CIMS nodes are also regarded as nodes too for this attribute.
- `licensed nodes` attribute specifies the maximum number of nodes that the cluster manager may manage. CIMS nodes are included.
- An `expiration date` for the license

A license file can only be used on the machine for which it has been generated and cannot be changed once it has been issued. The license file is the X509v3 certificate for the CIMS node and is used throughout system operations.

2.2.1 Displaying License Attributes

The license file is installed in the following location on the CIMS:

```
/cm/local/apps/cmd/etc/cert.pem
```

The associated private key file is in:

```
/cm/local/apps/cmd/etc/cert.key
```

To verify that the attributes of the license have been assigned the correct values, use the GUI to select the CIMS node, **License** tab, to display license details.

Alternatively the `cmsh main` mode `licenseinfo` command displays:

Example 3. Display license attributes in cmsh

```
esms1:~ # cmsh
[esms1]% main licenseinfo
License Information
---------------------------- ------------------------------------------
Licensee                     /C=US/ST=Wisconsin/L=Chippewa Falls/O=Cray
                              Training/OU=Training and Doc/CN=Training
Serial Number                5510
Start Time                   Tue May  1 00:00:00 2012
End Time                     Fri Feb  8 23:59:00 2013
Version                      6.0
Edition                      Advanced
Pre-paid Nodes               512
Max Pay-as-you-go Nodes      1000
Node Count                   6
MAC Address / Cloud ID       78:2B:CB:40:CE:CA
```

The license in the example above enables 512 nodes. It is tied to a specific MAC address, and the `Node Count` field in the output of `licenseinfo` shows the current number of nodes used.

2.2.2 Verifying A License

The `verify-license` utility determines whether a license is valid even when the cluster management daemon is not running.

Example 4. Verifying a License

```
esms1# /etc/init.d/cmd start
Waiting for CMDaemon to start...
CMDaemon failed to start please see log file.
esms1# tail -1 /var/log/cmdaemon
Dec 30 15:57:02 esms-1 CMDaemon: Fatal: License has expired
```

2.2.3 Installing the Bright License

The initial installation of Bright is licensed only for three nodes, including the CIMS. A permanent license must be installed before configuring the system.

- Use Procedure 1 on page 44 to install the license.
- If you have added a second CIMS in a HA configuration, contact Cray to purchase another node license for the second CIMS.
- If your existing license has expired and must reinstate your license.

Certificate Sign Request (CSR) data is displayed and saved in the file `/cm/local/apps/cmd/etc/cert.csr.new`. The `cert.csr.new` file may be used with an internet-connected browser.

After using a product key with `request-license`, reboot the system using the **`pexec reboot`** command from the CIMS. If you are relicensing an existing system, a reboot is not required.

> **Important:** If licensing a secondary CIMS for an HA configuration, get the MAC address for `eth0` of the secondary node. The MAC address for the secondary node is typically located on a label on the front panel of the node.

Procedure 1. Installing the Bright license on a CIMS

Obtain a product key from Cray which enables the administrator to obtain and activate a license. The product key looks like the following string:

XXXXXX-XXXXXX-XXXXXX-XXXXXX-XXXXXX

1. Log in to the CIMS as `root`.

```
remote% ssh root@esms1
```

2. Get the MAC address (`HWaddr`) for `eth0` (`BOOTIF`) interface.

```
esms1# /sbin/ifconfig eth0
eth0      Link encap:Ethernet  HWaddr 78:2B:CB:40:CE:CA
          inet addr:10.141.255.254  Bcast:10.141.255.255  Mask:255.255.0.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:11944661 errors:0 dropped:0 overruns:0 frame:0
          TX packets:11018308 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:2589377379 (2469.4 Mb)  TX bytes:2060383201 (1964.9 Mb)
          Interrupt:36 Memory:d6000000-d6012800
```

3. Run the `request-license` command on the CIMS.

   > **Important:** If you are configuring the primary CIMS, enter license information for the first CIMS only and do not enter the MAC address for the secondary CIMS in an HA configuration. You must run this procedure again when configuring the secondary CIMS and enter **`yes`** in step 4.c.

```
esms1# request-license
Product Key (XXXXXX-XXXXXX-XXXXXX-XXXXXX-XXXXXX):
```

   > **Note:** If the license already exists, you are prompted to re-use the private key and settings from the existing license.

4. Enter the product key, then press `Enter`.

   > **Note:** If you are licensing a secondary CIMS for an HA configuration you are prompted to re-use the private key settings from the existing license. Select **`yes`** at the following prompt and then proceed at step step 4.b.

   ```
   Re-use private key and settings from existing license? [Y/n] yes
   ```

a. Enter the Country Name 2-letter code, and other pertinent information when prompted:

```
Country Name (2 letter code): US
State or Province Name (full name): State
Locality Name (e.g. city): City
Organization Name (e.g. company): Company
Organizational Unit Name (e.g. department): ACME
Cluster Name: Training
Private key data saved to /cm/local/apps/cmd/etc/cert.key.new
```

b. Enter the MAC address of the primary CIMS for `eth0` on (`esmaint-net`). If you are licensing a secondary CIMS in an HA configuration, enter the MAC address for `eth0` for the secondary CIMS.

```
MAC Address of primary head node (esms1) for eth0  []: FF:AE:FF:B5:E2:64
MAC Address of secondary head node (esms2) for eth0 []: FF:AE:FF:B5:E2:65
```

Note: Enter **`N`** or **`No`** in step 4.c if you are configuring the primary CIMS. If you have already configured the primary CIMS, and are now configuring the secondary CIMS in an HA configuration, enter **`y`** or **`yes`** and supply the required information to obtain an HA license certificate.

c. If you are configuring the primary CIMS, enter **`no`** at the following prompt. If your are configuring an HA setup, enter **`yes`** at the following prompt.

```
Will this cluster use a high-availability setup with 2 head nodes? [y/N]: no
```

d. Answer **`no`** when you are prompted to submit the certificate request:

```
Certificate request data saved to /cm/local/apps/cmd/etc/cert.csr.new
Submit certificate request to http://support.brightcomputing.com/licensing/index.cgi
? [Y/n] no
```

The CSR (Certificate Sign Request) data is displayed and saved in the file `/cm/local/apps/cmd/etc/cert.csr.new` on the CIMS. The `cert.csr.new` file may be used to obtain a license with an Internet-connected browser:

Note: The license strings used below are fictitious.

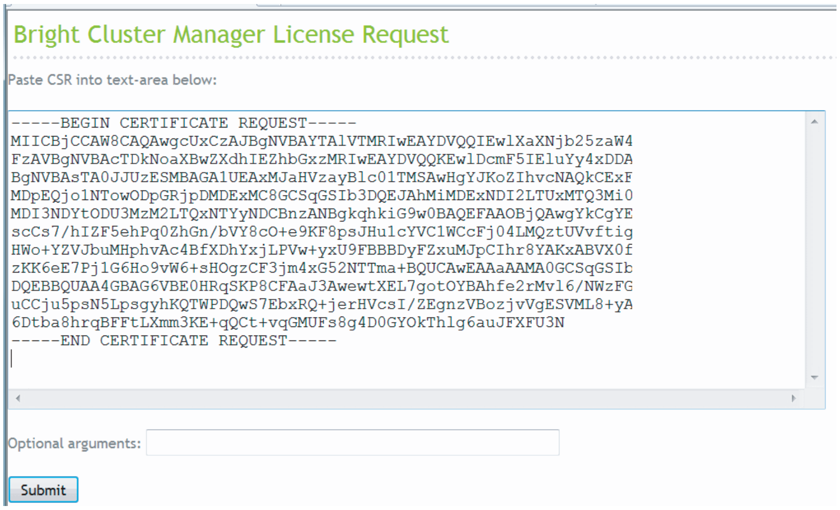
```
-----BEGIN CERTIFICATE REQUEST-----
MIICBjCCAW8CAQAwgcUxCzAJBgNVBAYTAlVTMRIwEAYDVQQIEwlXaXNjb25zaW4x
FzAVBgNVBAcTDkNoaXBwZXdhIEZhbGxzMRIwEAYDVQQKEwlDcmF5IEluYy4xDDAK
BgNVBAsTA0JJUzESMBAGA1UEAxMJaHVzayBlc01TMSAwHgYJKoZIhvcNAQkCExFF
MDpEQjo1NTowODpGRjpDMDExMC8GCSqGSIb3DQEJBhMiMDExNDI2LTUxMTQ3Mi0w
MDI3NDYtODU3MzM2LTQxNTYyNDCBnzANBgkqhkiG9w0BAQEFAAOBjQAwgYkCgYEA
scCs7/hIZF5ehPq0ZhGn/bVY8cO+e9KF8psJHu1cYVC1WCcFj04LMQztUVvftigI
HWo+YZVJbuMHphvAc4BfXDhYxjLPVw+yxU9FBBBDyFZxuMJpCIhr8YAKxABVX0fS
zKK6eE7Pj1G6Ho9vW6+sHOgzCF3jm4xG52NTTma+BQUCAwEAAaAAMA0GCSqGSIb3
DQEBBQUAA4GBAG6VBE0HRqSKP8CFAaJ3AwewtXEL7gotOYBAhfe2rMvl6/NWzFGD
uCCju5psN5LpsgyhKQTWPDQwS7EbxRQ+jerHVcsI/ZEgnzVBozjvVgESVML8+yA0
6Dtba8hrqBFFtLXmm3KE+qQCt+vqGMUFs8g4D0GYOkThlg6auJFXFU3N
-----END CERTIFICATE REQUEST-----
```

5. On a system with Internet access, use a web browser to open http://support.brightcomputing.com/licensing/.

6. Copy CSR data obtained in step 4.a to obtain a license certificate.

7. Paste the CSR data (contents of `cert.csr.new`) into the web form, then select **Submit**.

Figure 11. Bright License Request Form



Bright Cluster Manager License Request

Paste CSR into text-area below:

```
-----BEGIN CERTIFICATE REQUEST-----
MIICBjCCAW8CAQAwgcUxCzAJBgNVBAYTAlVTMRIwEAYDVQQIEwlXaXNjb25zaW4
FzAVBgNVBAcTDkNoaXBwZXdhIEZhbGxzMRIwEAYDVQQKEwlDcmF5IEluYy4xDDA
BgNVBAsTA0JJUzESMBAGA1UEAxMJaHVzayBlc01TMSAwHgYJKoZIhvcNAQkCExF
MDpEQjo1NTowODpGRjpDMDExMC8GCSqGSIb3DQEJAhMiMDExNDI2LTUxMTQ3Mi0
MDI3NDYtODU3MzM2LTQxNTYyNDCBnzANBgkqhkiG9w0BAQEFAAOBjQAwgYkCgYE
scCs7/hIZF5ehPq0ZhGn/bVY8cO+e9KF8psJHu1cYVC1WCcFj04LMQztUVvftig
HWo+YZVJbuMHphvAc4BfXDhYxjLPVw+yxU9FBBBDyFZxuMJpCIhr8YAKxABVX0f
zKK6eE7Pj1G6Ho9vW6+sHOgzCF3jm4xG52NTTma+BQUCAwEAAaAAMA0GCSqGSIb
DQEBBQUAA4GBAG6VBE0HRqSKP8CFAaJ3AwewtXEL7gotOYBAhfe2rMvl6/NWzFG
uCCju5psN5LpsgyhKQTWPDQwS7EbxRQ+jerHVcsI/ZEgnzVBozjvVgESVML8+yA
6Dtba8hrqBFFtLXmm3KE+qQCt+vqGMUFs8g4D0GYOkThlg6auJFXFU3N
-----END CERTIFICATE REQUEST-----
```

Optional arguments:

Submit

A signed license certificate is displayed (the following example is fictitious).

```
-----BEGIN CERTIFICATE-----
MIIDNzCCAh+gAwIBAgICFkwwDQYJKoZIhvcNAQEFBQAwbDELMAkGA1UEBhMCVVM
CzAJBgNVBAgTAkNBMREwDwYDVQQHEwhTYW4gSm9zZTEfMB0GA1UEChMWQnJpZ2h
IENvbXB1dGluZywgSW5jLjEcMBoGA1UEAxMTQnJpZ2h0IENvbXB1dGluZyBDQTA
Fw0xMjA5MTIwMDAwMDBaFw0zODEyMzEyMzU5MDBaMGYxCzAJBgNVBAYTAlVTMRQ
EgYDVQQIEwtNaXNzaXNzaXBwaTESMBAGA1UEBxMJVmlja3NidXJnMREwDwYDVQQ
EwhDcmF5IEluYzENMAsGA1UECxMEc3RjbzELMAkGA1UEAxMCbmEwgZ8wDQYJKoZ
hvcNAQEBBQADgY0AMIGJAoGBAN8lCM52TEnZ63yvxPvpe4WbBTPsFKUWOpIOHT8
tbctYf54E4K4A1A0ahX48OYdhafhTb7AO0gGSv/Vp+QxZQrkrSi6A8zwlNkrz4j
yDDYFNb4sBkJUbexHmEdR5Bhp/xfEx4X7EkFb5vdnhIyiwvn6Zs5tZ/Sgt+CJcH
KJFtAgMBAAGjbTBrMA8GA1UdEwEB/wQFMAMBAf8wHgYHKwYBBKFkIQQTFhE4NDo
Rjo2OTpFMzo1Qjo1ODAPBgcrBgEEoWQiBAQWAjE2MBAGBysGAQShZCMEBRYDNS4
MBUGBysGAQShZCQEChYIQWR2YW5jZWQwDQYJKoZIhvcNAQEFBQADggEBAF1pRtg
vjMr9TlihmEcO23raTLp308zkVFpW7vJ0T8KqEirwkzzrD83igtJNd2q6jtrpRL
3kxQ2sB0gGmuptHkrYecwZtVm5FhGOuPeDUG3ww4W+GyCkczCRtPkVTXul250Z9
LZqrK0zzPRKhMNEraTXPDEgHSEgEeykro30EGHpcuCoGCBJNvhi0bCIxgJoW5DV
ykGbeE4DKBlyW0r4NRqMBR+0BH2d1gCXBJtYhHMfDUWw6JOMmsCcoAY7Yhp4N9k
AJb++bi/pO2fQeDJopfxvlU2WsEEMcEItNklknaHlOYfQ3IcloH9w464MtGFakt
xGjtfqxcU
-----END CERTIFICATE-----
```

8. Copy the license text received and save it to a plain text file named *signedlicensefile* on the CIMS.

9. Enter the following command to install the license and answer each prompt.

```
esms1 # install-license signedlicensefile
========= Certificate Information ========
Version:                 6.0
Edition:                 Advanced
Common name:             na
Organization:            ACME
Organizational unit:     Training
Locality:                City
State:                   State
Country:                 US
Serial:                  3728
Starting date:           12 Sep 2012
Expiration date:         31 Dec 2038
MAC address:             84:8F:E4:E3:5B:64
Pre-paid nodes:          16
Max Pay-as-you-go Nodes: N/A
==========================================

Is the license information correct ? [Y/n] Y
Backup directory of old license:
/var/spool/cmd/backup/certificates/2013-01-28_08.56.22

In order to authenticate to the cluster using the Cluster Management GUI
(cmgui), one must hold a valid certificate and a corresponding key. The
certificate and key are stored together in a password-protected PFX (a.k.a.
PKCS#12)file.
```

Provide a password to protect the `admin.pfx` file holding the administrator certificate.

```
Please provide a password that will be used to password-protect the PFX file
holding the administrator certificate (/root/.cm/cmgui/admin.pfx).

Password:
Verify password:

Installed new license

Waiting for CMDaemon to stop: OK
Installing admin certificates

Waiting for CMDaemon to start: OK

New license was installed. In order to allow nodes to obtain a new
node certificate, all nodes must be rebooted.

Please issue the following command to reboot all nodes:
        pexec reboot
```

Note: If the license process fails, check `/var/log/cmdaemon` for failure information.

Important: Refer to Managing Bright `admin.pfx` Certificates on page 62 for important information about how to manage the Bright `admin.pfx` file holding the administrator certificate.

2.2.4 Reinstating an Expired License

Procedure 2. Reinstating an expired license

1. Log in to the CIMS as `root`.

```
# ssh root@cray-esms1
```

2. Run the `request-license` command on the CIMS.

```
cray-esms1:~ # request-license
Product Key (XXXXXX-XXXXXX-XXXXXX-XXXXXX-XXXXXX):
```

3. Enter the product key, then press `Enter` (the example is not a valid key).

```
714354-916786-132324-207440-186713
```

4. Answer each prompt to re-install the license.

```
Existing license was found:
  ...
Re-use private key and settings from existing license? [Y/n] y

Will this cluster use a high-availability setup with 2 head nodes? [y/N] n
MAC Address of primary head node for eth0 []: 78:2B:CB:40:CE:CA

Certificate request data saved to /cm/local/apps/cmd/etc/cert.csr.new
Submit certificate request to http://support.brightcomputing.com/licensing/index.cgi ? [Y/n] y

Contacting http://support.brightcomputing.com/licensing/index.cgi...

License granted.
License data was saved to /cm/local/apps/cmd/etc/cert.pem.new
Install license? [Y/n] y
========= Certificate Information ========
Version:                 6.0
Edition:                 Advanced
Common name:             Training
Organization:            ACME Training
Organizational unit:     Training and Doc
Locality:                Chippewa Falls
State:                   Wisconsin
Country:                 US
Serial:                  5846
Starting date:           01 May 2012
Expiration date:         13 Mar 2013
MAC address:             78:2B:CB:40:CE:CA
Pre-paid nodes:          512
Max Pay-as-you-go Nodes: 1000
==========================================

Is the license information correct ? [Y/n] y
Backup directory of old license: /var/spool/cmd/backup/certificates/2013-02-10_11.34.53
Is this host the cluster's head node? [Y/n] y
Installed new license

Restarting Cluster Manager Daemon to use new license: OK
```

2.2.5 Reboot After Installing License

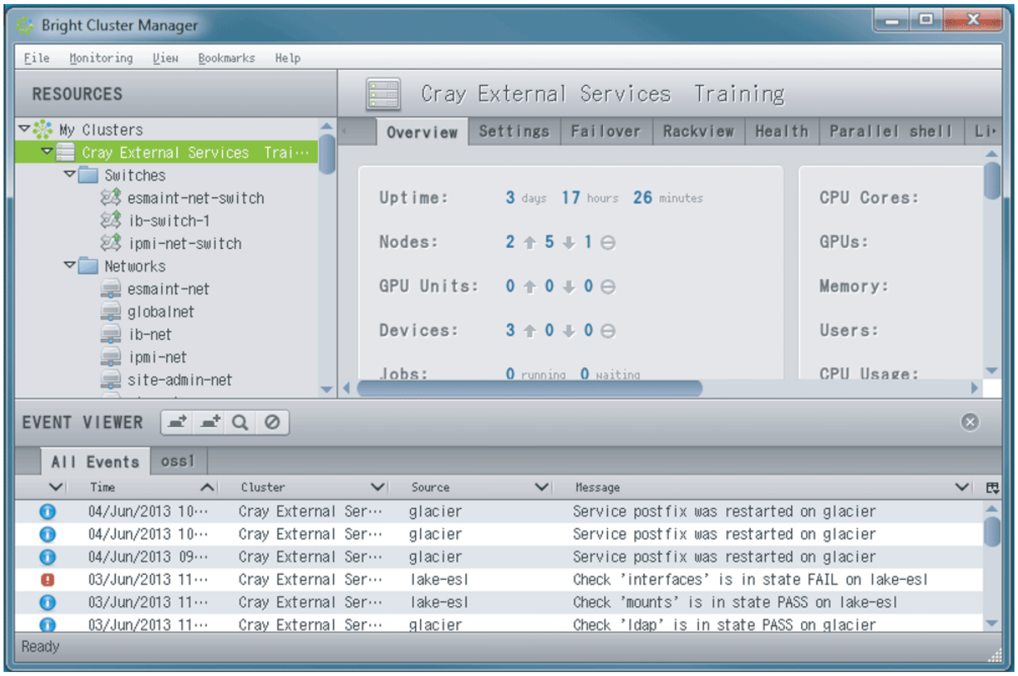
After using a product key with `request-license`, reboot the system using the **`pexec reboot`** command from the CIMS.

2.3 Bright GUI

Refer to Installing and Running cmgui on a Remote System on page 53 for procedures to install the cmgui. To connect to a system, use the procedures in Running cmgui and Connecting to a DMP System on page 54.

The Bright cmgui window provides a resource tree down the left side that lists all of the components in a system. Selecting a resource opens an associated tabbed pane on the right side of the window that allows tab-related parameters to be viewed and managed. The number of tabs displayed and their contents depend on the resource selected. When learning to use Bright software, the cmgui window may be easier to learn and understand as opposed to the shell (cmsh), conversely, the cmsh shell environment may be easier and more efficient to use for some tasks. Both user interfaces (cmsh and cmgui) provide the same administrative capabilities. Refer to the *Bright Cluster Manager 6.0 Administrator Manual*, is stored on the CIMS as a PDF file in /cm/shared/docs/cm.

Figure 12. Bright cmgui Window



Uptime: 3 days 17 hours 26 minutes

Nodes: 2 ↑ 5 ↓ 1 ⊖

GPU Units: 0 ↑ 0 ↓ 0 ⊖

Devices: 3 ↑ 0 ↓ 0 ⊖

Jobs: 0 running 0 waiting

CPU Cores:

GPUs:

Memory:

Users:

CPU Usage:

	Time	Cluster	Source	Message
ⓘ	04/Jun/2013 10···	Cray External Ser···	glacier	Service postfix was restarted on glacier
ⓘ	04/Jun/2013 10···	Cray External Ser···	glacier	Service postfix was restarted on glacier
ⓘ	04/Jun/2013 09···	Cray External Ser···	glacier	Service postfix was restarted on glacier
!	03/Jun/2013 11···	Cray External Ser···	lake-esl	Check 'interfaces' is in state FAIL on lake-esl
ⓘ	03/Jun/2013 11···	Cray External Ser···	lake-esl	Check 'mounts' is in state PASS on lake-esl
ⓘ	03/Jun/2013 11···	Cray External Ser···	glacier	Check 'ldap' is in state PASS on glacier

2.4 The Command Shell

The cluster management shell (cmsh) provides a command-line interface to the system. The cmsh and the cmgui each provide the same capability. The command-line shell (cmsh) is invoked from an interactive session (through ssh) on the CIMS node, but cmsh can also be used to manage a cluster remotely. This section introduces the cmsh and provides examples of common tasks.

Enter the following command as the `root` user to start the `cmsh` on the CIMS node:

```
esms1# cmsh
[esms1]%
```

When you run the `cmsh` from a UNIX® shell without arguments, it starts an interactive session. To return to the UNIX shell, enter the `quit` command:

```
[esms1]% quit
esms1#
```

The `cmsh` can be used in batch mode by specifying a command using the `-c` flag. Commands can be separated using semi-colons (`;`).

```
esms1# cmsh -c "main showprofile; device status eslogin01"
admin
eslogin-01 ............... [ UP ]
esms1#
```

The syntax for the `cmsh` is listed below:

```
cmsh [options] ................ Connect to localhost using default port
cmsh [options] <--certificate|-i certfile> <--key|-k keyfile> <host[:port]>
     Connect to a cluster using certificate and key in PEM format
cmsh [options] <--certificate|-i certfile>
     [-password|-p password] <uri[:port]>
     Connect to a cluster using certificate in PFX format

Valid options:
--help|-h ..................... Display this help
--noconnect|-u ................ Start unconnected
--controlflag|-z .............. ETX in non-interactive mode
--nossl|-s .................... Do not use SSL
--norc|-n ..................... Do not load cmshrc file on start-up
--command|-c <"c1; c2; ..."> .. Execute commands and exit
--file|-f <filename> .......... Execute commands in file and exit
--echo|-x ..................... Echo all commands
--quit|-q ..................... Exit immediately after error
```

Alternatively, commands can be piped to the `cmsh` from the UNIX® command line as `root` user:

```
esms1# echo device status | cmsh
eslogin01 ............... [ UP ]
mycluster ............... [ UP ]
oss001 .................. [ UP ]
oss002 .................. [ UP ]
switch01 ................ [ UP ]
esms1#
```

The cluster management functions are grouped in separate `cmsh` modes. The first thing you must do when performing a cluster management operation is switch to the appropriate mode. The `cmsh` modes are listed below:

```
disconnect .................... Disconnect from cluster
connect ....................... Connect to cluster
quit .......................... Quit shell
exit .......................... Exit from current object or mode
help .......................... Display this help
run ........................... Execute cmsh commands from specified file
alias ......................... Set aliases
unalias ....................... Unset aliases
modified ...................... List modified objects
export ........................ Display list of aliases current list formats
events ........................ Manage events
list .......................... List state for all modes
category ...................... Enter category mode
cert .......................... Enter cert mode
device ........................ Enter device mode
jobqueue ...................... Enter jobqueue mode
jobs .......................... Enter jobs mode
main .......................... Enter main mode
monitoring .................... Enter monitoring mode
network ....................... Enter network mode
nodegroup ..................... Enter nodegroup mode
partition ..................... Enter partition mode
process ....................... Enter process mode
profile ....................... Enter profile mode
session ....................... Enter session mode
softwareimage ................. Enter softwareimage mode
test .......................... Enter test mode
user .......................... Enter user mode
```

Type **`device`** at the `cmsh` prompt to enter device mode.

```
[esms1]% device
[esms1->device]% list
Type              Hostname             MAC             Ip
-------------- --------------- -------------------- ---------------
EthernetSwitch     switch01    00:00:00:00:00:00     10.142.253.1
MasterNode         mycluster   00:E0:81:34:9B:48     10.142.255.254
ossNode            oss0        00:E0:81:2E:F7:96     10.142.0.1
ossNode            oss2        00:30:48:5D:8B:C6     10.142.0.2
[esms1->device]% exit
[esms1]%
```

Most modes in `cmsh` require that you specify an object, for instance, `device` mode requires that you specify *device objects* such as `esfs-mds1`, or `ib-switch-1`, and `network` mode requires you to specify *network objects* such as `esmaint-net` or `site-user-net`. The commands that can be used for controlling objects are the same in all modes. Table 5 lists the commands that may be used to act on objects in a particular mode.

Table 5. Command Shell Object Descriptions

Command	Description
`use`	Make the specified object the current object
`add`	Create an object and make it the current object
`clone`	Clone an object and make it the current object
`remove`	Remove an object
`commit`	Commit local changes to an object to the cluster management infrastructure
`refresh`	Undo local changes to an object
`list`	List all objects
`format`	Set formatting preferences for `list` output
`show`	Display all properties of an object
`get`	Display a particular property of an object
`set`	Set a particular property of an object
`clear`	Set empty value for a particular property of an object
`append`	Append a value to a particular list-property of an object
`removefrom`	Remove a given value from a particular list-property of an object
`modified`	Lists objects with uncommitted local changes
`usedby`	Lists objects that depend on a particular object
`validate`	Perform validation-check on the properties of an object

2.4.1 Mixing `cmsh` and UNIX Shell Commands

You can execute UNIX commands while you perform cluster management. The `cmsh` enables users to execute UNIX commands by prefixing the command with a `!` character.

Example 5. Mixing `cmsh` and UNIX Commands

```
esms1# cmsh
[esms1]% !hostname -f
esms1.cm.cluster
[esms1]%
```

Executing the `!` command only starts an interactive login sub-shell. When you exit the sub-shell, you return to the `cmsh` prompt. It is also possible to use the output of UNIX shell commands as part of a `cmsh` command by using the "backtick" syntax" that is available in most UNIX shells as shown in Example 6.

Example 6. Using UNIX output in cmsh commands

```
[esms1->device]% device use `hostname`; status
cf-esms01 ........... [   UP   ]
[esms1->device]%
```

Similar to UNIX shells, `cmsh` also supports output redirection through common operators such as `>`, `>>` and `|`.

While looping over objects it may be helpful to execute a `cmsh` command for several objects simultaneously. The `foreach` can be used in several `cmsh` modes which enables you to loop over a list of objects. A `foreach` command takes a list of object names separated by spaces, and a list of commands that must be enclosed by `(` and `)` characters. The `foreach` command iterates over the specified objects and executes commands for each loop iteration. Example 7 shows an example of the `foreach` command syntax:

Example 7. Using a foreach loop to invoke commands

```
[esms1->device]%  foreach Object...Object ( Command; Command; )
[esms1->device]% foreach oss001 oss002 (get hostname; status)
oss001
oss001 ............. [ UP ]
oss002
oss002 ............. [ UP ]
[esms1->device]%
```

Refer to the *Bright Cluster Manager 6.0 Administrator Manual* for more information.

2.5 Installing and Running cmgui on a Remote System

The Linux™ or Windows® installation software for the cluster management GUI (`cmgui`) is located in `/cm/shared/apps/cmgui/dist` on the CIMS.

Procedure 3. Installing and running cmgui

Important: Whenever you update a CIMS with the latest ESM software, always re-install the `cmgui` software on the remote systems so that software updates are applied.

1. Copy the Windows `.exe` file, which is similar to this filename: (`install.cmgui.6.0.r4356.exe`). Or copy the Linux compressed TAR file (`cmgui-6.0-r4101-src.tar.bz2`) from the `/cm/shared/apps/cmgui/dist` directory on the slave node to a `tmp` directory on the remote system.

```
remote% scp root@esms1:/cm/shared/apps/cmgui/dist/* /tmp
```

2. Copy the PFX certificate file from the `root` directory of the DMP system to a secure location on the remote system so that it can be used for authentication purposes. Rename the file so that you can identify which system it authorizes (`esSystem-admin.pfx` for example).

> **Important:** Refer to Managing Bright `admin.pfx` Certificates on page 62 for important information about how to manage the Bright `admin.pfx` file holding the administrator certificate.

```
remote%  scp root@esms1:/root/admin.pfx /securelocation/esSystem-admin.pfx
```

3. Install the software.

   a. On Windows, execute the installer `.exe` file and follow the instructions.

   b. On Linux, extract the files using the `tar` command:

```
Remote%  tar -xvjf cmgui-6.0-xxxxx-src.tar.bz2
```

4. Start the `cmgui` and select the power plug icon and enter the PFX certificate password to connect to the DMP system. See Figure 14.

5. Run the executable and connect to the DMP system using the procedure in Running `cmgui` and Connecting to a DMP System on page 54.

2.6 Running `cmgui` and Connecting to a DMP System

Before making the initial connection from a desktop computer running `cmgui`, a PFX file containing both the certificate and private key must be copied from the CIMS (`/root/.cm/cmgui/admin.pfx`) on the DMP system and stored in a secure location on the remote system.

> **Important:** Refer to Managing Bright `admin.pfx` Certificates on page 62 for important information about how to manage the Bright `admin.pfx` file holding the administrator certificate.

If you need to manage more than one DMP system, rename the `admin.pfx` file on your local system appropriately. You only need to select and validate the `admin.pdx` file once.

Procedure 4. Starting the `cmgui` and connecting to the system

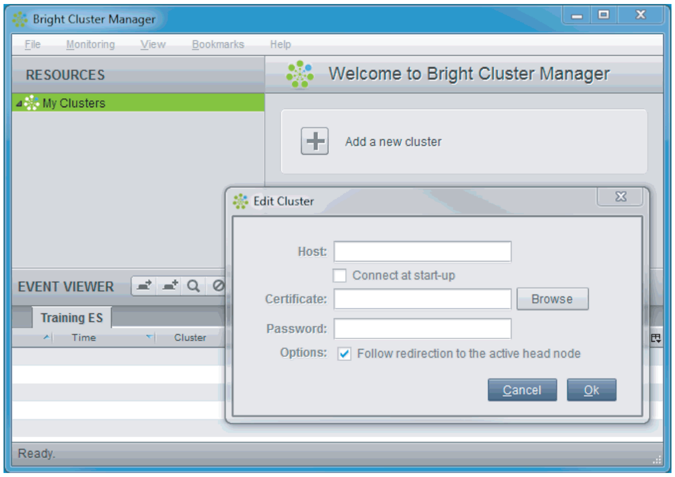
1. Copy the `admin.pfx` file to the remote computer. Rename the file to something specific, such as `cray_es_admin.pfx`.

```
remote# mkdir ~/cmgui-keys
remote# chmod 700 ~/cmgui-keys
remote# scp root@esms1:/root/.cm/cmgui/admin.pfx ~/cmgui-keys/cray_es_admin.pfx
```

2. Run the `cmgui` executable.

3. To connect `cmgui` to a DMP system, select the + button. When you run `cmgui` and add a new system, you must enter the host name of the CIMS, the location of the certificate file, and system password you configured during ESM installation and click **OK**.

Figure 13. Connecting cmgui to a DMP System



Host:

☐ Connect at start-up

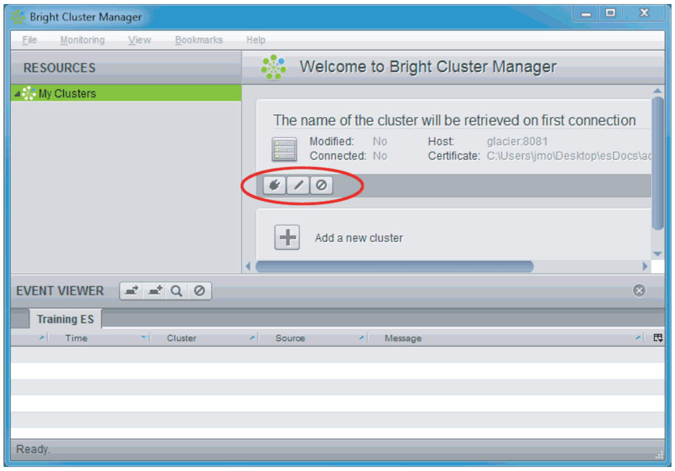
Certificate:

Password:

Options: ☑ Follow redirection to the active head node

4. The GUI window power plug icon enables you to connect to the system.

Figure 14. Connecting cmgui to a DMP System



The name of the cluster will be retrieved on first connection

Modified: No Host: glacier:8081

Connected: No Certificate: C:\Users\jmo\Desktop\esDocs\ac

2.7 Running cmgui From the CIMS

The cluster management GUI (cmgui) is used to manage the system after you have installed and licensed the Bright software. The cmgui program may be run on the CIMS node and displayed to a remote X Window System™ running on a Linux™ desktop or other platform. The cmgui program may also be installed on a Linux or Windows® platform and supports a virtual network computing (VNC®) server for remote connections.

> **Note:** Communication between the remote computer and the CIMS node should be encrypted. For Procedure 5 on page 56, we recommend using SSH port forwarding or SSH tunneling. When running the cmgui program from the remote computer, cmgui connects to the CIMS node using SSL. Cray recommends using SSH port forwarding when using VNC.

Procedure 5. Install and run cmgui from the CIMS

1. On a remote system such as a Linux desktop or PC, start an X-server application such as Xming or Cygwin/X.
2. Enter the following command to log in to the CIMS (in this example, esms1) with SSH X-forwarding.

```
remote% ssh -X root@esms1
esms1 #
```

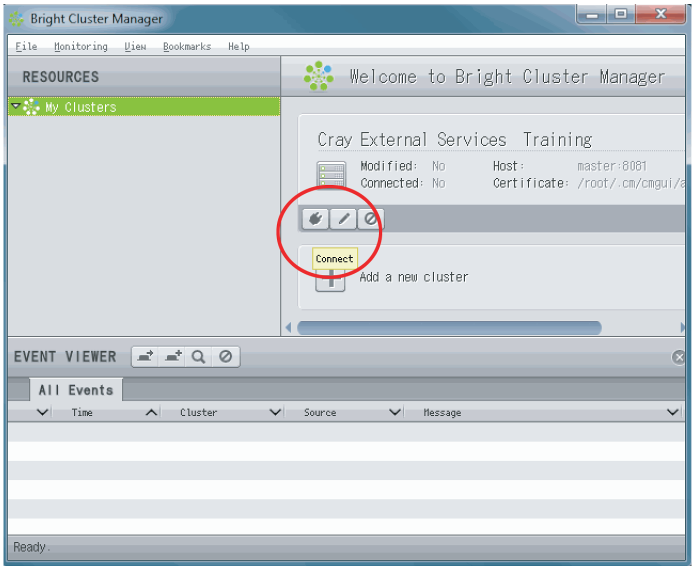
3. Start the cmgui program.

```
esms1# /cm/shared/apps/cmgui/cmgui &
```

Figure 15. cmgui Splash Screen

4. Select **Add a new cluster**.
5. Select the power plug icon and enter the system password to connect to the system.

Figure 16. cmgui Window

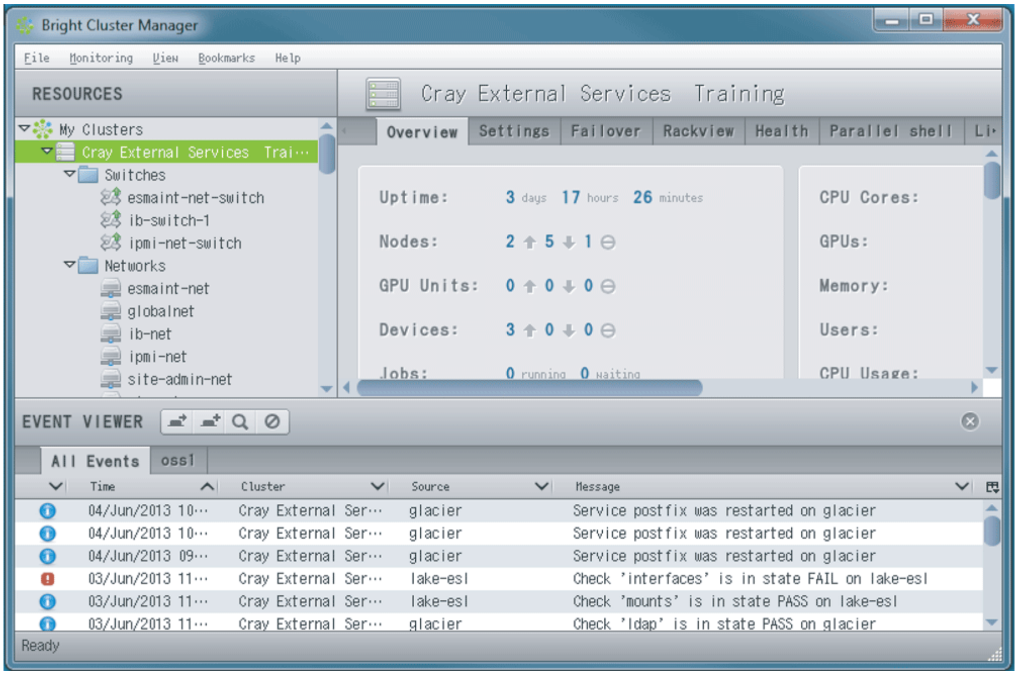


Cray External Services Training

Modified: No
Connected: No
Host: master:8081
Certificate: /root/.cm/cmgui/a

The cmgui window displays the DMP system configuration.

Figure 17. cmgui Connect-to-Cluster



Cray External Services Training

Uptime: 3 days 17 hours 26 minutes

Nodes: 2 ↑ 5 ↓ 1 ⊖

GPU Units: 0 ↑ 0 ↓ 0 ⊖

Devices: 3 ↑ 0 ↓ 0 ⊖

Jobs: 0 running 0 waiting

CPU Cores:

GPUs:

Memory:

Users:

CPU Usage:

	Time	Cluster	Source	Message
ⓘ	04/Jun/2013 10…	Cray External Ser…	glacier	Service postfix was restarted on glacier
ⓘ	04/Jun/2013 10…	Cray External Ser…	glacier	Service postfix was restarted on glacier
ⓘ	04/Jun/2013 09…	Cray External Ser…	glacier	Service postfix was restarted on glacier
!	03/Jun/2013 11…	Cray External Ser…	lake-esl	Check 'interfaces' is in state FAIL on lake-esl
ⓘ	03/Jun/2013 11…	Cray External Ser…	lake-esl	Check 'mounts' is in state PASS on lake-esl
ⓘ	03/Jun/2013 11…	Cray External Ser…	glacier	Check 'ldap' is in state PASS on glacier

CIMS Configuration Tasks [3]

3.1 Software Installation

Refer to the *Installing Cray Integrated Management Services (CIMS) Software* (S–2522) for software installation procedures.

3.1.1 Updating Slave Node RPMs from ESM Media

If you update ESM software, without updating CDL (ESL) or CLFS (ESF) software, you must run the `ESMupdateimage` command for all slave node production images to update the RPMs delivered via the ESM media which need to be installed on the CDL and CLFS nodes.

> **Note:** Always reboot the slave nodes that are running the updated image, or push the updated image to the running slave node using `cmgui` **Update Node** command or `cmsh imageupdate` command from `device` mode.

> **Note:** For CLFS nodes, the `lustre_control` command must be the same on the CIMS node and all CLFS nodes to control the Lustre® file system for actions such as start, stop, and status. This RPM is provided on the ESM media.

Procedure 6. Updating slave node RPMs from ESM media

1. Log in to the CIMS as `root`.
2. Run `ESMupdateimage` for each software image. The `ESMupdateimage` command verifies that the software image exists in `/cm/images` and in the Bright database (via `cmsh`). If it is not a valid software image, the command aborts.

```
esms1# ESMupdateimage -s softwareimage
```

> **Note:** If the software image is valid, the command determines whether the software image has ESF or ESL software installed (`/etc/opt/cray/release/ESFrelease` or `/etc/opt/cray/release/ESLrelease`) and then installs the proper RPMs for CLFS or CDL nodes. If neither of these files is present, then the generic set of slave node RPMs is installed.

3. Update the slave node from the software image. If possible, reboot the slave node. When the node reboots it will get all of the changes to the updated software image.

```
esms1# cmsh
[esms1]% device
[esms1->device]% reboot -n slavenode
```

If not possible to reboot the node, then push the changes in the updated software image to the node.

```
esms1# cmsh
[esms1]% device
[esms1->device]% imageupdate -w -n slavenode
```

Use `synclog` to display the provisioning sync log for the node.

```
[esms1->device]% synclog -p slavenode
```

3.2 Administrative Passwords

There are several administrative passwords for a Cray Data Management Platform (DMP) system. Each password is described below:

- CIMS - The `root` password for the primary CIMS and secondary CIMS (the same).
- The `root` password of the software images: This allows a `root` log in to a slave node, and is stored in the software image.
- The `root` password of the node-installer: This allows a `root` log in to the node when the node-installer, a stripped-down operating system, is running. The node-installer stage prepares the node for the final operating system when the node is booting up.
- The `root` password of MySQL®: This allows a `root` log in to the MySQL server.
- The administrator certificate password: This decrypts the `/root/admin.pfx` file on the CIMS so that the administrator certificate can be submitted to CMDaemon for administrative tasks. See Managing Bright `admin.pfx` Certificates on page 62.
- The baseboard management controller (BMC or iDRAC) password for the CIMS (changed using the `cmsh` shell, and not the `cm-change-passwd` script). See Changing the Password for the Baseboard Management Controller (BMC or iDRAC) on page 64.
- Switch administrative passwords should be managed using the device's console configuration commands.

Procedure 7. Changing DMP system passwords

1. Log in to the CIMS as `root`.
2. Enter `cm-change-passwd` and follow the prompts to change each password on the system.

```
esms1# cm-change-passwd
With this utility you can easily change the following passwords:
* root password of head node
* root password of slave images
* root password of node-installer
* root password of mysql
* administrator certificate for use with cmgui (/root/admin.pfx)

Note: if this cluster has a high-availability setup with 2 head
nodes, be sure to run this script on both head nodes.

Change password for root on head node? [y/N]: y
Changing password for root on head node.
Changing password for user root.
New UNIX password: newrootpassword
Retype new UNIX password: newrootpassword
passwd: all authentication tokens updated successfully.
Change password for root in default-image [y/N]: y
Changing password for root in default-image.
Changing password for user root.
New UNIX password: newdefaultimagepassword
Retype new UNIX password: newdefaultimagepassword
passwd: all authentication tokens updated successfully.
Change password for root in node-installer? [y/N]: y
Changing password for root in node-installer.
Changing password for user root.
New UNIX password: newnode-installerpassword
Retype new UNIX password: newnode-installerpassword
passwd: all authentication tokens updated successfully.
Change password for MYSQL root user? [y/N]: y
Changing password for MYSQL root user.
Old password: oldMYSQLpassword
New password: newMYSQLpassword
Re-enter new password: newMYSQLpassword
Change password for admin certificate file? [y/N]: y
Enter old password: oldcertificatepassword
Enter new password: newcertificatepassword
Verify new password: newcertificatepassword
Password updated
```

Important: See Managing Bright `admin.pfx` Certificates on page 62 for more information about changing passwords for the `admin.pfx` certificate.

3. Use `cmsh` to change the CIMS BMC (iDRAC port) password.

```
esms1# cmsh
[esms1]% partition use base
[esms1->partition[base]]% show
Parameter                      Value
------------------------------ ------------------------------
Administrator e-mail
BMC Password                   *********
BMC User ID                    2
BMC User name                  root
Burn configs                   <2 in submode>
Cluster name                   Training
Default burn configuration
Default category               default
Default software image         default-image
External network               site-admin-net
Externally visible IP
Failover                       not defined
Management network             esmaint-net
Masternode                     esms1
Name                           base
Name servers                   aaa.bbb.ccc.ddd  aaa.bbb.ccc.ddd
Node basename                  node
Node digits                    3
Notes                          <0 bytes>
Revision
Search domains                 your.domain.com
Time servers                   timeserver1.com timerserver2.com
Time zone                      America/Chicago
[esms1->partition[base]]% set bmcpassword newbmcpassword
[esms1->partition*[base*]]% commit
```

3.2.1 Managing Bright `admin.pfx` Certificates

Important: When an administrator changes the password on the system certificate, the certificate is re-encrypted with the new password. If an administrator has an old copy of a valid certificate that is encrypted with the old password, this administrator can continue to access the CMDaemon unless you revoke the old certificate. Old certificates must be revoked by using the `cmsh cert` mode `revokecertificate` command (refer to Procedure 8 on page 64), or by using the **Authentication** resource from the `cmgui` resource tree (see Figure 18).

The Bright Cluster Manager® (Bright) infrastructure (CMDaemon or `cmd`) requires public key authentication using X.509v3. X.509 is an ITU-T standard for a public key infrastructure (PKI) for single sign-on (SSO) and Privilege Management Infrastructure (PMI). The X.509 standard specifies, amongst other things, standard formats for public key certificates, certificate revocation lists, attribute certificates, and a certification path validation algorithm. This means in practice, a person authenticating to the cluster management infrastructure must present his/her certificate (i.e. the public key) and in addition must have access to the private key that corresponds to the certificate. A certificate includes a profile that determines which cluster management operations the holder of the certificate may perform.

The administrator password provided during Bright installation encrypts the `admin.pfx` file generated as part of the installation. The same password is also used as the initial `root` password for all nodes.

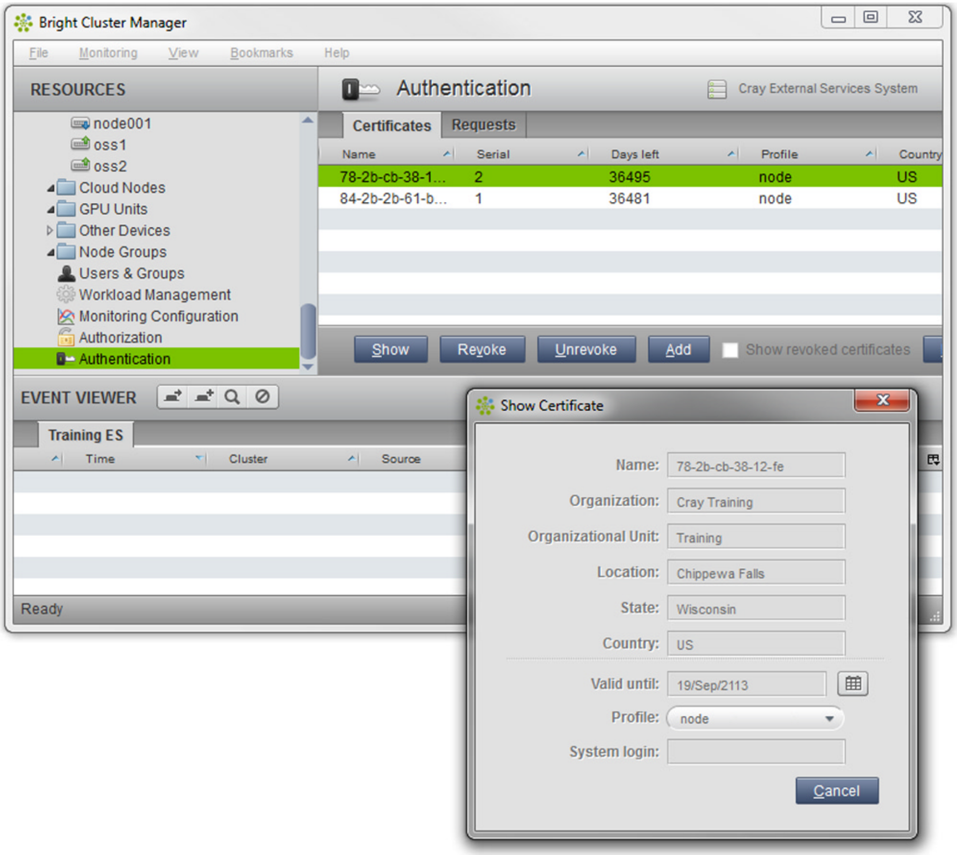
The administrator certificate is required to enable the CMDaemon and `cmsh` shell. Typically, administrators copy the `admin.pfx` file to their local laptop or workstation and use the Bright GUI (`cmgui`) to manage the system.

When the `/root/admin.pfx` file is updated with a new licence or password, the previous copy of the `admin.pfx` file continues to enable administrators to access the CMDaemon.

The password defined for the administrator certificate is used to decrypt the `admin.pfx` file, so that the administrator certificate can be presented to CMDaemon.

When the password for the `admin.pfx` file changes, the administrator must distribute the `admin.pfx` file and password to other administrators, and revoke older certificates to prevent administrators access with the old system certificate.

Figure 18. `cmgui` Authentication Menu



Name	Serial	Days left	Profile	Country
78-2b-cb-38-1...	2	36495	node	US
84-2b-2b-61-b...	1	36481	node	US

Name: 78-2b-cb-38-12-fe
Organization: Cray Training
Organizational Unit: Training
Location: Chippewa Falls
State: Wisconsin
Country: US
Valid until: 19/Sep/2113
Profile: node
System login:

Procedure 8. Revoking administration certificates

1. Log in to the CIMS as `root` and start `cmsh`.

```
esms1# cmsh
```

2. Switch to `cert` mode.

```
[esms1]% cert
[esms1->cert]% listcertificates
```

3. List the certificates. The Name column shows the MAC address of the node's `esmaint-net` network adapter.

```
[esms1->cert]% listcertificates
Serial num   Days left  Profile          Country          Name               Revoked
------------ ---------- ---------------- ---------------- ------------------ --------
1            36481      node             US               84-2b-2b-61-b0-04  No
2            36495      node             US               78-2b-cb-38-12-fe  No
```

4. To revoke a certificate, specify the Serial number.

```
[esms1->cert]% revokecertificate 1
Certificate revoked.

[esms1->cert]% listcertificates
Serial num   Days left  Profile          Country          Name               Revoked
------------ ---------- ---------------- ---------------- ------------------ --------
1            36481      node             US               84-2b-2b-61-b0-04  Yes
2            36495      node             US               78-2b-cb-38-12-fe  No
```

3.2.2 Changing the Password for the Baseboard Management Controller (BMC or iDRAC)

Procedure 9. Changing the password on the BMC (iDRAC)

1. Log in to the CIMS as `root` and start `cmsh`.

```
esms1# cmsh
```

2. Switch to `partition` mode. Use the `base` partition to change the BMC password.

```
[esms1]% partition use base
[esms1->partition[base]]%
```

3. Get the BMC user name.

```
[esms1->partition[base]]% get bmcusername
root
```

4. Get the BMC password (set during installation).

```
[esms1->partition[base]]% get bmcpassword
```
bmcpassword

5. Change and commit the BMC password.

```
[esms1->partition[base]]% set bmcpassword
enter new password: NewPassWord
retype new password: NewPassWord
[esms1->partition[base*]]% commit
[esms1->partition[base]]%
```

3.3 Changing CIMS Configuration Settings

You can modify the CIMS configuration settings such as baseboard management controller (BMC) password, name servers, search domains, and time servers using `cmsh partition` mode commands. The following example lists the CIMS configuration settings for the `base` partition. Use the `set` command from `partition` mode to set specific properties for the CIMS.

Example 8. CIMS configuration settings

```
esms1# cmsh
[esms1]% partition use base
[esms1->partition[base]]% show
Parameter                      Value
------------------------------ -----------------------------
Administrator e-mail
BMC Password                   *********
BMC User ID                    2
BMC User name                  root
Burn configs                   <2 in submode>
Cluster name                   Cray Training
Default burn configuration
Default category               default
Default software image         default-image
External network               site-admin-net
Externally visible IP
Failover                       not defined
Management network             esmaint-net
Masternode                     esms1
Name                           base
Name servers                   aaa.bbb.ccc.ddd aaa.bbb.ccc.ddd
Node basename                  node
Node digits                    3
Notes                          <0 bytes>
Revision
Search domains                 your.domain.com
Time servers                   timeserver1.com timerserver2.com
Time zone                      America/Chicago
```

3.4 Configuring the RAID Virtual Disks

A CIMS node has six physical disks. You must reconfigure the CIMS node disks into two RAID-5 virtual disks, `/dev/sda` and `/dev/sdb`. The Bright software creates the required disk partitions during installation.

> **Note:** If you configure partitions for a single CIMS, then later add a second CIMS, you must resize the `/cm` partition for the HA configuration.

Procedure 10. Setting up RAID virtual disks

> **Note:** This procedure includes detailed steps for the DELL™ R720 server using the PERC H710P Mini BIOS Configuration Utility 4.00-0014. Depending on your server model and version of RAID configuration utility, there could be minor differences in the steps to configure your system. For more information, refer to the documentation for your DELL™ PERC controller or server RAID controller software.

1. Connect a keyboard, monitor, and mouse to the front panel USB and monitor connectors on the CIMS.

2. Power up the CIMS. As the CIMS node reboots, enter the RAID controller configuration utility by pressing `Ctrl-R` when prompted.

   > **Note:** Cray recommends using the RAID configuration utility (via `Ctrl-R`) to configure the RAID virtual disks instead of the System Setup **Device Settings** menu.

   In this utility, use the `up-arrow` or `down-arrow` key to select (highlight) an item in a list. Press `Enter` to select items. To display a menu of options for an item, press the `F2` key. Use the `right-arrow`, `left-arrow`, or `Tab` key to change between the **Yes** and **No** buttons in a confirmation window.

3. Clear the default disk configuration, if necessary.

   a. If any disk groups are currently defined, select **Disk Group 0**, then press the `F2` key.

   b. Select **Delete Disk Group**, then press `Enter`.

   c. In the pop-up confirmation window, select **Yes** to confirm your changes.

4. Create a new virtual disk for `/dev/sda`. In this step, you will configure `/dev/sda` as a RAID-5 virtual disk with a capacity of 256 GB.

   a. Select **No Configuration Present**, then press the `F2` key.

   b. Select **Create New VD**, then press `Enter`. The **Create New VD** screen opens.

   c. Change the RAID level to RAID-5.

      1) Select **RAID Level**, then press `Enter` to display the available options.

   2) Select **RAID-5**.

   3) Press `Enter` to return to the main screen.

   d. Select all physical disks for this RAID-5 disk group.

      1) Press `Tab` to move to the **Physical Disks** area.

      2) Press `Enter` to check the box for a physical disk. This action also advances the selection to the next disk.

      3) Repeat the previous step for each physical disk.

   e. Press `Tab` to move to **VD Size**, then enter **`256`**.

      Note: Be sure to specific GB and not MB. The PERC controller software automatically adjusts this value to 255.9.

   f. Press `Tab` to move to **VD Name**, then enter **`sda`**.

   g. Enable disk initialization.

      1) Press `Tab` to move to the **Advanced Settings** area.

      2) Press `Enter` to check the **Advanced Settings** box so that you can make changes.

      3) Select **Initialize**, then press `Enter` to check the box.

   h. To confirm your changes, press the `Tab` key to select **OK**, then press `Enter`.

   i. A message appears to let you know that initialization will destroy data on the virtual disk. Select **OK** to continue, then press `Enter`.

   j. An "Initialization complete" message appears. Select **OK** to continue, then press `Enter`.

5. Add a new virtual disk for `/dev/sdb`. In this step, you will configure `/dev/sdb` as a RAID-5 virtual disk with the remainder of the available space.

   a. Select **Disk Group: 0, RAID-5**, then press the `F2` key.

   b. Select **Add New VD**, then press `Enter`. The **Add VD in Disk Group 0** screen opens.

   c. Keep **VD Size** as presented (the remainder of the disks).

   d. Press `Tab` to move to **VD Name**, then enter `sdb`.

   e. Enable disk initialization.

      1) Press `Tab` to move to the **Advanced Settings** area.

      2) Press `Enter` to check the **Advanced Settings** box so that you can make changes.

3) Select **Initialize**, then press `Enter` to check the box.

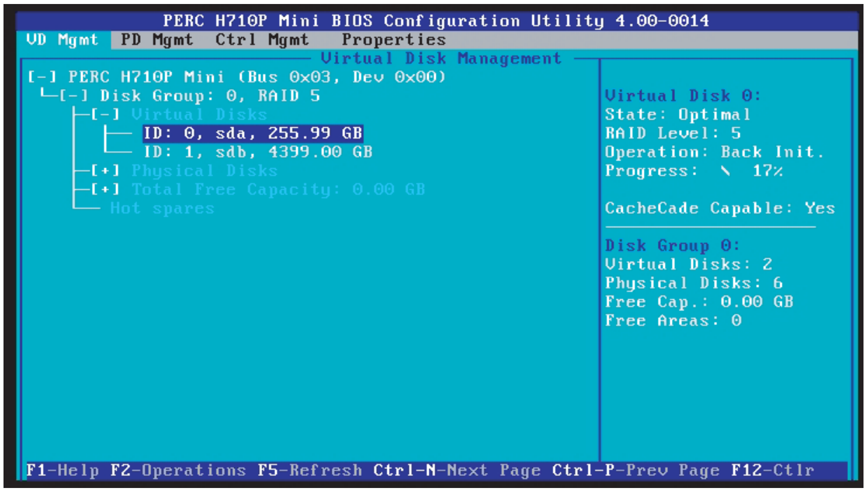
f. To confirm your changes, press the `Tab` key to select **OK**, then press `Enter`.

g. A message appears to let you know that initialization will destroy data on the virtual disk. Select **OK** to continue.

h. An "Initialization complete" message appears. Select **OK** to continue, then press `Enter`.

6. Verify the virtual disk changes. Compare your settings with those shown in Figure 19.

Figure 19. Final RAID Configuration Settings



```
              PERC H710P Mini BIOS Configuration Utility 4.00-0014
VD Mgmt  PD Mgmt  Ctrl Mgmt   Properties
                               Virtual Disk Management
[-] PERC H710P Mini (Bus 0x03, Dev 0x00)
 └─[-] Disk Group: 0, RAID 5                           Virtual Disk 0:
      ├─[-] Virtual Disks                              State: Optimal
      │    ├── ID: 0, sda, 255.99 GB                   RAID Level: 5
      │    └── ID: 1, sdb, 4399.00 GB                  Operation: Back Init.
      ├─[+] Physical Disks                             Progress:  \  17%
      ├─[+] Total Free Capacity: 0.00 GB
      └── Hot spares                                   CacheCade Capable: Yes

                                                       Disk Group 0:
                                                       Virtual Disks: 2
                                                       Physical Disks: 6
                                                       Free Cap.: 0.00 GB
                                                       Free Areas: 0

F1-Help F2-Operations F5-Refresh Ctrl-N-Next Page Ctrl-P-Prev Page F12-Ctlr
```

7. To exit the RAID configuration utility, press the `Escape` key.

8. To confirm, press **OK**, then press `Enter`.

   Note: Disk initialization is performed in the background, and takes about 2 hours to complete. You can exit this utility and continue to the next procedure.

9. A message appears prompting you to reboot. Press `Ctrl-Alt-Delete`. The server will restart the boot process and will not interrupt RAID initialization.

   Note: During the system reboot, be prepared to type `F2`, when prompted, to change the system setup.

Refer to Configuring the LSI® MegaCLI™ RAID Utility on page 69 for a procedure to configure Bright `healthchecks` for local RAID devices.

3.5 Configuring the LSI® MegaCLI™ RAID Utility

CIMS nodes that use LSI® Inc. MegaRAID™ controllers and the megaraid_sas kernel module use PERC710P, PERC 6/i RAID or other hardware modules. To manage, monitor, and configure the local RAID systems, install the LSI MegaCLI RAID utility on the CIMS. The MegaCLI utility also enables you to configure monitoring metrics, healthchecks, and administrator alerts in Bright that monitor the CIMS local RAID systems.

Use Procedure 11 on page 69 to install and run the MegaCLI utility. The utility installs in /opt/MegaRAID/MegaCli. Verify the utility is installed and running correctly, then use Procedure 13 on page 72 to configure the Bright healthcheck feature to monitor CIMS node RAID devices. Use Procedure 12 on page 70 to configure the MegaCLI utility for a slave node.

Procedure 11. Installing the MegaCLI utility on the CIMS

Note: This procedure configures the MegaCLI utility on the CIMS node.

1. Open a web browser and access the license agreement at http://www.lsi.com/Pages/user/eula.aspx?file=http://www.lsi.com/. Click **Accept** to accept the software license agreement.

2. Navigate to the storage downloads area of the LSI website and search for "MegaCLI".

3. Download the latest MegaCLI archive for Linux® (for example, MegaCli_Linux.zip) from the Downloads area of the www.lsi.com website.

   a. Log in to CIMS as root, copy the downloaded MegaCLI archive to the CIMS, and decompress the archive.

```
esms1# mkdir /root/MegaCLI
esms1# cd /root/MegaCLI
esms1# scp user@remotesystem:/user/MegaCli_Linux.zip /root/MegaCLI
esms1# unzip MegaCli_Linux.zip
Archive:  ./MegaCli_Linux.zip
   creating: MegaCli_Linux/
  inflating: MegaCli_Linux/MegaCli-8.07.08-1.i386.rpm
  inflating: MegaCli_Linux/megacli_8.07.08-1_all.deb
```

   b. Install the Linux MegaCLI RPM.

```
esms1# pwd
/root/MegaCLI
esms1# cd MegaCli_Linux
esms1# rpm -iMegaCli-8.07.08-1.i386.rpm
```

4. Run the utility to verify it is functioning.

```
esms1# cd /opt/MegaRAID/MegaCli
esms1# ./MegaCli64 -AdpAllInfo -aAll
Adapter #0
========================================================
                    Versions
                ================
Product Name    : PERC 6/i Integrated
Serial No       : 1122334455667788
FW Package Build: 6.0.2-0002

                    Mfg. Data
                ================
Mfg. Date       : 06/08/07
Rework Date     : 06/08/07
Revision No     :
Battery FRU     : N/A

                Image Versions in Flash:
                ================
FW Version         : 1.11.52-0396
BIOS Version       : NT13-2
WebBIOS Version    : 1.1-32-e_11-Rel
Ctrl-R Version     : 1.01-010B
Boot Block Version : 1.00.00.01-0008
...
```

Procedure 12. Installing the MegaCLI utility on slave node

1. Open a web browser and access the license agreement at http://www.lsi.com/Pages/user/eula.aspx?file=http://www.lsi.com/. Click **Accept** to accept the software license agreement.

2. Navigate to the storage downloads area of the LSI website and search for "MegaCLI".

3. Download the latest MegaCLI archive for Linux® (for example, `MegaCli_Linux.zip`) from the Downloads area of the `www.lsi.com` website.

4. Log in to CIMS as `root`, copy the downloaded MegaCLI archive to the CIMS, and decompress the archive.

```
esms1# mkdir /root/MegaCLI
esms1# cd /root/MegaCLI
esms1# scp user@remotesystem:/user/MegaCli_Linux.zip /root/MegaCLI
esms1# unzip MegaCli_Linux.zip
Archive:  ./MegaCli_Linux.zip
   creating: MegaCli_Linux/
  inflating: MegaCli_Linux/MegaCli-8.07.08-1.i386.rpm
  inflating: MegaCli_Linux/megacli_8.07.08-1_all.deb
```

5. Clone the current working slave node software image. Choose a unique name to identify the MegaCLI utility image.

   Note: Copy the image from the UNIX™ prompt and wait for the copy to complete before cloning the image in Bright. This ensures the clone operation is complete before you continue.

```
esms1# cp -pr /cm/images/SlaveImage /cm/images/megacli-image
```

6. Start `cmsh`, clone the slave node software image to `megacli-image`, setup a node category for the MegaCLI utility, and assign the `megacli-image` to the new category (`megacli-category`).

```
esms1# cmsh
[esms1]% softwareimage
[esms1->softwareimage]% clone SlaveImage megacli-image
[esms1->softwareimage*]% commit
[esms1->softwareimage*]% category
[esms1->category]% clone SlaveCategory megacli-category
[esms1->category*[megacli-category*]% commit
[esms1->category[megacli-category]% set softwareimage megacli-image
[esms1->category*[megacli-category*]% commit
[esms1->category[megacli-category]% quit
esms1#
```

7. Bind mount `/root/MegaCLI_Linux` to `/cm/images/megacli-image/tmp/MegaCLI` or copy the RPM to a directory in the `megacli-image` software image. This example shows the bind mount method.

```
esms1# mkdir -p /cm/images/megacli-image/tmp/MegaCLI
esms1# mount --bind /root/MegaCLI_Linux /cm/images/megacli-image/tmp/MegaCLI
```

8. Install the MegaCLI software on the slave node software image (`megacli-image`).

```
esms1# chroot /cm/images/megacli-image/
esms1:> rpm -ivh /tmp/MegaCLI/MegaCli-8.07.08-1.i386.rpm
Preparing...                ########################################### [100%]
   1:MegaCli                ########################################### [100%]
exitesms1:> exit
```

Important: You must remove the bind mount.

9. Remove the bind mount.

```
esms1# umount /cm/images/megacli-image/tmp/MegaCLI
esms1# rm -f /cm/images/megacli-image/tmp/MegaCLI
```

10. Use `cmsh` to assign a slave node (in this example, `esfs-mds1`) to the `megacli-category`.

```
esms1# cmsh
[esms1]% device
[esms1->device]% use esfs-mds1
[esms1->device[esfs-mds1]]% set category megacli-category
[esms1->device*[esfs-mds1*]]% commit
```

11. Reboot the `esfs-mds1` node (or from`cmsh` use `imageupdate`) to test the `megacli-image` and exit `cmsh`.

```
[esms1->device[esfs-mds1]]% reboot esfs-mds1
[esms1->device[esfs-mds1]]% quit
```

    Open a remote console to the `esfs-mds1` node and verify that the `megacli-image` software image boots without errors.

12. SSH to `esfs-mds1` and run the utility to verify it is functioning on the slave node.

```
esms1# ssh esfs-mds01
Last login: Thu Nov  7 12:56:51 2013 from esms1.cm.cluster
[root@esfs-mds1 ~]# cd /opt/MegaRAID/MegaCli
[root@esfs-mds1 ~]# ./MegaCli64 -AdpAllInfo -aAll
Adapter #0
========================================================
                    Versions
                ================
Product Name    : PERC 6/i Integrated
Serial No       : 1122334455667788
FW Package Build: 6.0.2-0002

                    Mfg. Data
                ================
Mfg. Date       : 06/08/07
Rework Date     : 06/08/07
Revision No     :
Battery FRU     : N/A

                Image Versions in Flash:
                ================
FW Version         : 1.11.52-0396
BIOS Version       : NT13-2
WebBIOS Version    : 1.1-32-e_11-Rel
Ctrl-R Version     : 1.01-010B
Boot Block Version : 1.00.00.01-0008
...
```

13. Configure the `megaraid` healthcheck in Bright using Procedure 13 on page 72.

14. Assign other slave nodes to the `megacli-category`.

Procedure 13. Configuring the `megaraid` healthcheck in Bright

1. Log in to the CIMS as `root` and start `cmsh`.

```
esms1: # cmsh
[esms1]%
```

2. Switch to `monitoring healthchecks` mode.

```
[esms1]% monitoring healthchecks
[esms1->monitoring->healthchecks]% list
Name (key)                   Command
---------------------------- ------------------------------------------------
DeviceIsUp                   <built-in>
ManagedServicesOk            <built-in>
chrootprocess                /cm/local/apps/cmd/scripts/healthchecks/chrootp+
cmsh                         /cm/local/apps/cmd/scripts/healthchecks/cmsh
diskspace                    /cm/local/apps/cmd/scripts/healthchecks/diskspa+
exports                      /cm/local/apps/cmd/scripts/healthchecks/exports
failedprejob                 /cm/local/apps/cmd/scripts/healthchecks/failedp+
failover                     /cm/local/apps/cmd/scripts/healthchecks/failover
hardware-profile             /cm/local/apps/cmd/scripts/healthchecks/node-ha+
hpraid                       /cm/local/apps/cmd/scripts/healthchecks/hpraid
interfaces                   /cm/local/apps/cmd/scripts/healthchecks/interfa+
ipmihealth                   /cm/local/apps/cmd/scripts/metrics/sample_ipmi
ldap                         /cm/local/apps/cmd/scripts/healthchecks/ldap
lustre                       /cm/local/apps/cmd/scripts/healthchecks/lustre
mounts                       /cm/local/apps/cmd/scripts/healthchecks/mounts
mysql                        /cm/local/apps/cmd/scripts/healthchecks/mysql
ntp                          /cm/local/apps/cmd/scripts/healthchecks/ntp
oomkiller                    /cm/local/apps/cmd/scripts/healthchecks/oomkill+
portchecker                  /cm/local/apps/cmd/scripts/healthchecks/portche+
rogueprocess                 /cm/local/apps/cmd/scripts/healthchecks/roguepr+
schedulers                   /cm/local/apps/cmd/scripts/healthchecks/schedul+
smart                        /cm/local/apps/cmd/scripts/healthchecks/smart
ssh2node                     /cm/local/apps/cmd/scripts/healthchecks/ssh2node
swraid                       /cm/local/apps/cmd/scripts/healthchecks/swraid
testhealthcheck              /cm/local/apps/cmd/scripts/healthchecks/testhea+
```

3. Add the `megaraid` healthcheck.

```
[esms1->monitoring->healthchecks]% add megaraid
[esms1->monitoring->healthchecks*[megaraid*]]% show
Parameter                      Value
------------------------------ ------------------------------------------------
Class of healthcheck           misc
Command
Description
Disabled                       no
Extended environment           no
Name                           megaraid
Notes                          <0 bytes>
Only when idle                 no
Parameter permissions          optional
Revision
Sampling method                samplingonnode
State flapping count           7
Timeout                        5
Valid for                      node,headnode
```

4. Configure the `megaraid` healthcheck and commit the settings.

```
[esms1->monitoring->healthchecks*[megaraid*]]% set classofhealthcheck disk
[esms1->monitoring->healthchecks*[megaraid*]]% set command /cm/local/apps/cmd/scripts/healthchecks/megaraid
[esms1->monitoring->healthchecks*[megaraid*]]% commit
[esms1->monitoring->healthchecks[megaraid]]%
```

5. Configure the `megaraid` healthcheck for the CIMS.

   Note: To configure the healthcheck on a slave node, specify its category (in this example, `megacli-category`) using: **`monitoring setup healthconf megacli-category`**

```
[esms1->monitoring->healthchecks[megaraid]]% monitoring setup healthconf headnode
[esms1->monitoring->setup[HeadNode]->healthconf]% add megaraid
[esms1->monitoring->setup*[HeadNode*]->healthconf*[megaraid*]]% show
Parameter                      Value
------------------------------ ------------------------------------------------
Check Interval                 120
Disabled                       no
Fail Actions
Fail severity                  10
GapThreshold                   2
HealthCheck                    megaraid
HealthCheckParam
LogLength                      3000
Only when idle                 no
Pass Actions
Revision
Stateflapping Actions
Store                          yes
ThresholdDuration              1
Unknown Actions
Unknown severity               10
```

6. Commit the changes.

```
[esms1->monitoring->setup*[HeadNode*]->healthconf*[megaraid*]]% commit
[esms1->monitoring->setup[HeadNode]->healthconf[megaraid]]%
```

7. Go into `device` mode and show the health data for the CIMS or slave node. Verify the `megaraid` health data shows PASS.

Note: To show the health data for a slave node (`esfs-mds1`), type the command **`device use esfs-mds1`**.

```
[esms1->monitoring->setup[HeadNode]->healthconf[megaraid]]% device use esms1
[esms1->device[esms1]]% latesthealthdata
Health Check                 Severity Value            Age (sec.) Info Message
---------------------------- -------- ---------------- ---------- ------------------------
DeviceIsUp                   0        PASS             1
ManagedServicesOk            0        PASS             19
mounts                       0        PASS             19
exports                      0        PASS             19
smart                        0        PASS             19         sda: Smart command failed
ldap                         0        PASS             19
failover                     0        PASS             19
interfaces                   40       FAIL             19         eth4 not up
oomkiller                    0        PASS             19
cmsh                         0        PASS             19
mysql                        0        PASS             19
failedprejob                 0        PASS             19
diskspace:2% 10% 20%         0        PASS             19
ntp                          0        PASS             19
schedulers                   0        PASS             19
chrootprocess                0        PASS             19
megaraid                     0        PASS             19
```

Note: Use the following command to run the `megaraid` healthcheck from a command line.

```
[esms1->device[esms1]]% quit
esms1# /cm/local/apps/cmd/scripts/healthchecks/megaraid
PASS
esms1# /cm/local/apps/cmd/scripts/healthchecks/megaraid -d 3>&1
megacli command path: /opt/MegaRAID/MegaCli/MegaCli64
cmd:     /opt/MegaRAID/MegaCli/MegaCli64 -LdPdInfo -aALL -NoLog
line:    Adapter #0
adapter: 0
line:    Virtual Drive: 0 (Target Id: 0)
vdrive:  0
line:    State               : Optimal
vstate:  Optimal
line:    Span: 0 - Number of PDs: 3
span:    0
line:    PD: 0 Information
pdisk:   0
line:    Enclosure Device ID: 32
enc:     32
line:    Slot Number: 0
encslot: 0
line:    Firmware state: Online, Spun Up
pstate:  Online, Spun Up
line:    Drive has flagged a S.M.A.R.T alert : No
psmart:  No
line:    PD: 1 Information
...
```

3.6 Adding a New or Modified Disk Setup XML File to the Bright Database

> **Important:** If the default disk setup XML files are updated in a ESM release and the site disk setup XML files have been customized, system administrators must compare the newly released disk setup XML files with the current production disk setup XML files, and merge the changes manually. After the changes have been merged, you must load the updated disk setup file into the Bright database for the node category and reboot the node.

An ESM software update may modify the default disk setup XML files for the default `esFS-MDS` and `esFS-OSS` categories or default CDL categories. New disk setup files may also be added to the `/opt/cray/esms/cray-es-diskpartitions-XX/default/` directory, which then must be added to the Bright database manually. Use this procedure to add a new disk setup XML file to an existing node category (in this example, the `esFS-MDS` category).

Procedure 14. Changing the disk setup XML file for a category

1. Log in to the CIMS as `root` and start `cmsh`.

```
esms1# cmsh
[esms1]%
```

2. Switch to `category` mode and select the `esFS-MDS` category.

```
[esms1]% category
[esms1->category]% use esFS-MDS
```

3. Get the current disk setup for the esFS-MDS category.

```
[esms1->category[esFS-MDS]]% get disksetup
```

4. Set your disk setup to either the full disk setup using 1TB capacity disks (`esfs-diskfull.xml`), or if the system contains smaller capacity disks, choose (`esfs-small-diskfull.xml`), depending on the hardware configuration.

```
[esms1->category[esFS-MDS]]% set disksetup
/opt/cray/esms/cray-es-diskpartitions-XX/default/esfs-diskfull.xml
```

or

```
[esms1->category[esFS-MDS]]% set disksetup
/opt/cray/esms/cray-es-diskpartitions-XX/default/esfs-small-diskfull.xml
```

5. Commit the change.

```
[esms1->category[esFS-MDS*]]% commit
```

6. Reboot the nodes in the `esFS-MDS` category.

```
[esms1->category[esFS-MDS]]% device
[esms1->device]% reboot -c esFS-MDS
esfs-mds1: Reboot in progress ...
esfs-mds2: Reboot in progress ...
```

7. Repeat this procedure, for the `esFS-OSS` category, or other default node categories that use the new disk setup files.

3.7 Changing BIOS for a DELL™ R720 CIMS Node

This procedure describes how to change the system setup for the CIMS: the network connections, remote power control, and the remote console.

Procedure 15. Changing the system setup for the CIMS

Note: This procedure includes detailed steps for the Dell R720 server. Depending on your server model and version of BIOS configuration utility, there could be minor differences in the steps to configure your system. For more information, refer to the documentation for your Dell server.

Note: When configuring a secondary CIMS, do not disable the embedded NIC in the BIOS settings on the secondary CIMS. The secondary CIMS needs to initially PXE boot from the primary CIMS to perform the cloning operation. Also, the secondary CIMS should have `Boot Sequence` set to `Integrated Nic Hard drive C:`, and then the DVD/Optical drive.

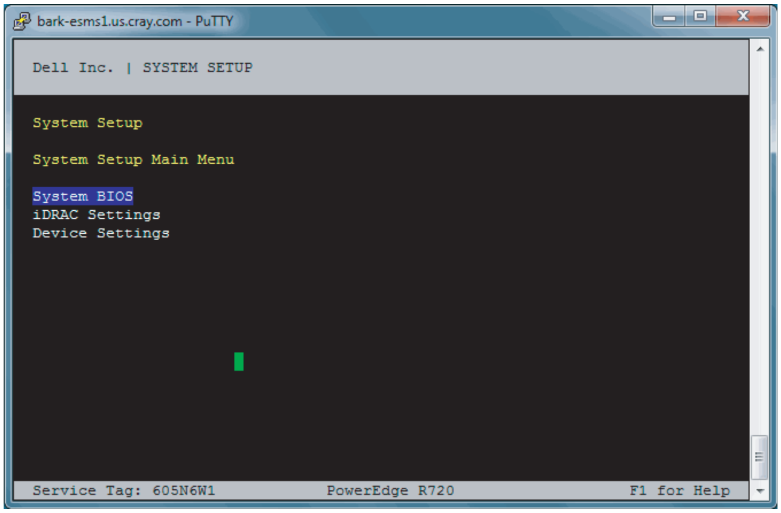
1. Watch as the system reboots. When the BIOS power-on self-test (POST) process begins, **quickly press the `F2` key** after the following messages appear in the upper-right of the screen.

```
      F2 = System Setup
  F10 = System Services
F11 = BIOS Boot Manager
         F12 = PXE Boot
```

When the `F2` keypress is recognized, the `F2 = System Setup` line changes to `Entering System Setup`.

After the POST process completes and all disk and network controllers have been initialized, the **Dell System Setup** screen appears. The following submenus are available on the System Setup Main Menu:

Figure 20. Dell 720 BIOS Menu

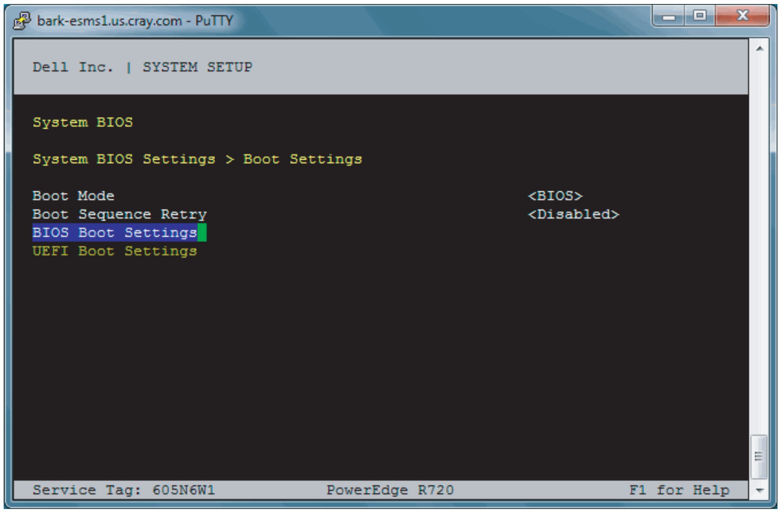


```
Dell Inc. | SYSTEM SETUP

System Setup

System Setup Main Menu

System BIOS
iDRAC Settings
Device Settings

Service Tag: 605N6W1          PowerEdge R720          F1 for Help
```

Note: In this utility, use the `Tab` key to move to different areas on the screen. To select an item, use the `up-arrow` and `down-arrow` keys to highlight the item, then press the `Enter` key. Press the `Escape` key to exit a submenu and return to the previous screen.

2. Change the System BIOS settings.

Figure 21. Dell 720 BIOS Boot Settings



```
Dell Inc. | SYSTEM SETUP

System BIOS

System BIOS Settings > Boot Settings

Boot Mode                                              <BIOS>
Boot Sequence Retry                                    <Disabled>
BIOS Boot Settings
UEFI Boot Settings

Service Tag: 605N6W1          PowerEdge R720          F1 for Help
```

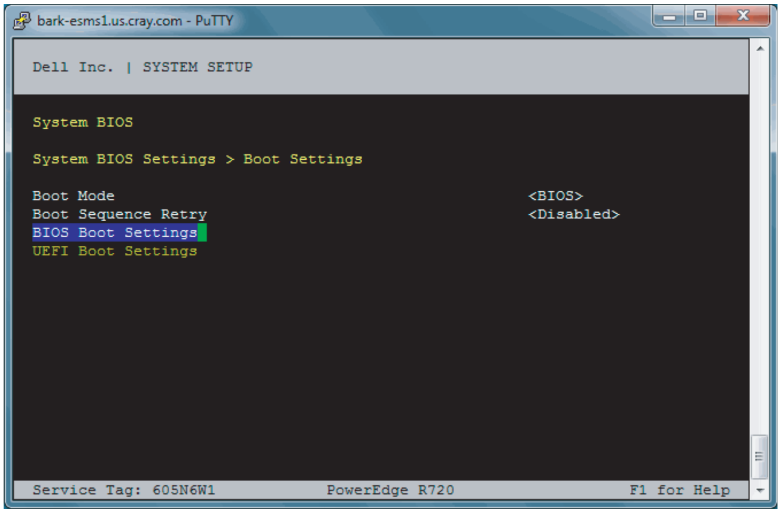
a. Select **System BIOS**, then press `Enter`.

b. Select **Boot Settings**, then press `Enter`.

c. Select **BIOS Boot Settings**, then press `Enter`.

d. Select **Boot Sequence**, then press `Enter` to view the boot settings.

Figure 22. Dell 720 BIOS Boot Sequence



```
Dell Inc. | SYSTEM SETUP

System BIOS

System BIOS Settings > Boot Settings

Boot Mode                                                  <BIOS>
Boot Sequence Retry                                        <Disabled>
BIOS Boot Settings
UEFI Boot Settings

Service Tag: 605N6W1            PowerEdge R720                   F1 for Help
```

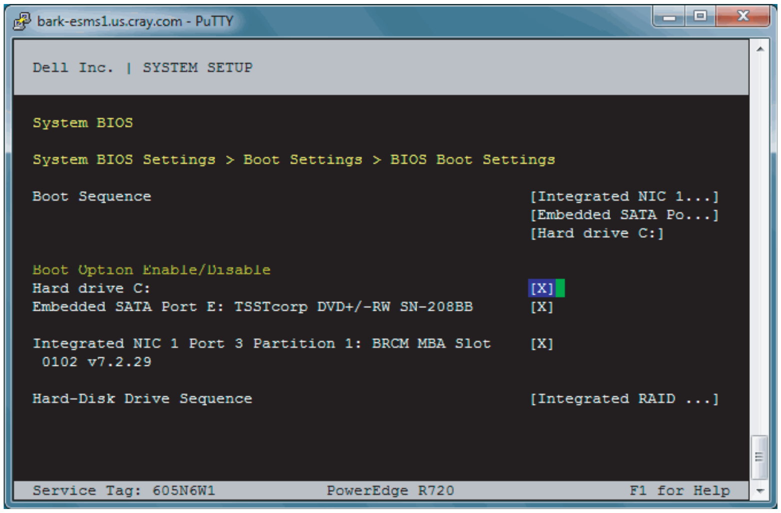
e. If creating a stand-alone CIMS, change the boot order in the pop-up window so that the optical drive appears first, then hard drive, then integrated NIC last.

> **Note:** If creating an HA CIMS, do not disable the embedded NIC in the BIOS settings for the secondary CIMS. The secondary CIMS must initially PXE boot from the primary CIMS to perform the cloning operation. Set the secondary CIMS boot sequence to boot from the integrated NIC first, then hard drive, then DVD/Optical drive last.

> **Tip:** Use the `up-arrow` or `down-arrow` key to highlight an item, then use the `+` and `-` keys to move the item up or down.

f. Enable **Hard drive C:** under the **Boot Option/Enable/Disable** section.

Figure 23. Dell 720 BIOS Boot Settings



```
Dell Inc. | SYSTEM SETUP

System BIOS

System BIOS Settings > Boot Settings > BIOS Boot Settings

Boot Sequence                                          [Integrated NIC 1...]
                                                       [Embedded SATA Po...]
                                                       [Hard drive C:]

Boot Option Enable/Disable
Hard drive C:                                          [X]
Embedded SATA Port E: TSSTcorp DVD+/-RW SN-208BB       [X]

Integrated NIC 1 Port 3 Partition 1: BRCM MBA Slot     [X]
 0102 v7.2.29

Hard-Disk Drive Sequence                               [Integrated RAID ...]


Service Tag: 605N6W1            PowerEdge R720               F1 for Help
```

g. Press `Enter` to return to the **BIOS Boot Settings** screen.

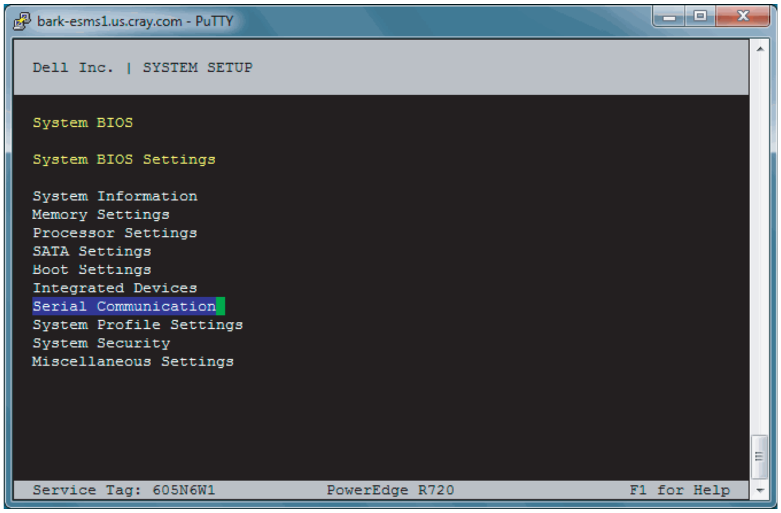
h. Press `Escape` to exit **BIOS Boot Settings**.

i. Press `Escape` to exit **Boot Settings** and return to the **System BIOS Settings** screen.

3. Change the serial communication settings.

a. On the **System BIOS Settings** screen, select **Serial Communication**.

Figure 24. Dell 720 BIOS Serial Communication Settings



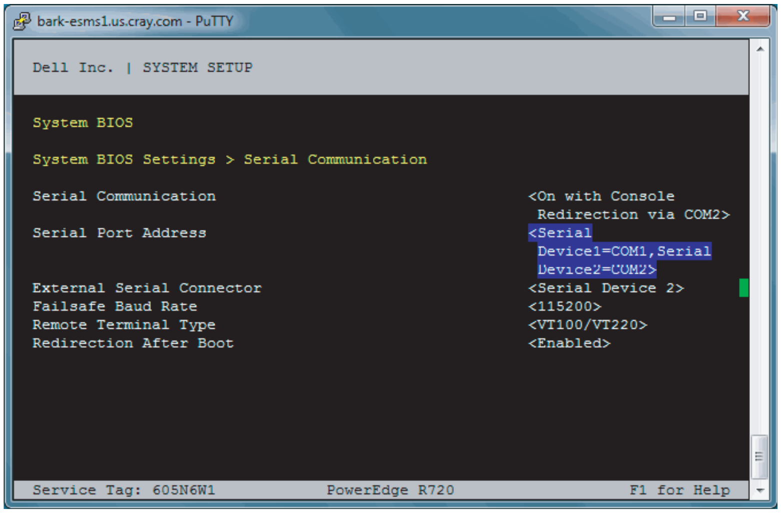
```
Dell Inc. | SYSTEM SETUP

System BIOS

System BIOS Settings

System Information
Memory Settings
Processor Settings
SATA Settings
Boot Settings
Integrated Devices
Serial Communication
System Profile Settings
System Security
Miscellaneous Settings


Service Tag: 605N6W1            PowerEdge R720               F1 for Help
```

b. On the **Serial Communication** screen, select **Serial Communication** and press `Enter`. A pop-up window displays the available options.

c. Select **On with Console Redirection via COM2**, then press `Enter`.

d. Select **Serial Port Address**, then select **Serial Device1=COM1, Serial Device2=COM2**, and press `Enter`.

Figure 25. Dell 720 BIOS Serial Port Address Settings



```
Dell Inc. | SYSTEM SETUP

System BIOS

System BIOS Settings > Serial Communication

Serial Communication                                   <On with Console
                                                        Redirection via COM2>
Serial Port Address                                    <Serial
                                                        Device1=COM1,Serial
                                                        Device2=COM2>
External Serial Connector                              <Serial Device 2>
Failsafe Baud Rate                                     <115200>
Remote Terminal Type                                   <VT100/VT220>
Redirection After Boot                                 <Enabled>

Service Tag: 605N6W1            PowerEdge R720                  F1 for Help
```

e. Select **External Serial Connector**, then press`Enter`. A pop-up window displays the available options.

f. In the pop-up window, select **Remote Access Device**, then press `Enter` to return to the previous screen.

g. Select **Failsafe Baud Rate**, then press `Enter`. A pop-up window displays the available options.

h. In the pop-up window, select **115200**, then press `Enter` to return to the previous screen.

i. Press the `Escape` key to exit the **Serial Communication** screen.

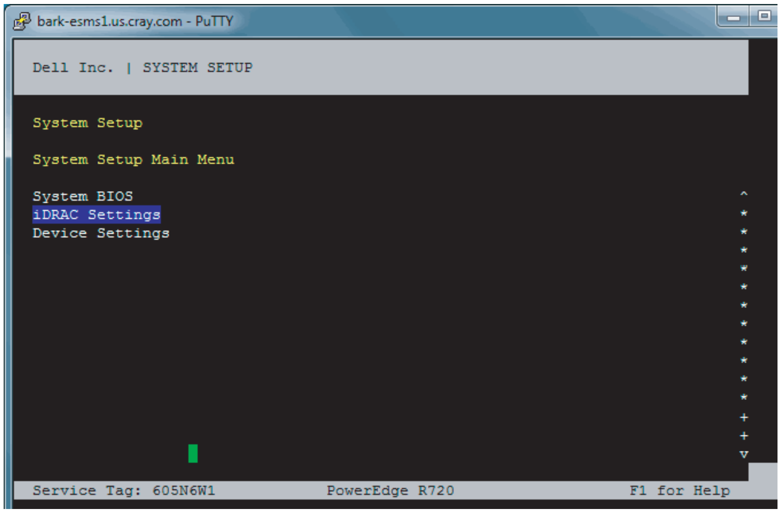
j. Press the `Escape` key to exit the **System BIOS Settings** screen.

k. A "Settings have changed" message appears. Select **Yes** to save your changes.

l. A "Settings saved successfully" message appears. Select **Ok**.

4. On the System Setup Main Menu, select **iDRAC Settings**, then press `Enter`.

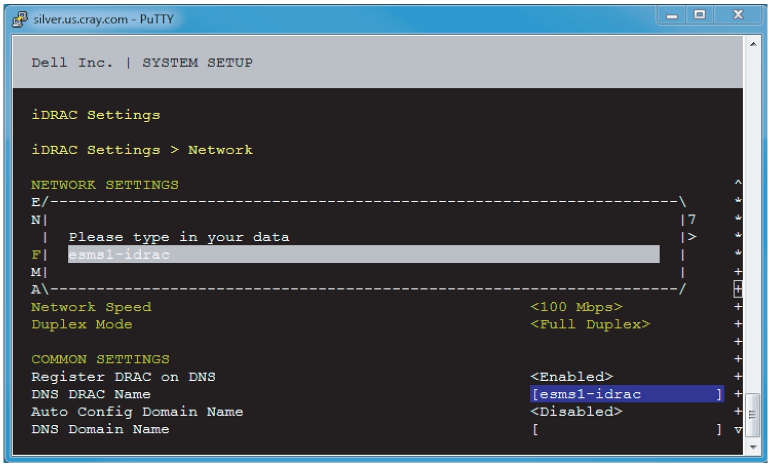
Figure 26. Dell 720 BIOS iDRAC Settings



```
Dell Inc. | SYSTEM SETUP

System Setup

System Setup Main Menu

System BIOS
iDRAC Settings
Device Settings

Service Tag: 605N6W1          PowerEdge R720          F1 for Help
```

5. Select **Network**, then press `Enter`. A long list of network settings is displayed.
6. Use the `down-arrow` key to scroll to **DNS DRAC Name** and press `Enter`.
7. Enter an iDRAC host name that is similar to the CIMS node host name. For example, `esms1-idrac`.

Figure 27. Dell 720 BIOS iDRAC Name



```
Dell Inc. | SYSTEM SETUP

iDRAC Settings

iDRAC Settings > Network

NETWORK SETTINGS
E/--------------------------------------------------------------------\
N|                                                                    |7
 |   Please type in your data                                         |>
F|   esms1-idrac                                                      |
M|                                                                    |
A\--------------------------------------------------------------------/
Network Speed                                         <100 Mbps>
Duplex Mode                                           <Full Duplex>

COMMON SETTINGS
Register DRAC on DNS                                  <Enabled>
DNS DRAC Name                                         [esms1-idrac       ]
Auto Config Domain Name                               <Disabled>
DNS Domain Name                                       [                  ]
```

8. Change the IPv4 settings.

   a. Use the `down-arrow` key to scroll to the **IPV4 SETTINGS** list.

   b. Ensure that IPv4 is enabled.

      1) If necessary, select **Enable IPV4** and press `Enter`.

2) In the pop-up window, select **<Enabled>**.

3) Press `Enter` to return to the previous screen.

c. Ensure that DHCP is disabled.

1) If necessary, select **Enable DHCP** and press `Enter`.

2) In the pop-up window, select **<Disabled>**.

3) Press `Enter` to return to the previous screen.

d. Change the IP address.

1) Select **IP Address**. A pop-up window opens for entering the new data.

2) In the pop-up window, enter the IP address of the iDRAC interface (`ipmi0`) for `site-admin-net` on the CIMS.

3) Press `Enter` to return to the previous screen.

e. Change the gateway.

1) Select **Gateway**. A pop-up window opens for entering the new data.

2) In the pop-up window, enter the appropriate value for the gateway of the `site-admin-net` network.

3) Press `Enter` to return to the previous screen.

f. Change the subnet mask.

1) Select **Subnet Mask**. A pop-up window opens for entering the new data.

2) In the pop-up window, enter the subnet mask for `site-admin-net` (such as `255.255.255.0`).

3) Press `Enter` to return to the previous screen.

g. Change the DNS server settings.

1) Select **Preferred DNS Server**. A pop-up window opens for entering the new data.

2) In the pop-up window, enter the IP address of the primary DNS server.

3) Press `Enter` to return to the previous screen.

4) Select **Alternate DNS Server**. A pop-up window opens for entering the new data.

5) In the pop-up window, enter the IP address of the alternate DNS server.

6) Press `Enter` to return to the previous screen.

9. Change the IPMI settings to enable the Serial Over LAN (SOL) console.

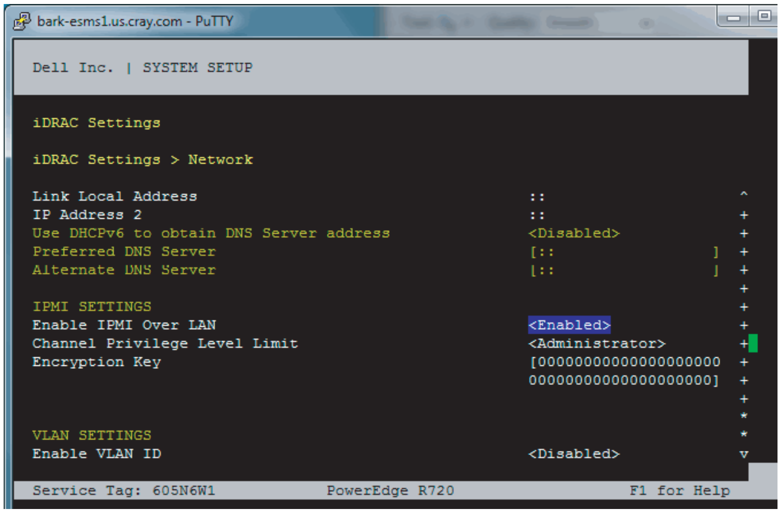
a. Use the `down-arrow` key to scroll to the **IPMI SETTINGS** list.

b. Ensure that IPMI over LAN is enabled.

1) If necessary, select **Enable IPMI over LAN**, then press `Enter`.

2) In the pop-up window, select **<Enabled>**.

Figure 28. Dell 720 BIOS Enable IPMI over LAN (SOL)



```
Dell Inc. | SYSTEM SETUP

iDRAC Settings

iDRAC Settings > Network

Link Local Address                                    ::                        ^
IP Address 2                                          ::                        +
Use DHCPv6 to obtain DNS Server address               <Disabled>                +
Preferred DNS Server                                  [::                    ]  +
Alternate DNS Server                                  [::                    ]  +
                                                                                +
IPMI SETTINGS                                                                   +
Enable IPMI Over LAN                                  <Enabled>                 +
Channel Privilege Level Limit                         <Administrator>           +
Encryption Key                                        [00000000000000000000     +
                                                      00000000000000000000]     +
                                                                                +
                                                                                *
VLAN SETTINGS                                                                   *
Enable VLAN ID                                        <Disabled>                v

Service Tag: 605N6W1             PowerEdge R720                  F1 for Help
```

3) Press `Enter` to return to the previous screen.

c. Verify that **Channel Privilege Level Limit** is set to **Administrator**.

1) If necessary, select **Channel Privilege Level Limit** to display the pop-up window.

2) In the pop-up window, select **Administrator**.

3) Press `Enter` to return to the previous screen.

d. Press the `Escape` key to exit the Network screen and return to the **iDRAC Settings** screen.

10. On the **iDRAC Settings** screen, change the user configuration settings.

a. Use the `down-arrow` key to highlight **User Configuration**, then press `Enter`.

b. Confirm that **User Name** is **root**.

1) If necessary, select **User Name**. A pop-up window opens to let you enter the user name.

2) In the pop-up window, enter `root`.

3) Press `Enter` to return to the previous screen.

c. Select **Change Password**. A pop-up window opens to let you create a new password.

d. In the pop-up window, enter a new password.

e. In the next pop-up window, re-enter the new password to confirm it.

f. Press the `Escape` key to exit the **User Configuration** screen.

11. Change the LCD configuration to show the host name in the LCD display.

a. On the **iDRAC Settings** screen, use the `down-arrow` key to scroll down and highlight **LCD**, then press `Enter`.

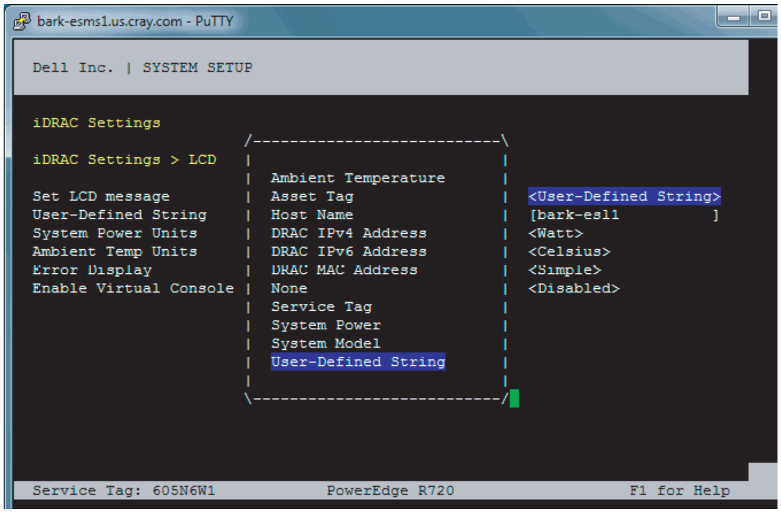
b. Select **Set LCD message**. A pop-up window opens (line 1).

c. In the pop-up window, select **User-Defined String**, then press `Enter`.

d. Select **User-Defined String** , then press `Enter`. A text pop-up window opens (line 2) for entering the new string.

e. In the text pop-up window, enter the CIMS host name (such as `esms1`), then press `Enter`.

Figure 29. Dell 720 BIOS iDRAC LCD Settings



```
Dell Inc. | SYSTEM SETUP

iDRAC Settings
                        /---------------------------\
iDRAC Settings > LCD    |                           |
                        |  Ambient Temperature      |
Set LCD message         |  Asset Tag                |  <User-Defined String>
User-Defined String     |  Host Name                |  [bark-esl1            ]
System Power Units      |  DRAC IPv4 Address        |  <Watt>
Ambient Temp Units      |  DRAC IPv6 Address        |  <Celsius>
Error Display           |  DRAC MAC Address         |  <Simple>
Enable Virtual Console  |  None                     |  <Disabled>
                        |  Service Tag              |
                        |  System Power             |
                        |  System Model             |
                        |  User-Defined String      |
                        |                           |
                        \---------------------------/

Service Tag: 605N6W1           PowerEdge R720                F1 for Help
```

f. Press the `Escape` key to exit the LCD screen.

g. Press the `Escape` key to exit the **iDRAC Settings** screen.

h. A "Settings have changed" message appears. Select **Yes**, then press `Enter` to save your changes.

i. A "Settings saved successfully" message appears. Select **Ok**, then press `Enter`. The main screen (System Setup Main Menu) appears.

12. Disable the integrated NIC device by changing the setting for the integrated NIC on port 1 from **PXE** to **None**.

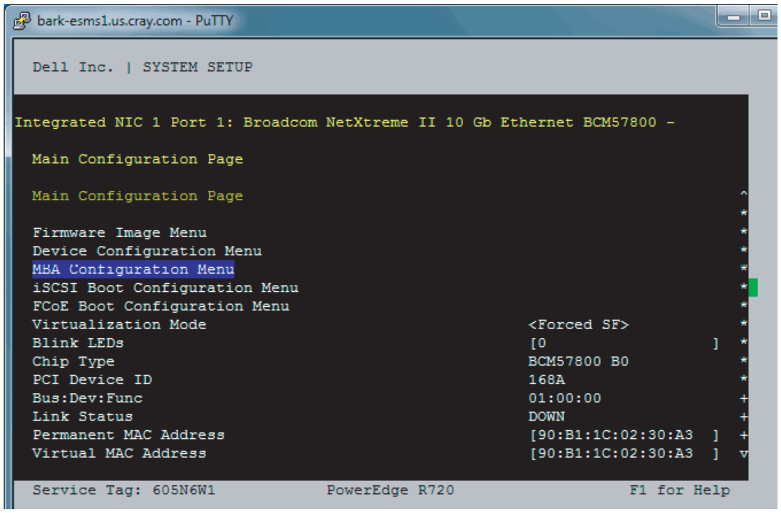
    Note: If you are configuring a secondary CIMS in an HA configuration, set the integrated NIC port (on `esmaint-net`) to **PXE** so that it PXE boots from the primary CIMS.

a. On the System Setup Main Menu, select **Device Settings**, then press `Enter`.

b. On the Device Settings screen, select **Integrated NIC 1 Port 1: ...**, then press `Enter`.

c. On the Main Configuration Page screen, select **MBA Configuration Menu**, then press `Enter`.

Figure 30. Dell 720 BIOS MBA Configuration Settings



```
 Dell Inc. | SYSTEM SETUP

Integrated NIC 1 Port 1: Broadcom NetXtreme II 10 Gb Ethernet BCM57800 -

  Main Configuration Page

  Main Configuration Page                                                 ^
                                                                          *
  Firmware Image Menu                                                     *
  Device Configuration Menu                                               *
  MBA Configuration Menu                                                  *
  iSCSI Boot Configuration Menu                                           *
  FCoE Boot Configuration Menu                                            *
  Virtualization Mode                              <Forced SF>            *
  Blink LEDs                                       [0                  ]  *
  Chip Type                                        BCM57800 B0            *
  PCI Device ID                                    168A                   *
  Bus:Dev:Func                                     01:00:00               +
  Link Status                                      DOWN                   +
  Permanent MAC Address                            [90:B1:1C:02:30:A3  ]  +
  Virtual MAC Address                              [90:B1:1C:02:30:A3  ]  v

  Service Tag: 605N6W1         PowerEdge R720               F1 for Help
```

d. On the MBA Configuration Menu screen, select **Legacy Boot Protocol**, then press `Enter`. A pop-up window displays the available options.

e. In the pop-up window, use the `down-arrow` key to highlight **None**, then press `Enter`.

f. Press the `Escape` key to exit the MBA Configuration Menu screen.

g. Press the `Escape` key to exit the Main Configuration Page screen.

h. Press the `Escape` key to exit the **Device Settings** screen.

i. A "Settings have changed" message appears. Select **Yes**, then press `Enter` to save your changes.

   j. A "Settings saved successfully" message appears. Select **Ok**, then press `Enter`. The main screen (System Setup Main Menu) appears.

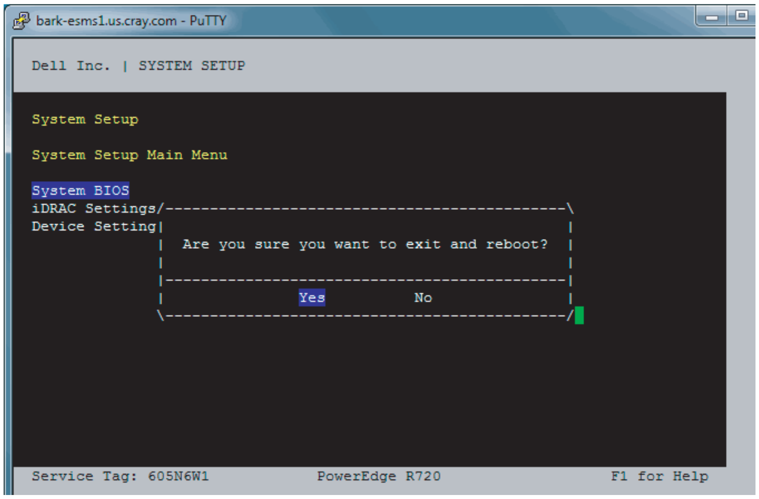
13. Insert the Bright software media in the optical (DVD) drive of the CIMS node.

    Important: The CIMS must boot from the Bright software media to configure and install the Bright software. While the memory-resident operating system is loaded, you must copy the XML configuration file from the Cray ESM software media and save it on the CIMS, then edit and save the file to `/root/cm` with your site-specific configuration settings. Be aware that changes to the XML configuration file will be lost if the file is not saved to a remote system before the CIMS is rebooted.

14. While viewing the System Setup Main Menu, press the `Escape` key to exit the Dell System Setup utility.

15. A message appears asking if you want to exit and reboot. Select **Yes**. The server will restart the boot process.

Figure 31. Dell 720 System BIOS Settings



```
Dell Inc. | SYSTEM SETUP

System Setup

System Setup Main Menu

System BIOS
iDRAC Settings/--------------------------------------------\
Device Setting|                                            |
              |  Are you sure you want to exit and reboot? |
              |                                            |
              |--------------------------------------------|
              |              Yes          No               |
              \--------------------------------------------/

Service Tag: 605N6W1          PowerEdge R720             F1 for Help
```

3.8 Power Control

The Bright software, IPMI, and the DELL™ Remote Access Controller (iDRAC) enable you to monitor and control power remotely. (If the system includes intelligent PDUs, these too can be controlled and monitored from Bright.) Refer to iDRAC Remote Console on page 120 for more information about the iDRAC.

The Bright `cmgui` **Overview** tab of a device can be used to check its power status information. Right-clicking a node in the resource tree also displays power control commands. The **Task** tab, enables you to select:

- Power on
- Power off
- Reset - powers off a device and powers it on again after a brief delay

When doing a power operation on multiple devices, CMDaemon inserts a 1 second delay between successive devices, to avoid power surges on the infrastructure. The delay period may be altered using `cmsh -d | --delay` option.

The following power control examples can be used from `cmsh device` mode. Log in to the CIMS as `root`, start `cmsh`, and switch to `device` mode.

```
esms1# cmsh
[esms1]% device
[esms1-<device]%
```

`power -n eslogin01 on`

Powers up an individual node such as, `eslogin01`

`power -n eslogin01..eslogin04,eslogin06 off`

Powers off a list of nodes, such as `eslogin01` to `eslogin04` and `eslogin06`

`power -c eslogin -d 10 reset`

Power cycles all nodes in the `eslogin` category, with a 10 second delay between each node power reset

`power -g es-datamover`

Power on all nodes in the `es-datamover` node group

`power -g esfs-oss status`

Check power status of all nodes in the `esfs-oss` node group.

`ON`	Power is ON
`OFF`	Power is OFF
`RESET`	Displays during the short time the power is off during a power reset. The reset is a hard power off for PDUs, but can be a soft or hard reset for other power control devices.
`FAILED`	Power status communication failure
`FAILED`	Power status communication failure
`UNKNOWN`	Power status script timeout

`pexec power off`

Powers off all nodes

Bright software also supports power saving features through resource managers such as Simple Linux Utility for Resource Management (SLURM) or other workload management software. Refer to the *Bright Cluster Manager 6.0 Administrator Manual* for more information.

3.9 Rebooting Slave Nodes

Procedure 16. Rebooting slave nodes

1. Log in to the CIMS as `root` and start `cmsh`.

```
esms1# cmsh
[esms1]%
```

2. Switch to `device` mode and launch a remote console (`rconsole`) on the slave node (in this example `eslogin1`).

```
[esms1]% device use eslogin1
[esms1->device[eslogin1]]% rconsole
```

3. In a separate CIMS window, login as `root` and reboot the slave node using `cmsh` or use the **Reboot** button from the `cmgui`.

```
esms1# cmsh
[esms1]% device use eslogin1
[esms1->device[eslogin1]]% reboot
```

The following reboot examples can be used from `cmsh device` mode

Log in to CIMS as `root`, start `cmsh`, and switch to `device` mode.

```
esms1# cmsh
[esms1]% device
[esms1->device]%
```

`reboot -n eslogin01`

Reboot an individual node

`reboot -n eslogin01..eslogin04,eslogin06`

To reboot a list of nodes

`reboot -c esLogin-XC`

Reboot all nodes in the `eslogin` category

`reboot -g Login`

Reboot all nodes in the `Login` node group

`pexec reboot`

Reboot all nodes.

`reboot esfs-mds[1,2],esfs-oss[1,2,3,4]`

Specifies a range of nodes

The parallel shell execution command, `pexec`, can be run from within the OS shell (bash by default), or from within CMDaemon (`cmsh` or `cmgui`). The OS shell `pexec` commands run on the nodes sequentially by default, and wait for the output from one node before moving on to the next. If the OS shell `pexec` is run with the background execution option (`-b`), then the `bash` commands are executed in parallel. Running in parallel is not done by default, because it could be risky for some commands, such as power-cycling nodes with a reboot, which may put unacceptable surge demands on the power supplies. For example: Within `cmsh` or `cmgui`, the execution of a `power reset` command from `device` mode to power cycle a properly-configured group of nodes is safe, due to safeguards in CMDaemon to prevent nodes powering up too soon after each other.

3.10 Shutting Down Slave Nodes

This procedure shows you how to perform an orderly shutdown and power off a node or nodes. You can shutdown nodes individually, by list, range, rack, and by category or node group.

The following reboot examples can be used from `cmsh device` mode. Log in to the CIMS as `root`, start `cmsh`, and switch to `device` mode.

```
esms1# cmsh
[esms1]% device
[esms1->device]%
```

`shutdown -n eslogin01`

Shutdown an individual node

`shutdown -n eslogin01..eslogin04,eslogin06`

Shutdown a list of nodes

`shutdown -c eslogin`

Shutdown all nodes in the `eslogin` category

`shutdown -g es-datamover`

Shutdown all nodes in the `es-datamover` node group

3.11 Network Settings

Bright Cluster Manager® (Bright) configures three default network objects. These are `internalnet`, `externalnet`, and `globalnet`. These are renamed for a DMP system, but used throughout the GUI menus as a way to classify the different networks.

Internal
: The internal system network, or management network (these networks are renamed to `esmaint-net`, `ib-net`, `ipmi-net`, `wlm-net`).

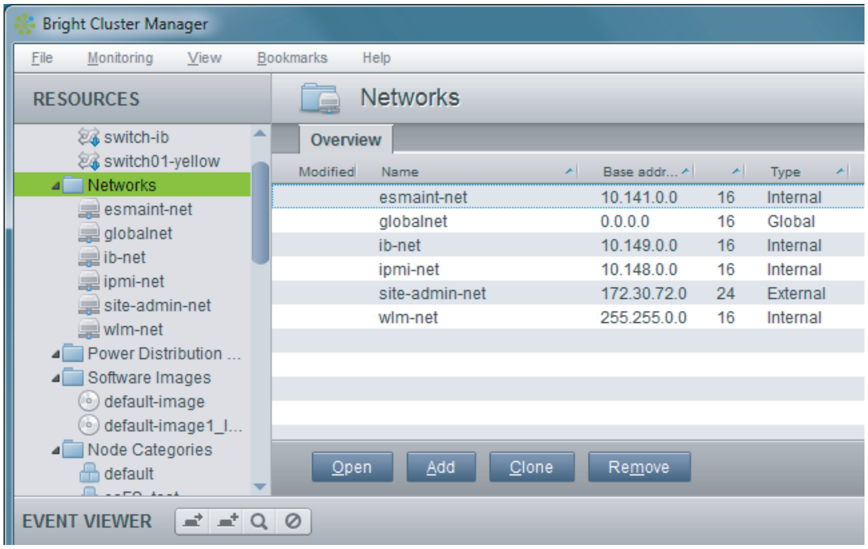
External
: The network connecting the DMP system to the outside world (`site-user-net`, `site-admin-net` typically a user or campus network).

Global
: A special network used to set the domain name for nodes so that they can be resolved (not used in a Cray DMP system).

Figure 2 shows an example of the networks in a Cray DMP system from the Bright GUI.

Select the `Networks` object in the **Resources** tree to view all the networks defined in the DMP system. You can sort on each of the columns,

Figure 32. Bright Network Configuration GUI



Modified	Name	Base addr...		Type
	esmaint-net	10.141.0.0	16	Internal
	globalnet	0.0.0.0	16	Global
	ib-net	10.149.0.0	16	Internal
	ipmi-net	10.148.0.0	16	Internal
	site-admin-net	172.30.72.0	24	External
	wlm-net	255.255.0.0	16	Internal

The `network` mode of the `cmsh` command can be used to modify network parameters for each of the networks defined in the system.

A DMP system requires the following networks:

`esmaint-net`

Internal management network that connects the CIMS server(s) with the slave nodes. This network enables Bright to manage and provision the slave nodes and other devices in the DMP system.

`ipmi-net` Internal IPMI/DRAC (Dell Remote Access Controller) network that provides remote console and power management of the slave nodes from the CIMS.

site-admin-net

External administration network used by site administrators to log in to the CIMS server (typically on the same network that the SMW is on). The name and IP address of this network are customized during installation.

Note: The CIMS IPMI interface (BMC or iDRAC) may also be on this network (instead of `ipmi-net`) to provide remote console and power management of the CIMS server.

`site-user-net`

External user network used by the slave nodes. On CDL nodes, this network provides user access and authentication services such as LDAP. On CLFS nodes, this network connects to the site LDAP for file ownership authentication. The name and IP address of this network are customized during installation.

> **Note:** Connections to additional site-specific networks are optional.

`ib-net` InfiniBand® network used by the slave nodes for Lustre LNET traffic.

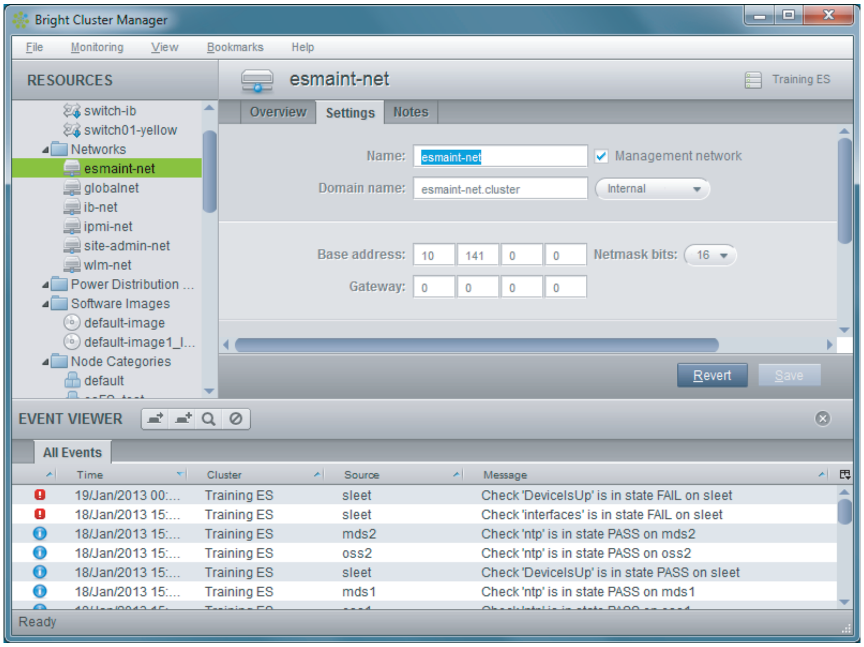
`failover-net`

Internal failover network used between two CIMS servers in an HA configuration for heartbeats between the active/passive CIMS nodes. This network does not connect to a managed switch.

> **Note:** Depending on system configuration, additional network configuration may be required.

The network parameters can be modified using Bright **Network→Settings** tab from the `cmgui`. See Figure 33. Table 6 lists and describes the network parameters you can modify either from the `cmgui` or from the `cmsh`.

Figure 33. Network Settings GUI



Name: esmaint-net ☑ Management network

Domain name: esmaint-net.cluster Internal

Base address: 10 141 0 0 Netmask bits: 16

Gateway: 0 0 0 0

	Time	Cluster	Source	Message
!	19/Jan/2013 00:...	Training ES	sleet	Check 'DevicesUp' is in state FAIL on sleet
!	18/Jan/2013 15:...	Training ES	sleet	Check 'interfaces' is in state FAIL on sleet
i	18/Jan/2013 15:...	Training ES	mds2	Check 'ntp' is in state PASS on mds2
i	18/Jan/2013 15:...	Training ES	oss2	Check 'ntp' is in state PASS on oss2
i	18/Jan/2013 15:...	Training ES	sleet	Check 'DevicesUp' is in state PASS on sleet
i	18/Jan/2013 15:...	Training ES	mds1	Check 'ntp' is in state PASS on mds1

Table 6. Network Configuration Settings

Setting	Description
Name	Name of this network
Domain name	DNS domain associated with the network
Management network	Modify this setting if nodes are managed by the CIMS.
External network	Modify this setting if it is an external network.
Base address	Base address of the network (also known as the *network address*)
Gateway	Default route IP address
Netmask bits	Prefix-length, or number of bits in netmask. The part after the `/` in classless inter-domain routing (CIDR) notation.
MTU	Maximum Transmission Unit. The maximum size of an IP packet transmitted without fragmenting.
Dynamic range start/end	Start/end IP addresses of the DHCP range temporarily used by nodes during PXE boot on the internal network.
Allow node booting	Nodes set to boot from this network (useful in the case of nodes on multiple networks).
Don’t allow nodes to boot from this network	New nodes are not offered a PXE DHCP IP address from this network (DHCPD is locked down by default in `/cm/local/apps/cmd/etc/cmd.conf`). The `lockdowndhcpd` setting is can also be configured in `cmsh network` mode for a specific network.

The example `cmsh` commands below show how to view or set the network parameters for a DMP system CIMS node (`esms1`) and `esmaint-net` network.

IP address

```
esms1# cmsh -c "device interfaces esms-1; get eth1 ip"
esms1# cmsh -c "device interfaces esms-1; set eth1 ip address;commit"
```

Base address

```
esms1# cmsh -c "network get esmaint-net baseaddress"
esms1# cmsh -c "network; set esmaint-net baseaddress address;commit"
```

Broadcast address

```
esms1# cmsh -c "network get esmaint-net broadcastaddress"
esms1# cmsh -c "network; set esmaint-net broadcastaddress address;commit"
```

Netmask bits

```
esms1# cmsh -c "network get esmaint-net netmaskbits"
esms1# cmsh -c "network; set esmaint-net netmaskbits bitsize;commit"
```

Gateway

```
esms1# cmsh -c "network get esmaint-net gateway"
esms1# cmsh -c "network; set esmaint-net gateway address; commit"
```

Name servers

```
esms1# cmsh -c "partition get base nameservers"
esms1# cmsh -c "partition; set base nameservers address; commit"
```

Search domains

```
esms1# cmsh -c "partition get base searchdomains"
esms1# cmsh -c "partition; set base searchdomains hostname;commit"
```

Time servers

```
esms1# cmsh -c "partition get base timeservers"
esms1# cmsh -c "partition; set base timeservers hostname; commit"
```

3.11.1 The `sipcalc` Utility

The `sipcalc` utility installed on the CIMS node is a useful tool for calculating or checking such IP subnet values (see the man page on `sipcalc` or see `sipcalc -h` for help on this utility).

Example 9. The `sipcalc` Utility

```
esms1# sipcalc 192.168.0.1/28
-[ipv4 : 192.168.0.1/28] - 0

[CIDR]
Host address                    - 192.168.0.1
Host address (decimal)          - 3232235521
Host address (hex)              - C0A80001
Network address                 - 192.168.0.0
Network mask                    - 255.255.255.240
Network mask (bits)             - 28
Network mask (hex)              - FFFFFFF0
Broadcast address               - 192.168.0.15
Cisco wildcard                  - 0.0.0.15
Addresses in network            - 16
Network range                   - 192.168.0.0 - 192.168.0.15
Usable range                    - 192.168.0.1 - 192.168.0.14
```

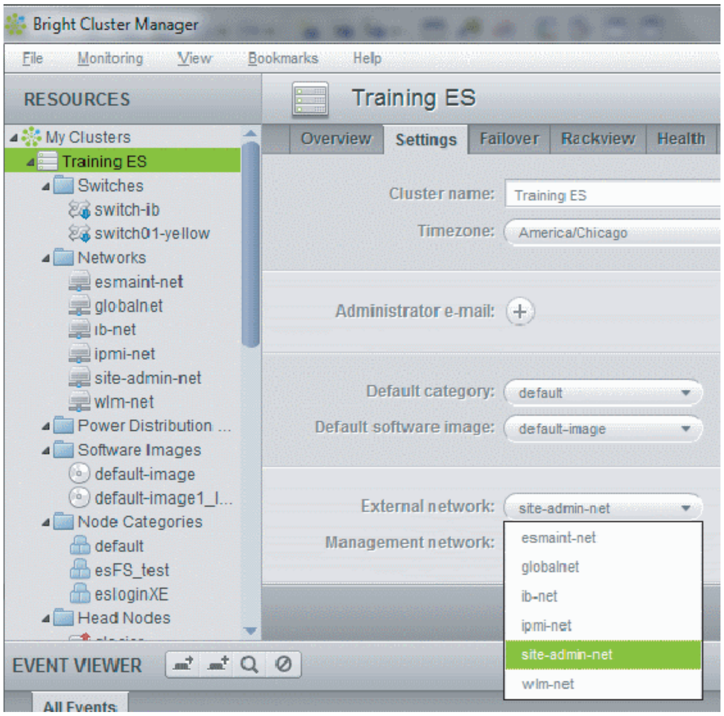
3.11.2 DNS Domains

Every network has an associated DNS domain which can be used to access a device through a particular network. For `esmaint-net`, the default DNS domain is set to `esmaint-net.cluster`, which means that the host name `esms1.cm.cluster` can be used to access device `esms1` through the maintenance network. The InfiniBand® network domain is `ib-net.cm.cluster`. Internal DNS zones are generated automatically based on the network definitions and the defined nodes on these networks. For networks marked as external, no DNS zones are generated.

3.11.3 Adding a Network

In `cmsh`, a new network can be added from the `network` mode using the `add` or `clone` commands. The default assignment of networks can be set from the GUI **Management network** and **External network** menus on the **Settings** tab of the top level DMP system object in the resource tree.

Figure 34. Adding a Network



Cluster name: Training ES

Timezone: America/Chicago

Administrator e-mail: +

Default category: default

Default software image: default-image

External network: site-admin-net

Management network:

In `cmsh` the assignment to **Management network** and **External network** is set or modified from the base object in `partition` mode:

Example 10. Changing the Default Setting of a Network

```
 esms1# cmsh
[esms1]% partition use base
[esms1->partition[base]]% set managementnetwork esmaint-net; commit
[esms1->partition[base]]% set externalnetwork site-user-net; commit
```

3.11.4 Changing Node Host Names

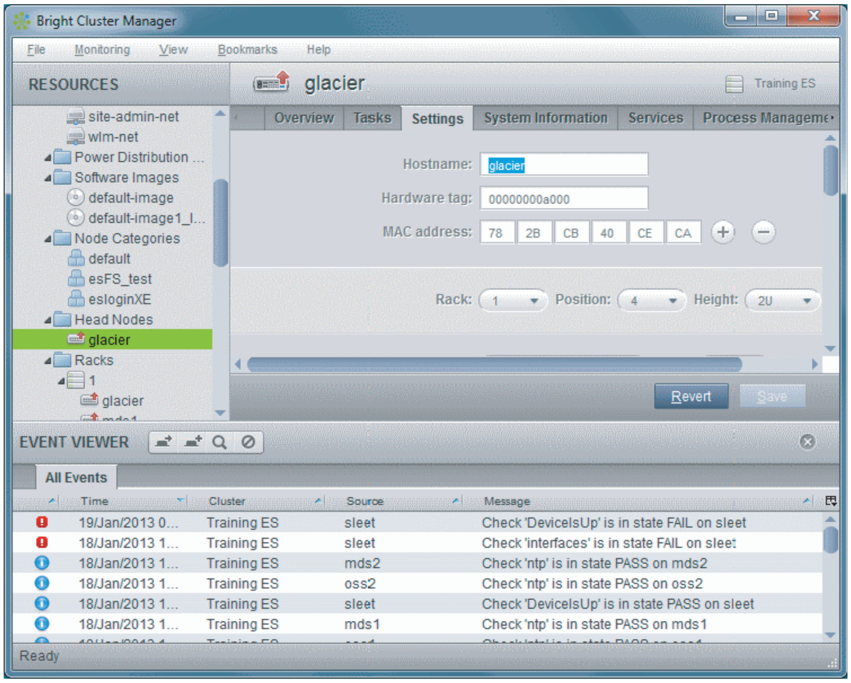
The alias `master` may be used to reach the head node. The name can be changed in a similar manner for each, following the guidelines in Devices and Device Names in Bright on page 35.

Procedure 17. Changing node hostnames

1. To change the host name of the head node (CIMS), the CIMS device object listed under **Head Nodes** must be modified (see Figure 35).

2. Using `cmgui`, select the device listed under **Head Nodes** in the resource tree, then select the **Settings** tab.

Figure 35. Changing Node Host Names with `cmgui`



Hostname: glacier
Hardware tag: 00000000a000
MAC address: 78 2B CB 40 CE CA
Rack: 1 Position: 4 Height: 2U

Time	Cluster	Source	Message
19/Jan/2013 0...	Training ES	sleet	Check 'DeviceIsUp' is in state FAIL on sleet
18/Jan/2013 1...	Training ES	sleet	Check 'interfaces' is in state FAIL on sleet
18/Jan/2013 1...	Training ES	mds2	Check 'ntp' is in state PASS on mds2
18/Jan/2013 1...	Training ES	oss2	Check 'ntp' is in state PASS on oss2
18/Jan/2013 1...	Training ES	sleet	Check 'DeviceIsUp' is in state PASS on sleet
18/Jan/2013 1...	Training ES	mds1	Check 'ntp' is in state PASS on mds1

3. Modify the **Hostname** property (follow guides in Devices and Device Names in Bright on page 35), and click on the **Save** button.

In `cmsh`, the host name of the head node is changed in `device` mode:

Example 11. Changing node host names with cmsh

```
esms1# cmsh
[esms1]% device use esms1
[esms1->device[esms1]]% set hostname esms2
[esms2->device*[esms2*]]% commit
[esms2->device[esms2]]% quit
esms1# sleep 30; hostname -f esms2.cm.cluster esms2.cm.cluster
```

3.11.5 Adding Hostname to an Internal Network

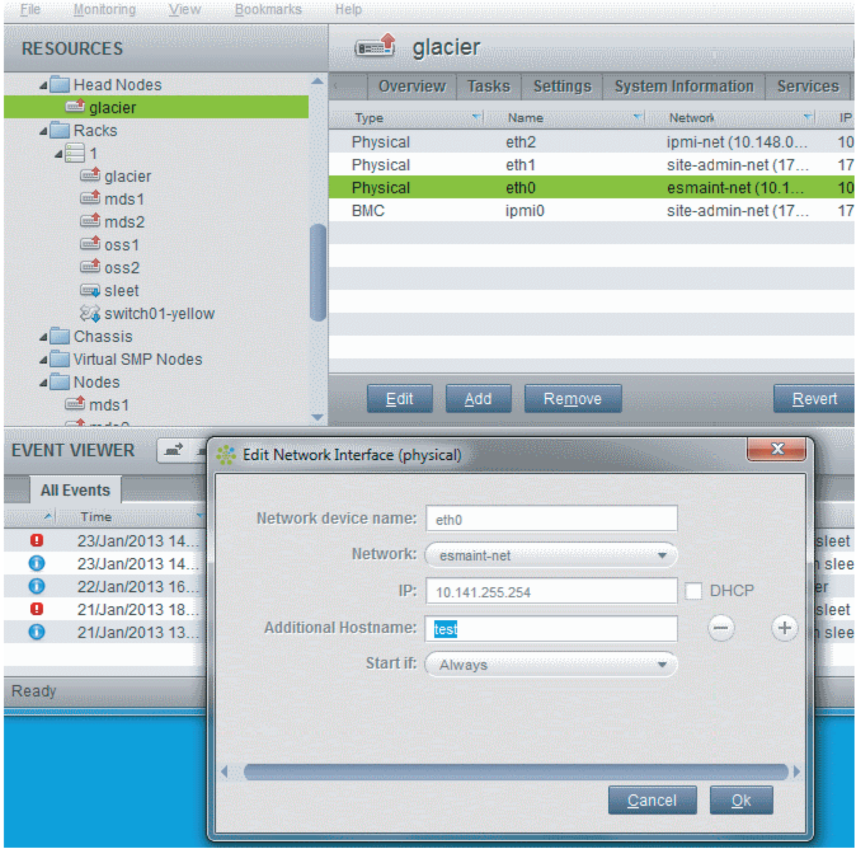
Hostname can be added as name/value pairs to the `/etc/hosts` file(s) within the system, but it is recommended to let Bright manage host name resolution for devices on the `esmaint-net` through its DNS server on the `esmaint-net` interface.

Multiple host names can be added as space-separated entries. The `named` service automatically restarts within about 20 seconds after committal, implementing the configuration changes. The system restarts automatically when there are changes made to service configurations by `cmgui` or `cmsh`.

Note: The CIMS in Figure 36 is `glacier`.

The `cmgui` can be used to add a host name to a network by selecting the CIMS head node (`glacier`) in the resource tree, then the **Networks** tab, and physical device for `eth0` and the `esmaint-net`, and clicking **Edit**. See Figure 36.

Figure 36. Adding a Hostname to an Internal Network



Type	Name	Network	IP
Physical	eth2	ipmi-net (10.148.0...	10
Physical	eth1	site-admin-net (17...	17
Physical	eth0	esmaint-net (10.1...	10
BMC	ipmi0	site-admin-net (17...	17

23/Jan/2013 14...
23/Jan/2013 14...
22/Jan/2013 16...
21/Jan/2013 18...
21/Jan/2013 13...

Network device name: eth0
Network: esmaint-net
IP: 10.141.255.254 □ DHCP
Additional Hostname: test
Start if: Always

In cmsh, the host names can be added to the additionalhostnames object, from within interfaces submode for the CIMS. In Example 12, the CIMS is glacier). The interfaces submode is accessible from the device mode. Thus, for the CIMS, with eth0 as the interface for esmaint-net:

Example 12. Adding host names to an internal network using cmsh

```
glacier# cmsh
[glacier]% device use glacier
[glacier->device[glacier]]% interfaces
[glacier->device[glacier]->interfaces]% list

Type         Network device name  IP               Network
------------ -------------------- ---------------- ----------------
bmc          ipmi0                aaa.bbb.ccc.ddd  site-admin-net
physical     eth0 [prov]          10.141.255.254   esmaint-net
physical     eth1                 aaa.bbb.ccc.ddd  site-admin-net
physical     eth2                 10.148.255.254   ipmi-net

[glacier->device[glacier]->interfaces]% use eth0
[glacier->device[glacier]->interfaces[eth0]]% set additionalhostnames test
[glacier->device*[glacier*]->interfaces*[eth0*]]% commit
[glacier->device[glacier]->interfaces[eth0]]%<return>
[glacier->device[glacier]->interfaces[eth0]]%
Tue Jan 22 16:40:29 2013 [notice] glacier: Service named was restarted
[glacier->device[glacier]->interfaces[eth0]]% !ping test
PING test.cm.cluster (10.141.255.254) 56(84) bytes of data.
64 bytes from glacier.cm.cluster (10.141.255.254): icmp_seq=1 ttl=64 time=0.038 ms
64 bytes from glacier.cm.cluster (10.141.255.254): icmp_seq=2 ttl=64 time=0.033 ms
```

Note: The `!` symbol can be used to invoke Linux commands such as `ping`, when in the `cmsh`.

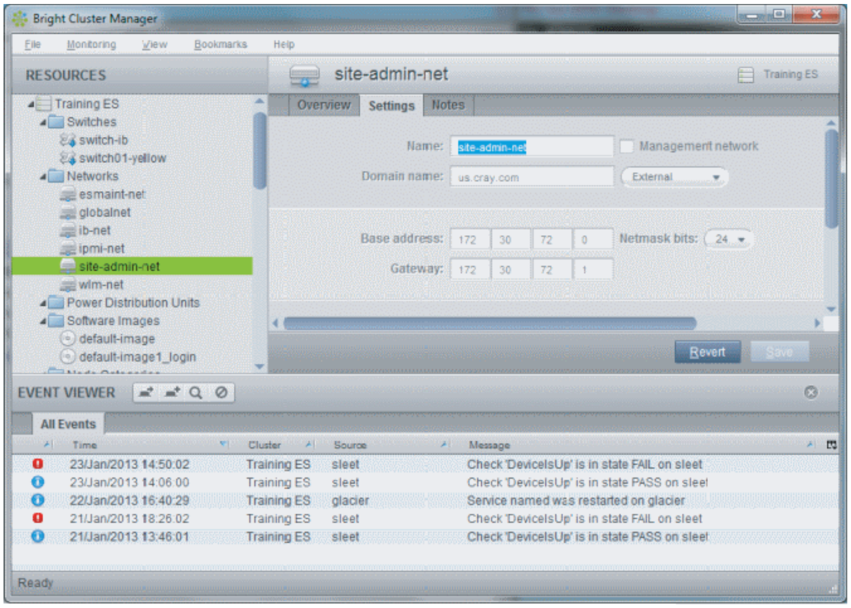
3.11.6 Changing External Network Parameters for the System

Changing the network parameters of a DMP system (apart from the IP address of the system) requires making changes to the external network object (`site-admin-net`, `site-user-net`), and the system object network settings.

3.11.6.1 Changing the External Network Object Settings

External network objects (`site-admin-net` or `site-user-net`) contain the network settings to enable connections to the external network, for example, a head node. Network settings are configured in the **Settings** tab of the **Networks** resource of `cmgui`. See Figure 37.

Figure 37. Changing External Network Object Parameters



Name: site-admin-net ☐ Management network

Domain name: us.cray.com External

Base address: 172 30 72 0 Netmask bits: 24

Gateway: 172 30 72 1

	Time	Cluster	Source	Message
❗	23/Jan/2013 14:50:02	Training ES	sleet	Check 'DevicelsUp' is in state FAIL on sleet
ℹ	23/Jan/2013 14:06:00	Training ES	sleet	Check 'DevicelsUp' is in state PASS on sleet
ℹ	22/Jan/2013 16:40:29	Training ES	glacier	Service named was restarted on glacier
❗	21/Jan/2013 18:26:02	Training ES	sleet	Check 'DevicelsUp' is in state FAIL on sleet
ℹ	21/Jan/2013 13:46:01	Training ES	sleet	Check 'DevicelsUp' is in state PASS on sleet

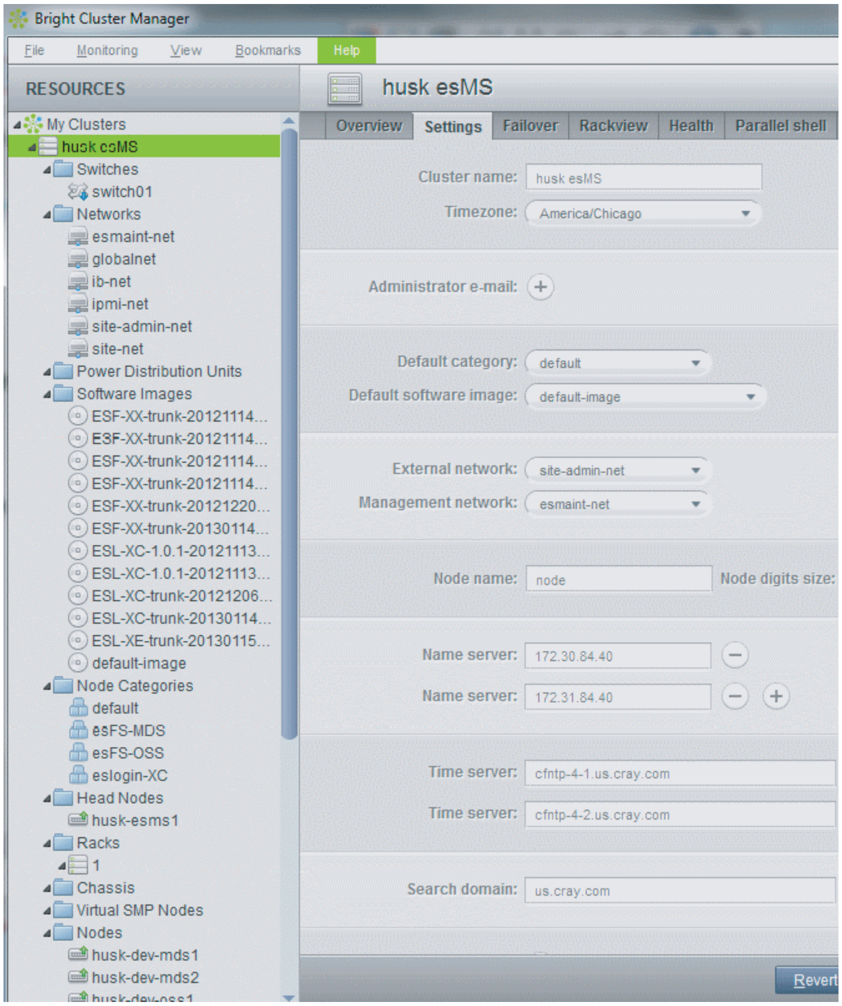
The following external network parameters can be configured:

- IP network parameters of the system (but not the IP address of the system):
  - **Base address**: the IP address of the external network. This is not to be confused with the IP address of the system.
  - **Netmask bits**: the netmask size, or prefix-length, of the external network, in bits.
  - **Gateway**: the default route for the external network.
  - **Dynamic range start** and **Dynamic range end**: Not used by the external network configuration.
- **Domain name**: the network domain (LAN domain, i.e. what domain machines on the external network use as their domain)
- **Name**: the network name such as, `site-admin-net`, `site-user-net`, `site-net`)
- The External network checkbox: this is checked for a Type 1 cluster (nodes are connected on a private internal network)
- **MTU**: size (the maximum value for a TCP/IP packet before it fragments on the external network the default value is 1500)

3.11.6.2 Changing Network Settings for the CIMS

The CIMS (head node object) contains other network settings used to connect to the outside. These are configured in the **Settings** tab of the head node object resource in `cmgui`. See Figure 38. These settings are e-mail address(es) for the administrator, the external name servers used by the system to resolve external host names, the DNS search domain (what the cluster uses as its domain), and NTP time servers (used to synchronize the time on the system with standard time) and time zone settings.

Figure 38. Changing Network Settings for the CIMS



Cluster name: husk esMS

Timezone: America/Chicago

Administrator e-mail:

Default category: default

Default software image: default-image

External network: site-admin-net

Management network: esmaint-net

Node name: node

Node digits size:

Name server: 172.30.84.40

Name server: 172.31.84.40

Time server: cfntp-4-1.us.cray.com

Time server: cfntp-4-2.us.cray.com

Search domain: us.cray.com

The static IP address of the head node can also be changed using `cmsh` in the `base` object under `partition` mode.

Example 13. Changing the Network Settings for the CIMS

```
esms1# cmsh
[esms1]% network use site-admin-net
[esms1->network[site-admin-net]]% set baseaddress 192.168.1.0
[esms1->network*[site-admin-net*]]% set netmaskbits 24
[esms1->network*[site-admin-net*]]% set gateway 192.168.1.1
[esms1->network*[site-admin-net*]]% commit
[esms1->network[site-admin-net]]% partition use base
[esms1->partition[base]]% set nameservers 192.168.1.1
[esms1->partition*[base*]]% set searchdomains searchdomain1.com searchdomain2.com
[esms1->partition*[base*]]% append timeservers ntp.timeserver1.com ntp.timeserver2.com
[esms1->partition*[base*]]% commit
[esms1->partition[base]]% device use esms1
[esms1->device[esms1]]% interfaces
[esms1->device[esms1]->interfaces]% use eth1
[esms1->device[esms1]->interfaces[eth1]]% set ip 192.168.1.176
[esms1->device[esms1]->interfaces*[eth1*]]% commit
[esms1->device[esms1]->interfaces[eth1]]% exit; exit;
[esms1->device]% reboot
```

Note: Reboot the CIMS to activate the changes.

3.11.7 Using DHCP to Supply Network Values for the External Interface

Connecting the DMP system via DHCP on the external network is not recommended. This is because DHCP-related issues can complicate network troubleshooting when compared with using static assignments.

3.12 Isolate a Slave Node for Testing

This procedure describes how to isolate a slave node (in this example, `eslogin1`) for testing.

Procedure 18. Isolating slave node for testing

1. Log in to the CIMS node as `root`.

2. Use Bright `cmsh` to create a test image.

a. Copy (clone) the current working software image. Choose a unique name to identify the new test image.

Note: This example clones the image name `ESL-XE-2.1.0` to `ESL-test-image`. Copy the image from the UNIX® prompt and wait for the copy to complete before cloning the image in Bright. This ensures the clone operation is complete before you continue.

```
esms1# cp -pr /cm/images/ESL-XE-2.1.0 /cm/images/ESL-test-image

esms1# cmsh
[esms1]% softwareimage
[esms1->softwareimage]% list
Name (key)            Path                               Kernel version
-------------------- ------------------------------------ -----------------
default-image          /cm/images/default-image            3.0.80-0.5-default
ESL-XE-2.1.0           /cm/images/ESL-XE-2.1.0             3.0.80-0.5-default

[esms1->softwareimage]% clone ESL-XE-2.1.0 ESL-test-image
[esms1->softwareimage*[ESL-test-image*]]% commit
```

b. Create a test category from your default slave node category (in this example, `esLogin-XE`) and assign the cloned image to that category.

```
[esms1->softwareimage[ESL-test-image]]% category
[esms1->category]% clone esLogin-XE esLogin-test
[esms1->category*[esLogin-test*]]% set softwareimage ESL-test-image
[esms1->category*[esLogin-test*]]% commit
```

c. Temporarily assign a CDL node (in this example, `eslogin1`) to the `esLogin-test` category.

```
[esms1->category[esLogin-test]]% device
[esms1->device]% use eslogin1
[esms1->device[eslogin1]]% set category esLogin-test
[esms1->device*[eslogin1*]]% commit
[esms1->device[eslogin1]]% category
[esms1->category]% list
Name (key)               Software image
------------------------ ------------------------
default                  default-image
esLogin-XC               default-image
esLogin-XE               ESL-XE-2.1.0
esLogin-test             ESL-test-image

[esms1->category]% usedby esLogin-test
Category used by the following:
Type             Name                     Parameter                Autochange
---------------- ------------------------ ------------------------ ------------
Device           eslogin1                 category                 no
```

d. Open a new shell window and log in to the CIMS as `root`.

e. Start `cmsh`, and launch a remote console (`rconsole`) on the CDL node.

```
esms1# cmsh
[esms1]% device use eslogin1
[esms1->device[eslogin1]]% rconsole
```

f. In a separate CIMS window, login as `root` and reboot the slave node (`eslogin1` in the example) using `cmsh` or use the **Reboot** button from the `cmgui`.

```
esms1# cmsh
[esms1]% device use eslogin1
[esms1->device[eslogin1]]% reboot
```

3. Verify the node boots without errors before you begin your testing.

4. Install and configure the new software image using the test node, and routinely test boot the system to verify proper operation.

5. After you have created the new software image, move the slave node out of the `esLogin-test` category, back into the default CDL category (in this example, `esLogin-XE`).

```
esms1# cmsh
[esms1]% device use eslogin1
[esms1->device[eslogin1]]% set category esLogin-XE
[esms1->device*[eslogin1*]]% commit
[esms1->device[eslogin1]]% list
Type           Hostname (key)   MAC                Category     Ip          Network
-------------- ---------------- ------------------ ------------ ----------- ---------
...
PhysicalNode    eslogin1         00:00:00:00:00:00  esLogin-XE   10.141.0.2  esmaint-net
```

6. Clone the new test image (`ESL-test-image`) into the new working CDL software image (in this example, `ESL-XE-2.1.0_CLE4.2`). Copy the image from the UNIX® prompt and wait for the copy to complete before cloning the image in Bright. This ensures the clone operation is complete before you continue.

```
[esms1->device[eslogin1]]% quit
esms1# cp -pr /cm/images/ESL-test-image /cm/images/ESL-XE-2.1.0_CLE4.2

esms1# cmsh
[esms1]% softwareimage clone ESL-test-image ESL-XE-2.1.0_CLE4.2
[esms1->softwareimage*[ESL-XE-2.1.0_CLE4.2*]]% commit
[esms1->softwareimage[ESL-XE-2.1.0_CLE4.2]]% list
Name (key)                     Path                                      Kernel version
------------------------------ ----------------------------------------- ----------------------
ESL-XE-2.1.0                   /cm/images/ESL-XE-2.1.0                   2.6.32.59-0.7-default
ESL-XE-2.1.0_CLE4.2            /cm/images/ESL-XE-2.1.0_CLE4.2            2.6.32.59-0.7-default
ESL-test-image                 /cm/images/ESL-test-image                 2.6.32.59-0.7-default
default-image                  /cm/images/default-image                  3.0.38-0.5-default
```

7. Use Bright to assign the new default CDL software (`ESL-XE-2.1.0_CLE4.2`) to the default CDL category (`esLogin-XE`).

```
[esms1->softwareimage[ESL-XE-2.1.0_CLE4.2]]% category
[esms1->category]% use esLogin-XE
[esms1->category*[esLogin-XE*]]% set softwareimage ESL-XE-2.1.0_CLE4.2
[esms1->category*[esLogin-XE*]]% commit
```

8. Reboot all of slave nodes in the `esLogin-XE` category with the new image.

```
[esms1->category[esLogin-XE]]% device reboot -c esLogin-XE
```

3.13 Changing Node Category

Sometimes it is necessary to change a nodes configuration for testing or in preparation for an image update. Procedure 19 describes how to change a node to a testing category which can be used to verify a new image update, etc.

Procedure 19. Change node configuration

1. Log in to the CIMS as `root`.
2. Type `cmsh` on the command line to enter the command shell:

```
esms1# cmsh
[esms1]%
```

3. Type **`category`** at the `cmsh` prompt to enter category mode and display the category mode prompt:

   ```
   [esms1->category]%
   ```

4. Clone the category of the node you wish to test. For example, we have node `eslogin01` in category `eslogin`. We wish to test a new image (`eslogin-new-image`) with this node.

   ```
   [esms1->category]% clone eslogin eslogin-test; commit
   ```

5. Now set the software image for `eslogin-test` to be the new image.

```
 [esms1->category]% set eslogin-test softwareimage eslogin-new-image; commit
```

6. Change to device mode and set the category for the node (`eslogin01`) to be `eslogin-test`.

```
[esms1->category]% device
[esms1->device]% set eslogin01 category eslogin-test; commit
```

The new configuration is applied when the node reboots.

3.14 Creating a CDL Node Group

Optional: Node groups can simplify and automate administration tasks by allowing management operations to be performed on groups of nodes. It is not necessary to configure node groups to manage the system.

Nodes may belong to several groups at the same time. There are no parameters associated with a node group other than the member nodes.

For sites with multiple CDL nodes, Cray recommends creating a node group for these nodes.

Procedure 20. Creating a CDL node group

1. Log in to the CIMS as `root` and start `cmsh`.

```
esms1# cmsh
```

2. Switch to `nodegroup` mode:

```
[esms1]% nodegroup
[esms1->nodegroup]%
```

3. Use the `add` command to add a node group. This example creates a new node group called `Login`.

```
[esms1->nodegroup]% add Login
[esms1->nodegroup*[Login*]]%
```

4. Use the `append` command to add nodes to the group.

   Note: Multiple nodes can be added as a list (*N*) or a range (`node1..node`*N*).

```
[esms1->nodegroup*[Login*]]% append nodes eslogin1..eslogin5
```

5. Commit your changes.

```
[esms1->nodegroup*[Login*]]% commit
[esms1->nodegroup[Login]]%
```

6. Exit `cmsh`.

```
[esms1->nodegroup[Login]]% quit
esms1#
```

3.15 Configuring Virtual Network Computing (VNC®) on the CIMS

Virtual Network Computing (VNC®) software enables you to view and interact with the CIMS from another computer. The Cray system provides a VNC server, `Xvnc`; you must download a VNC client to connect to it. Refer to TightVNC (http://www.tightvnc.com/) for more information.

> **Note:** The VNC software requires a TCP/IP connection between the server and the viewer. Firewalls or/and site security may restrict this connection.

Cray configures a VNC account `cray-vnc`.

Procedure 21. Starting the VNC server

1. Log in to the CIMS as `root`.

2. Use the `chkconfig` command to check the current status of the server:

   ```
   esms1# chkconfig vnc
   vnc  off
   ```

3. Disable `xinetd` startup of `Xvnc`.

   If the `chkconfig` command you executed in step 2 reports that `Xvnc` was started by INET services (`xinetd`):

   ```
   esms1# chkconfig vnc
   vnc xinetd
   ```

Execute the following commands to disable `xinetd` startup of `Xvnc` (`xinetd` startup of `Xvnc` is the SLES 11 default, but it usually is disabled by `chkconfig`):

```
esms1# chkconfig vnc off
esm1# /etc/init.d/xinetd reload
Reload INET services (xinetd).                    done
```

If no other `xinetd` services have been enabled, the `reload` command will return `failed` instead of `done`. If the `reload` command returns `failed`, this is normal and you can ignore the `failed` notification.

4. Use the `chkconfig` command to start `Xvnc` at boot time:

```
esms1# chkconfig vnc on
```

5. Start the `Xvnc` server immediately:

```
esms1# /etc/init.d/vnc start
```

If the password for `cray-vnc` has not already been established, the system prompts you for one. You must enter a password to access the server.

```
Password: ********
Verify:
Would you like to enter a view-only password (y/n)? n
xauth:  creating new authority file /home/cray-vnc/.Xauthority

New 'X' desktop is esms1:1

Creating default startup script /home/cray-vnc/.vnc/xstartup
Starting applications specified in /home/cray-vnc/.vnc/xstartup
Log file is /home/cray-vnc/.vnc/esms1:1.log

esms1# ps -eda | grep vnc
1839 pts/0    00:00:00 Xvnc
```

Note: The startup script starts the `Xvnc` server for display `:1`.

To access the `Xvnc` server, use a VNC client, such as `vncviewer`, `tight_VNC`, `vnc4`, or a web browser. Direct it to the CIMS that is running `Xvnc`. Many clients allow you to specify whether you want to connect in view-only or in an active mode. If you choose active participation, every mouse movement and keystroke made in your client is sent to the server. If more than one client is active at the same time, your typing and mouse movements are intermixed.

Note: Commands entered through the VNC client affect the system as if they were entered from the CIMS. However, the main CIMS window and the VNC clients cannot detect each other. It is a good idea for the administrator who is sitting at the CIMS to access the system through a VNC client.

Procedure 22. Connecting to VNC server through an ssh tunnel, using the vncviewer

Important: This procedure is for use with the TightVNC client program.

Verify that you have the `vncviewer -via` option available. If you do not, use Procedure 23 on page 109.

- If you are connecting from a workstation or laptop running Linux™, enter the `vncviewer` command shown below.

  The first password you enter is for `cray-vnc` on the CIMS. The second password you enter is for the VNC server on the CIMS, which was set when the VNC server was started for the first time using `/etc/init.d/vnc start` on the CIMS.

  ```
  > vncviewer -via cray-vnc@esms1 localhost:1
  Password: ********
  VNC server supports protocol version 3.130 (viewer 3.3)
  Password: ********
  VNC authentication succeeded
  Desktop name "cray-vnc's X desktop (esms:1)"
  Connected to VNC server, using protocol version 3.3
  ```

Procedure 23. Connecting to the VNC server through an ssh tunnel

Note: This procedure assumes that the VNC server on the CIMS is running with the default port of `5901`.

1. This `ssh` command starts an `ssh` session between the local Linux computer and the CIMS, and it also creates an SSH tunnel so that port `5902` on the local host is forwarded through the encrypted SSH tunnel to port `5901` on the CIMS. You will be prompted for the `cray-vnc` password on the CIMS.

   ```
   local_linux_prompt> ssh -L 5902:localhost:5901 esms1 -l cray-vnc
   Password:
   cray-vnc@esms1>
   ```

2. Now `vncviewer` can be started using the local side of the SSH tunnel, which is port `5902`. You will be prompted for the password of the VNC server on the CIMS. This password was set when the VNC server was started for the first time using `/etc/init.d/vnc start` on the CIMS.

   ```
   remote% vncviewer localhost:2
   Connected to RFB server, using protocol version 3.7
   Performing standard VNC authentication
   Password:
   ```

   The VNC window from the CIMS appears. All traffic between the `vncviewer` on the local Linux computer and the VNC server on the CIMS is now encrypted through the SSH tunnel.

Procedure 24. Connecting an Apple® Mac® OS X system to the VNC server through an ssh tunnel

Note: This procedure assumes that the VNC server on the CIMS is running with the default port of `5901`.

1. The following `ssh` command starts an `ssh` session between the local Mac OS X® computer and the CIMS, and it also creates an SSH tunnel so that port `5902` on the localhost is forwarded through the encrypted SSH tunnel to port `5901` on the CIMS. You will be prompted for the `cray-vnc` password on the CIMS.

   ```
   local_mac_prompt> ssh -L 5902:localhost:5901 esms1 -l cray-vnc
   Password:
   cray-vnc@esms1>
   ```

2. The `vncviewer` can now be started using the local side of the SSH tunnel, which is port `5902`. You will be prompted for the password of the VNC server on the CIMS. This password was set when the VNC server was started for the first time using `/etc/init.d/vnc start` on the CIMS.

   If you type this on the Mac OS X command line after having prepared the SSH tunnel, the `vncviewer` window displays.

   ```
   local_mac_prompt% open vnc://localhost:5902
   ```

   The VNC window from the CIMS appears. All traffic between the `vncviewer` on the local Mac OS X computer and the VNC server on the CIMS is now encrypted through the SSH tunnel.

Procedure 25. Connecting to the VNC server through an ssh tunnel with Windows®

Note: If you are connecting from a computer running Windows®, then both a VNC client program, such as TightVNC and an SSH program, such as PuTTY, SecureCRT®, or OpenSSH are recommended.

1. The same method described in Procedure 23 can be used for computers running the Windows operating system.

   Although TightVNC encrypts VNC passwords sent over the network, the rest of the traffic is sent unencrypted. To avoid a security risk, install and configure an SSH program that creates an SSH tunnel between TightVNC on the local computer (localhost port `5902`) and the remote VNC server (localhost port `5901`).

   > **Note:** Details about how to create the SSH tunnel vary amongst the different SSH programs for Windows computers.

2. After installing TightVNC, start the VNC viewer program by double-clicking on the **TightVNC** icon. Enter the host name and VNC screen number, `localhost:`*number* (such as, `localhost:2` or `localhost:5902`), and then click on the **Connect** button.

3.16 Adding a Managed Switch or Device to the Bright Configuration

You can include Ethernet, InfiniBand® (IB), Fibre Channel (FC), or serial-attached SCSI (SAS) switches, RAID controllers, or intelligent PDU to the Bright configuration. Refer to the device documentation supplied by the manufacturer for configuration and setup procedures. Bright uses SNMP community strings to communicate to devices. SNMP must be enabled for the device and the SNMP community strings should be configured correctly. By default, the SNMP community strings for switches and PDUs are typically set to public and private for respectively read and write access. Example 14 shows how to configure SNMP community strings for an Ethernet switch using `cmsh`.

Example 14. Changing SNMP community strings for devices

```
[esms1]% device use switch1-esmaint-net
[esms1->device[switch1-esmaint-net]]% get readstring
public
[esms1->device[switch1-esmaint-net]]% get writestring
private
[esms1->device[switch1-esmaint-net]]% set readstring public2
[esms1->device*[switch1-esmaint-net*]]% set writestring private2
[esms1->device*[switch1-esmaint-net*]]% commit
```

The following procedure describes how to setup a Mellanox IS50xx series IB switch and configure Bright to manage it. Refer to Figure 3 for the standard IP addressing scheme used on the `esmaint-net` network for switches or other devices.

> **Note:** Most device command-line interfaces (CLIs) have built-in help systems that can be displayed by entering `?` on the command line. Some switches also support a context-sensitive help system that displays valid commands or command options when pressing the `Tab` key.

Uplink ports (switch ports that are connected to other switches or to the `esmaint-net`) must be configured in Bright. CMDaemon must be told about any switch ports that are uplink ports, or the traffic passing through an uplink port will lead to mistakes in what CMDaemon knows about port and MAC correspondence.

Procedure 26. Adding a Mellanox IS50XX series switch to the Bright configuration

1. Connect the serial management port on the switch to a laptop or PC running terminal emulator software (e.g., minicom, Putty, etc.).

   > **Note:** Settings are typically 9600 Baud, 8N1, no flow control, and VT100 emulation.

2. Press return in emulator software console window to display the console prompt. It may be necessary to power cycle the switch to reset the console.

3. Do **not** use the setup wizard. Enter `Ctrl-z` to exit the wizard, if it starts.

4. Enter the login and password (refer to the switch documentation for default login and password).

```
Mellanox FabricIT Switch Management
switch-5e0120 login: admin
Password: admin
Last login: Mon Aug 20 12:55:57 on ttyS0
Mellanox Switch
```

5. Type a question mark **?** on the command line to display valid commands from the current mode.

```
switch-5e0120 [standalone: master] > ?
cli              Configure CLI shell options
enable           Enter enable mode
exit             Log out of the CLI
fabric           Manage fabric diagnostics
help             View description of the interactive help system
no               Negate or clear certain configuration options
ping             Send ICMP echo requests to a specified host
show             Display system configuration or statistics
slogin           Log into another system securely using ssh
telnet           Log into another system using telnet
terminal         Set terminal parameters
test             Diagnostics
traceroute       Trace the route packets take to a destination
ib-switch-1 [standalone: master] >
```

6. At the console prompt, run the following commands to enable switch configuration from a terminal:

```
switch-5e0120 [standalone: master]# enable
switch-5e0120 [standalone: master]# configure terminal
```

7. Set up simple network management protocol (SNMP).

```
conswitch-5e0120 [standalone: master] (config)# snmp-server community public
```

8. Set the IP address and netmask of the Ethernet port used to connect to the `esmaint-net` network (in this example `eth0`).

```
switch-5e0120 [standalone: master] (config)# interface eth0 ip address
10.141.200.1 255.255.255.0
```

9. Set a host name for the switch.

```
switch-5e0120 [standalone: master] (config)# hostname ib-switch-1
ib-switch1 [standalone: master] (config) #
```

10. Write the configuration to memory and exit.

```
ib-switch1 [standalone: master] (config) # write memory
ib-switch1 [standalone: master] (config) #
ib-switch-1 [standalone: master] (config) # exit
ib-switch-1 [standalone: master] # exit

Mellanox FabricIT Switch Management

ib-switch-1 login:
```

11. Log in to the CIMS as `root` and start `cmsh`.

```
esms1# cmsh
[esms1]%
```

12. From `device` mode, add the IB switch to Bright. Your options for device type are: `cloudnode`, `physicalnode`, `virtualsmpnode`, `headnode`, `ethernetswitch`, `ibswitch`, `myrinetswitch`, `powerdistributionunit`, `genericdevice`, `racksensor`, `chassis`, `gpuunit`. Use the host name that you configured for the switch in step 9.

```
[esms1]% device add ibswitch ib-switch-1
[esms1->device*[ib-switch-1*]]%
```

13. Set the management network to `esmaint-net`.

```
[esms1->device*[ib-switch-1*]]% set network esmaint-net
```

14. Set the IP address for interface configured in step 8.

```
[esms1->device*[ib-switch-1*]]% set ip 10.141.200.1
```

15. Configure the SNMP read string to public and write string to private.

```
[esms1->device*[ib-switch-1*]]% set readstring public
[esms1->device*[ib-switch-1*]]% set writestring private
```

16. (Optional) Use the `cmsh set` command to set other switch parameters such as `rack` ID, `deviceheight` (1U), `deviceposition` in rack, `mac` address, hardware `tag`, and administrator `notes`. All of these settings can be configured using the `cmgui` after the switch configured in Bright.

17. Commit the changes and list the devices managed by Bright.

```
[esms1->device*[ib-switch-1*]]% commit
[esms1->device[ib-switch-1]]% list
esms1#

[esms1->device[ib-switch-1]]% quit
esms1#Type                   Hostname (key)      MAC                Category        Ip            Network
---------------------- ------------------- ------------------ ---------------- --------------- ------------
EthernetSwitch         esmaint-net-switch  00:0F:8F:8E:9D:C0                   10.141.50.1     esmaint-net
EthernetSwitch         ipmi-net-switch     00:0B:5F:CE:2F:40                   10.148.50.1     ipmi-net
EthernetSwitch         wlm-net-switch      00:00:00:00:00:00                   10.128.100.1    wlm-net
HeadNode               esms1               78:2B:CB:40:CE:CA                   10.141.255.254  esmaint-net
IBSwitch               ib-switch-1         00:00:00:00:00:00                   10.141.200.1    esmaint-net
PhysicalNode           eslogin-001         84:2B:2B:61:B0:04  esLogin-XC       10.141.0.37     esmaint-net
PhysicalNode           mds001              78:2B:CB:50:E9:A3  -mds         10.141.0.10     esmaint-net
[esms1->device[ib-switch-1]]%
```

18. Exit `cmsh`.

```
[esms1->device*[ib-switch-1*]]% quit
esms1#
```

3.17 DELL™ 5548 Switch Configuration

The CIMS system should include configuration settings for Ethernet switches so that they can be monitored by Bright. Use this procedure to change switch settings for a Dell 5548 switch if your system is not pre-configured, or if you need to reconfigure another Ethernet switch.

For the VLAN port assignments, see Figure 2.

Procedure 27. Configuring the Dell 5548 1GbE switch

> **Note:** This procedure shows the instructions for a 48-port Ethernet switch. For a 24-port Ethernet switch, use the VLAN port rules and example commands to adapt the configuration for a smaller switch.

1. Connect the serial port of the switch to a suitable VT100 emulator (minicom, Putty, etc.).

   > **Note:** Settings are 9600 Baud, 8N1, no flow control, VT100 emulation.

2. Power on the switch.
3. Do **not** use the setup wizard. Enter `Ctrl-z` to exit the wizard, if it starts.
4. At the console prompt, run the following commands:

```
console> enable
console# config
```

5. Set up SNMP.

```
console (config)# snmp-server community public
```

6. Set up the VLANs.

```
console (config)# vlan database
console (config-vlan)# vlan 2
console (config-vlan)# vlan 3
console (config-vlan)# vlan 4
console (config-vlan)# exit
console (config)# interface vlan 1
console (config-if)# name esmaint-net
console (config-if)# interface vlan 2
console (config-if)# name ipmi-net
console (config-if)# interface vlan 3
console (config-if)# name site-admin-net
console (config-if)# interface vlan 4
console (config-if)# name site-user-net
console (config-if)# exit
```

7. Configure management IP and the netmask. This is always on VLAN 1 (on `esmaint-net`).

```
console (config)# interface vlan 1
console (config-if)# ip address 10.141.0.100 255.255.0.0
console (config-if)# exit
```

8. Set the default gateway of VLAN 1 to be the IP address of `eth0` on the CIMS.

```
console (config)# ip default-gateway 10.141.255.254
```

9. Configure the ports to the VLANs using the scheme shown in Figure 2.

   Note: In the commands below, replace *NN* with the appropriate VLAN port number.

   a. Configure the remaining VLAN 1 ports (on `esmaint-net`) by running the following two commands for each port on this VLAN.

```
console (config)# interface gigabitethernet 0/NN
console (config-if)# switchport access vlan 1
```

   b. Configure the VLAN 2 ports (on `ipmi-net`) by running the following two commands for each port on this VLAN.

```
console (config-if)# interface gigabitethernet 0/NN
console (config-if)# switchport access vlan 2
```

   c. Configure the VLAN 3 ports (on `site-admin-net`) by running the following two commands for each port on this VLAN.

```
console (config-if)# interface gigabitethernet 0/NN
console (config-if)# switchport access vlan 3
```

   d. Configure the VLAN 4 ports (on `site-user-net`) by running the following two commands for each port on this VLAN.

```
console (config-if)# interface gigabitethernet 0/NN
console (config-if)# switchport access vlan 4
```

10. Disable spanning tree protocol (STP) to disable loop-free, redundant bridging paths between daisy-chained switches.

```
console (config-if)# no spanning-tree
```

11. Set up the `admin` and `root` users:

```
console (config-if)# exit
console (config)# username admin privilege 15 password initial0
console (config)# username root privilege 15 password initial0
console (config)# exit
```

12. Save the configuration.

```
console# exit
console# write
Overwrite file [startup-config]? [yes/press any key for no] yes
console# exit
```

3.18 Zoning the QLogic® FC Switch

If your system includes QLogic® Fibre Channel (FC) switch, follow Procedure 28 on page 116 to zone the LUNs on your QLogic SANBox™ switch by using a utility called QuickTools.

> **Note:** If a LUN is to be shared between failover host pairs, each host must be given access to the LUN. The CIMS host port should be given access to all LUNs.

QuickTools is an application that is embedded in the QLogic switch and is accessible from a workstation browser with a compatible Java™ plug-in. You must have a Java browser plugin, version 1.4.2 or later.

These instructions assume that the disk device has four host ports connected to ports 0-3 for the QLogic SANbox switch.

Zoning is implemented by creating a *zone set*, adding one or more zones to the zone set, and selecting the ports to use in the zone.

This procedure presupposes that the SANBox is configured and on `esmaint-net` network.

Procedure 28. Configuring zoning for a QLogic SANbox switch using QuickTools utility

1. Start a web browser.
2. Enter the IP address of your switch on the `esmaint-net` network. The IP address of each RAID controller is preconfigured by Cray and is listed on a sticker on the back of the RAID controller.
3. Enter the login name and password when the **Add a New Fabric** window pops up and prompts for them. The default administrative login name is `admin`, and the default password is `password`.
4. The QuickTools utility displays in your browser. Click **Add Fabric**.

   > **Note:** If you receive a dialog box notification that the request failed to connect over a secured connection, click **Yes** and continue.

5. The switch is located and displayed in the window. Double-click the **switch** icon. Information about the switch displays in the right panel.
6. At the bottom of the panel, click the **Configured Zonesets** tab.
7. From the Tool Bar menu, select **Zoning** and then **Edit Zoning**. The **Edit Zoning** window displays.
8. Click the **Zone Set** button. The **Create a Zone Set** window displays. Create a new zone set. (In this example, assume that the zone set is named `XT0`.)
9. Right-click the **XT0 zone** and select **Create a Zone**.

10. Create a new zone name.

11. On the right panel, click the button in front of *zonename* to open a view of the domain members.

12. Define the ports in the zone to ensure that the discovery of LUNs is consistent among the CIMS, CLFS, and CDL nodes. Using the mouse, left-click on the desire port, and draft it to *zonename*.

13. Click **Apply**. The **error-checking** window displays.

14. When prompted, select **Perform Error Check**.

15. After confirming that no errors were found, click **Save Zoning**.

16. When prompted to activate a Zone Set, click **Yes** and then select the appropriate **XT3** zone set.

17. At this point, Cray recommends that you create a backup of your switch configuration (Procedure 29 on page 117) before you close and exit the application.

Procedure 29. Creating a backup of your QLogic switch configuration

Create a backup of your QLogic switch configuration with the QuickTools utility. You must have a Java browser plugin, version 1.4.2 or later to use QuickTools.

If you need to start your web browser and open the QuickTools utility, complete steps 1 through 4. If you currently have the QuickTools utility open, skip to step 5.

1. Start a web browser.

2. Enter the IP address of your switch on `esmaint-net`. The IP address of each RAID controller is preconfigured by Cray and is listed on a sticker on the back of the RAID controller.

3. Enter the login name and password when the **Add a New Fabric** window pops up and prompts for them. The RAID default administrative login name is `admin`, and the default password is `password`.

4. The QuickTools utility appears. Click **Add Fabric**.

   Note: If you receive a dialog box that states that the request failed to connect over a secured connection, click **Yes** and continue.

5. From within the QuickTools utility, complete the configuration backup.

   a. At the top bar, select **Switch** and then **Archive**. A **Save** window pops up with blanks for **Save in:** and **File Name:**.

   b. Enter the directory (for example, `crayadm`) and a file name (for example, `sanbox_archive`) for saving your QLogic switch configuration.

c. Click the **Save** button.

6. Close and exit the application.

3.19 Configuring the InfiniBand (ib-net) Network for Slave Nodes

The InfiniBand® network (ib-net) is used only by slave nodes in the DMP system, but is configured on the CIMS. Before adding any slave nodes to the system, you must configure the InfiniBand network (ib-net) in Bright.

Procedure 30. Configuring the InfiniBand (ib-net) network in Bright

1. Open a window on the CIMS, log in as root, and enter the cmsh command:

```
esms1# cmsh
[esms1]%
```

2. Switch to network mode:

```
[esms1]% network
[esms1->network]%
```

3. Check the currently configured networks with the list command. These networks were defined in the customized Cray XML configuration file.

Note: The network globalnet is created by Bright but is not used in a DMP system.

```
[esms1->network]% list
Name (key)       Type         Netmask bits     Base address     Domain name          IPv6
---------------- ------------ ---------------- ---------------- -------------------- ----
esmaint-net      Internal     16               10.141.0.0       esmaint-net.cluster  no
globalnet        Global       16               0.0.0.0          cm.cluster           no
ipmi-net         Internal     16               10.148.0.0       ipmi-net.cluster     no
site-admin-net   External     20               aaa.bbb.ccc.ddd  your.domain.com       no
```

4. Use the clone subcommand to clone a similar network:

```
[esms1->network]% clone ipmi-net ib-net
```

Note: The prompt displayed in step 5.a is abbreviated as "%" in the following steps.

5. Set the network parameters.

a. Set the base IP address to 10.149.0.0.

```
% set baseaddress 10.149.0.0
```

b. Set the domain name to ib-net.cluster.

```
% set domainname ib-net.cluster
```

c. Set the netmask bits to 16.

```
% set netmaskbits 16
```

d. Set the MTU:

```
% set mtu 2044
```

e. Set the broadcast address:

```
% set broadcastaddress 10.149.255.255
```

f. Use the `show` subcommand to view your changes.

```
% show
Parameter                      Value
------------------------------ ------------------------------------------------
Base address                   10.149.0.0
Broadcast address              10.149.255.255
Domain Name                    ib-net.cluster
Dynamic range end              0.0.0.0
Dynamic range start            0.0.0.0
Gateway                        0.0.0.0
IPv6                           no
Lock down dhcpd                no
MTU                            2044
Management allowed             no
Netmask bits                   16
Node booting                   no
Notes                          <0 bytes>
Revision
Type                           Internal
name                           ib-net
```

g. Save your changes.

```
% commit
```

6. Display the changed network list.

```
[esms1->network]% list
Name (key)       Type         Netmask bits     Base address     Domain name          IPv6
---------------- ------------ ---------------- ---------------- -------------------- ----
esmaint-net      Internal     16               10.141.0.0       esmaint-net.cluster  no
globalnet        Global       16               0.0.0.0          cm.cluster           no
ib-net           Internal     16               10.149.0.0       ib-net.cluster       no
ipmi-net         Internal     16               10.148.0.0       ipmi-net.cluster     no
site-admin-net   External     20               aaa.bbb.ccc.ddd  your.domain.com      no
```

7. Exit `cmsh`.

```
% quit
```

3.20 iDRAC Remote Console

In addition to the remote console capabilities of Bright, DELL™ servers provide a remote console and administrative interface through the IP address of the iDRAC port on the CIMS that is accessible from a web browser. The iDRAC interface enables CIMS control through the node's baseboard management controller (BMC).

> **Note:** Refer to Administrative Passwords on page 60 to change the iDRAC administrative password from the Bright `cmsh` shell.

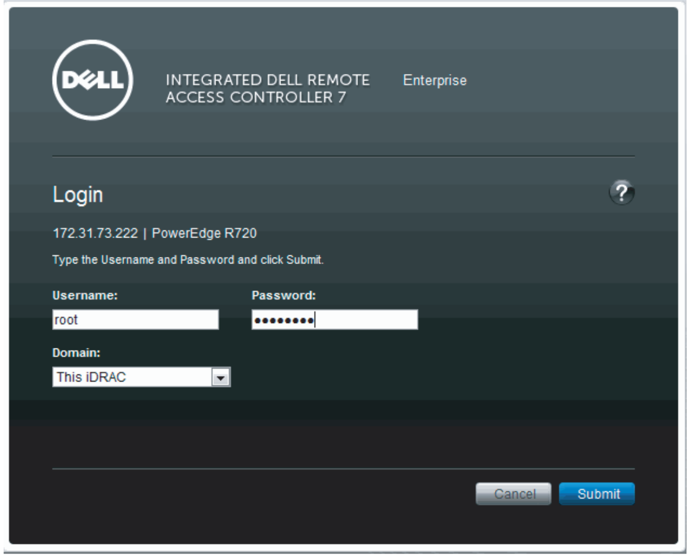
For detailed information, see the Dell iDRAC documentation:

`http://support.dell.com/support`

Procedure 31. Using the iDRAC7 web interface and remote console

1. From a web browser, open the IP address of the CIMS iDRAC port, `https://`*idrac_port_IP*. A login screen displays.

   Figure 39. iDRAC Login Page

   172.31.73.222 | PowerEdge R720

   Type the Username and Password and click Submit.

   Username: root

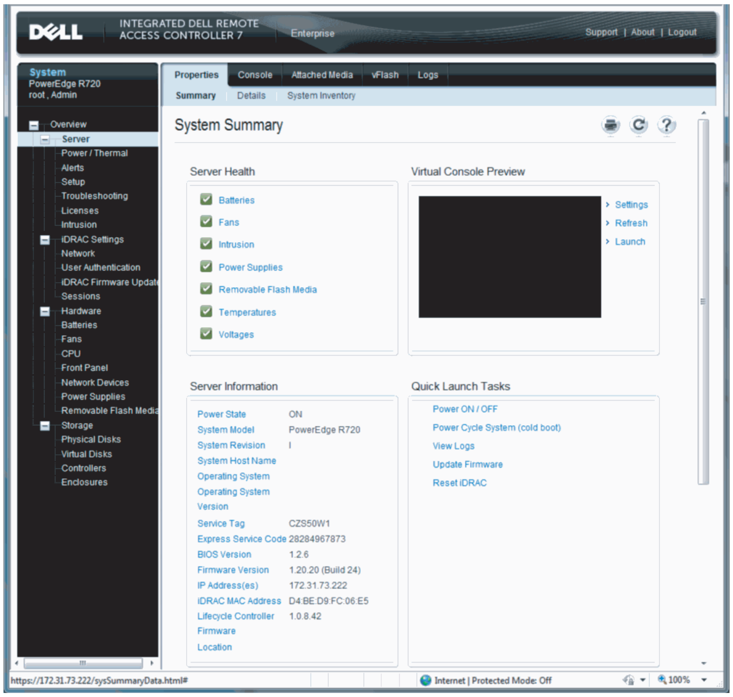
   Password: ••••••••

   Domain: This iDRAC

2. Enter the account user name (`root`) and password (`initial0`). Then click on **Submit**.

   The **System Summary** window displays. CIMS power, control, and status information is available from this interface.

Figure 40. iDRAC System Summary Page



Server Health

- ✓ Batteries
- ✓ Fans
- ✓ Intrusion
- ✓ Power Supplies
- ✓ Removable Flash Media
- ✓ Temperatures
- ✓ Voltages

Server Information

Power State	ON
System Model	PowerEdge R720
System Revision	I
System Host Name	
Operating System	
Operating System Version	
Service Tag	CZS50W1
Express Service Code	28284967873
BIOS Version	1.2.6
Firmware Version	1.20.20 (Build 24)
IP Address(es)	172.31.73.222
iDRAC MAC Address	D4:BE:D9:FC:06:E5
Lifecycle Controller Firmware	1.0.8.42
Location	

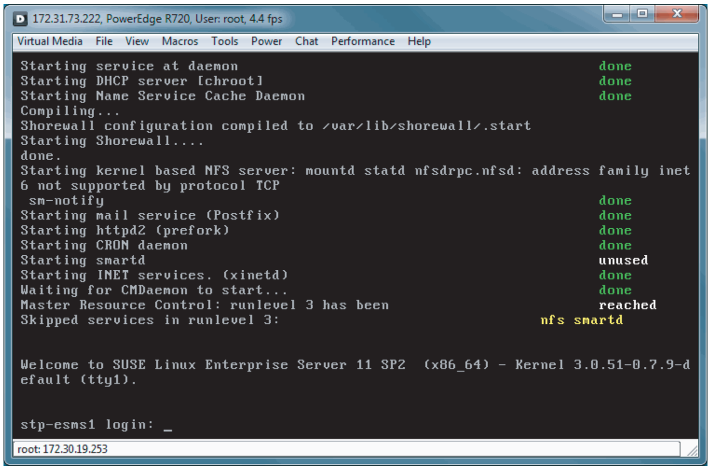
3. To access the CIMS console, click on the **Console** tab.

   The **Virtual Console** window appears.

4. Click on **Launch Virtual Console**.

   > **Note:** The iDRAC web interface may request to install a Virtual Console Java™ application. Confirm the installation of this application to use the Virtual Console feature.

Figure 41. iDRAC Remote Console Window



```
Starting service at daemon                                           done
Starting DHCP server [chroot]                                        done
Starting Name Service Cache Daemon                                   done
Compiling...
Shorewall configuration compiled to /var/lib/shorewall/.start
Starting Shorewall....
done.
Starting kernel based NFS server: mountd statd nfsdrpc.nfsd: address family inet
6 not supported by protocol TCP
 sm-notify                                                           done
Starting mail service (Postfix)                                      done
Starting httpd2 (prefork)                                            done
Starting CRON daemon                                                 done
Starting smartd                                                      unused
Starting INET services. (xinetd)                                     done
Waiting for CMDaemon to start...                                     done
Master Resource Control: runlevel 3 has been                         reached
Skipped services in runlevel 3:                               nfs smartd


Welcome to SUSE Linux Enterprise Server 11 SP2  (x86_64) - Kernel 3.0.51-0.7.9-d
efault (tty1).


stp-esms1 login: _
```

Tip: Press the `F9` key to access the console window menu.

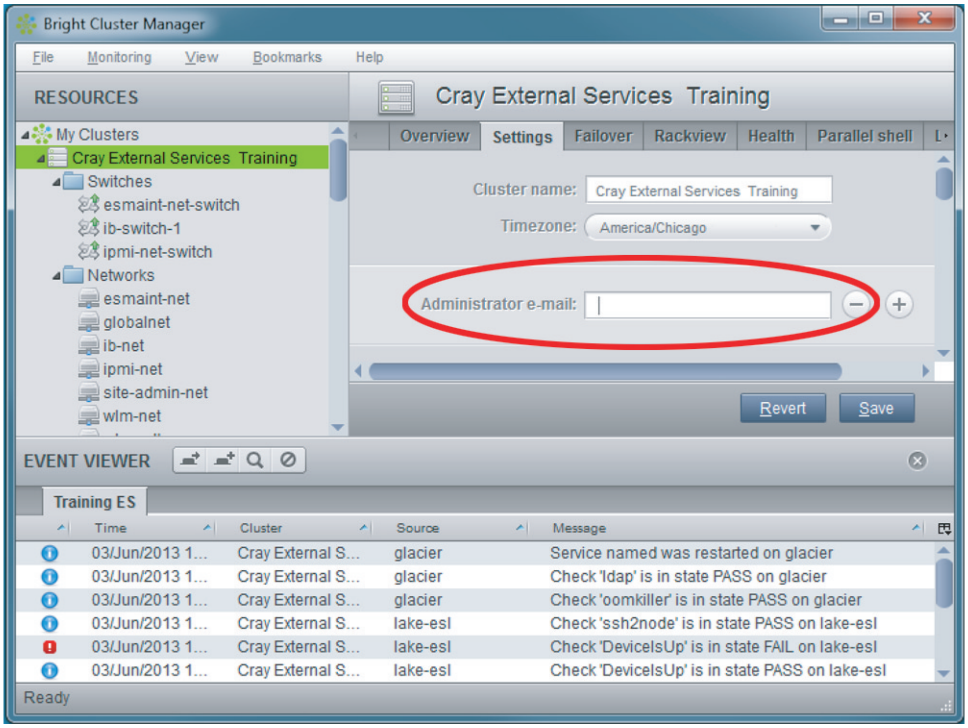
Tip: To logout of the virtual console, close the window or select **File**, then **Exit** from the console menu. You will still be logged into the iDRAC port from your web browser.

3.21 Configuring Administrator Email Alerts from the CIMS

Procedure 32. Configuring administrator email alerts from the CIMS using `cmgui`

1. Open the `cmgui` and select the DMP system name in the **RESOURCES** tree.
2. Select the **Settings** tab.
3. Click on the + symbol (see Figure 42), and enter the administrator Email address in the **Administrator e-mail** field.

Figure 42. Administrator's Email Address



Cluster name: Cray External Services Training

Timezone: America/Chicago

Administrator e-mail:

	Time	Cluster	Source	Message
i	03/Jun/2013 1...	Cray External S...	glacier	Service named was restarted on glacier
i	03/Jun/2013 1...	Cray External S...	glacier	Check 'ldap' is in state PASS on glacier
i	03/Jun/2013 1...	Cray External S...	glacier	Check 'oomkiller' is in state PASS on glacier
i	03/Jun/2013 1...	Cray External S...	lake-esl	Check 'ssh2node' is in state PASS on lake-esl
!	03/Jun/2013 1...	Cray External S...	lake-esl	Check 'DeviceIsUp' is in state FAIL on lake-esl
i	03/Jun/2013 1...	Cray External S...	lake-esl	Check 'DeviceIsUp' is in state PASS on lake-esl

Procedure 33. Configuring administrator email alerts from the CIMS using `cmsh`

1. Log in to the CIMS as `root` and start `cmsh`.

```
esms1# cmsh
[esms1]%
```

2. Switch to `partition` mode.

```
[esms1]%partition
[esms1->partition]%
```

3. Use the base object in partition mode.

```
[esms1->partition]% use base
[esms1->partition[base]]%
```

4. Set the administrator's email address.

```
[esms1->partition[base]]% set administratore-mail johndoe@server.com
[esms1->partition*[base*]]% commit
Tue Jun  4 10:09:27 2013 [notice] esms1: Service postfix was restarted
```

5. (Optional) To include additional administrator email addresses, enter:

```
[esms1->partition[base]]% append administratore-mail janesmith@server.com
[esms1->partition*[base*]]% get administratore-mail
johndoe@server.com
janesmith@server.com
[esms1->partition*[base*]]% commit
Tue Jun  4 10:11:12 2013 [notice] esms1: Service postfix was restarted
```

6. (Optional) To remove `johndoe@server.com` from the administrators email list enter:

```
[esms1->partition[base]]% removefrom administratore-mail johndoe@server.com
[esms1->partition*[base*]]% commit
Tue Jun  4 10:11:12 2013 [notice] esms1: Service postfix was restarted
```

3.22 Configuring SSH Keys for `eswrap` on CDL and Internal Login Nodes

This procedures describes how to configure SSH Keys on CDL and internal login nodes by using `ssh-agent` or passphrase-less RSA®/DSA keys. By default, SSH prompts for a password on each command wrapped by `eswrap`.

Note: Consult the site security policies before configuring transparent SSH access. This procedure creates DSA keys.

Procedure 34. Configuring SSH Keys for `eswrap` on CDL and internal login nodes

1. Log in to the CIMS as `root`.

2. SSH to a CDL node as `root` and create a key with `ssh-keygen`.

```
esms1# ssh eslogin1
Last login: Tue May  7 10:52:08 2013 from esms1.cm.cluster
eslogin1#
```

3. Select the type of key, either RSA or DSA and the number of bits (DSA keys must be 1024 bits). The choice depends on the site security policy. Save the key in `id_dsa.pub`.

```
eslogin1# ssh-keygen -t dsa -b 1024
Generating public/private dsa key pair.
Enter file in which to save the key (/root/.ssh/id_dsa): /root/.ssh/id_dsa.pub
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /root/.ssh/id_dsa.pub
Your public key has been saved in /root/.ssh/id_dsa.pub
The key fingerprint is:
56:cd:94:e4:3f:ef:a2:9a:a2:bc:17:c4:63:8b:a6:1a root@eslogin1
The key's randomart image is:
+--[ DSA 1024]----+
|           .o.   |
|           =.    |
|       .  . +    |
|        =.   .   |
|       +So    o  |
|      o.o      o |
|  E  o   .      .|
|   ...  o  .  .. |
|  ..  ++ .o... ..|
+-----------------+
```

4. Copy the contents of the public key file (`id_dsa.pub` or `id_dsa.pub`).

5. On the Cray internal login node (aka login gateway), edit the file `$HOME/.ssh/authorized_keys` and append the public key from the CDL file `id_dsa.pub`.

6. Repeat step 2 through step 4 for all CDL nodes that can access that Cray system.

   Note: On a system that does not share user home directories between CDL nodes and the Cray system, you can remove the SSH key prompts for an unknown host by setting up a `known_hosts` file (`$HOME/.ssh/known_hosts`) and/or authorized_keys file (`$HOME/.ssh/authorized_keys`) on the Cray system.

7. SSH to an internal Cray login node (`craylogin`).

```
eslogin1# ssh craylogin
The authenticity of host 'craylogin (10.128.1.132)' can't be established.
DSA key fingerprint is a8:0d:b0:5c:f8:d2:ec:4f:00:b8:69:87:7d:28:ac:05.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'craylogin,10.128.1.132' (DSA) to the list of known hosts.
Password:
Creating directory '/home/users/username'.

Welcome to XE system  craylogin
```

8. Create a `.ssh` directory for login `username` and `cd` into that directory.

```
craylogin users/username> mkdir -p ~/.ssh
craylogin users/username> cd .ssh
```

9. Use secure FTP to transfer the id_dsa.pub file you create in step 3 from the eslogin1 node to the Cray internal login node.

```
craylogin users/username/.ssh> sftp username@eslogin1:.ssh/id_dsa.pub
. Connecting to eslogin1...
The authenticity of host 'eslogin1 (aaa.bbb.ccc.ddd)' can't be established.
DSA key fingerprint is b8:87:2c:43:31:2d:9f:64:2b:30:e3:08:45:cb:78:65.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'eslogin1,aa.bbb.ccc.ddd' (DSA) to the list of known hosts.
Password:
Fetching /home/users/username/.ssh/id_dsa.pub to ./id_dsa.pub
/home/users/username/.ssh/id_dsa.pub    100%  737     0.7KB/s   00:00

craylogin users/username/.ssh> ls
id_rsa.pub  known_hosts
```

10. Copy the id_dsa.pub key to an authorized_keys file.

```
craylogin users/username/.ssh> cat id_dsa.pub >> authorized_keys
ccraylogin users/username/.ssh> ls
authorized_keys  id_dsa  id_dsa.pub  known_hosts
```

11. Logout of the Cray internal login node.

```
craylogin users/username/.ssh> logout
Connection to craylogin closed.
```

12. Verify you can run wrapped commands without entering a password.

```
eslogin1# eswrap --help
eslogin1# echo $ESWRAP_LOGIN
eslogin1# which xtnodestat
/opt/cray/eslogin/eswrap/1.0.15/bin/xtnodestat

eslogin1# xtnodestat
Current Allocation Status at Mon Sep 10 13:13:00 2012

     C0-0             C1-0             C2-0             C3-0
  n3 ---------------- AAAAAAAAAAAAAAaa ---------------- --------------AA
  n2 ---------------- AAAAAAAAAAAAAAaa ---------------- --------------AA
  n1 ---------------- AAAAAAAAAAAAAAaa ---------------- --------------AA
c2n0 ---------------- AAAAAAAAAAAAAAaa ---------------- --------------AA
  n3 - -------------- AAAAAAAAAAAAAAAA a aaaaaaaaaaaaaa ----------------
  n2 -S-------------- AAAAAAAAAAAAAAAA aSaaaaaaaaaaaaaa ----------------
  n1 -S-------------- AAAAAAAAAAAAAAAA aSaaaaaaaaaaaaaa ----------------
c1n0 - -------------- AAAAAAAAAAAAAAAA a aaaaaaaaaaaaaa ----------------
  n3  --------------- --------------AA  aaaaaaaaaaaaaaa ----------------
  n2 S--------------- --------------AA Saaaaaaaaaaaaaaa ----------------
  n1 S--------------- --------------AA Saaaaaaaaaaaaaaa ----------------
c0n0  --------------- --------------AA  aaaaaaaaaaaaaaa ----------------
    s0123456789abcdef 0123456789abcdef 0123456789abcdef 0123456789abcdef


Legend:
   nonexistent node                      S  service node
;  free interactive compute node         -  free batch compute node
A  allocated (idle) compute or ccm node  ?  suspect compute node
W  waiting or non-running job            X  down compute node
Y  down or admindown service node        Z  admindown compute node

Available compute nodes:          0 interactive,        488 batch


Job ID     User       Size   Age        State           command line
--- ------ --------   -----  ---------  --------  ----------------------------------
a   302511 addy       128    0h17m      run        gamess.ga.x
eslogin1#
```

3.23 Save the System Configuration

After you have installed the CIMS software and configured all of the nodes and devices in Bright, save the site configuration to an XML file so you can recover the system configuration from a backup. To save your site customizations, use the `cmd -x` *siteconfigfile*`.xml` command, to generate a human-readable configuration file.

Caution: The `cmd -i` *siteconfigfile*`.xml` command can restore your system configuration only when all the system images available in `/cm/images` are present and all other site customizations have been configured in Bright.

Procedure 35. Save the system configuration settings to an XML file

1. Log in to the CIMS as `root`.

```
remote% ssh root@esms1
```

2. Stop the `cmd` daemon.

```
esms1#/etc/init.d/cmd stop
Waiting for CMDaemon (26823) to terminate...
                                              done
```

3. Dump the system configuration to an XML file.

```
# cmd -x SiteConfig_Dump.xml
Wed Feb 13 13:37:50 2013   Info: CMDaemon version 1.4 (r15096)
Wed Feb 13 13:37:50 2013   Info: Reading configuration from /cm/local/apps/cmd/etc/cmd.conf
Wed Feb 13 13:37:50 2013   Info: CMDaemon auditing is disabled
Wed Feb 13 13:37:50 2013   Info: Initialize cmdaemon database
Wed Feb 13 13:37:50 2013   Info: Initialize monitoring database
Wed Feb 13 13:37:50 2013   Info: Database: Mirroring not required to remote master. no partition
Wed Feb 13 13:37:50 2013   Info: Database: no index on timestamp present in MonData table
Wed Feb 13 13:37:50 2013   Info: Database: using mysql's bulkinsert with interval of 3600s
Wed Feb 13 13:37:51 2013   Info: Succesfully stored configuration in SiteConfig_Dump.xml
```

4. Start the `cmd` daemon.

```
# /etc/init.d/cmd start
Waiting for CMDaemon to start...                done
```

Procedure 36. Load system configuration settings from an XML file

⚠ **Caution:** Use the `cmd -i` *siteconfigfile*`.xml` command with caution. You can restore your system configuration using the `cmd -i` command only if you have all the system images available in `/cm/images` and all other site customizations properly configured in Bright. If the `cmd -i` command fails, it could potentially render the system inoperable.

1. Log in to the CIMS as `root`.

```
remote% ssh root@esms1
```

2. Stop the `cmd` daemon.

```
esms1# /etc/init.d/cmd stop
Waiting for CMDaemon (26823) to terminate...
                                              done
```

3. Dump the system configuration to an XML file.

```
esms1# cmd -i SiteConfig.xml
Wed Feb 13 13:44:48 2013   Info: CMDaemon version 1.4 (r15096)
Wed Feb 13 13:44:48 2013   Info: Reading configuration from /cm/local/apps/cmd/etc/cmd.conf
Wed Feb 13 13:44:48 2013   Info: CMDaemon auditing is disabled
Wed Feb 13 13:44:49 2013   Info: Billing Service enabled
Wed Feb 13 13:44:49 2013   Info: Initialize cmdaemon database
Wed Feb 13 13:44:49 2013   Info: Drop cmdaemon database
Wed Feb 13 13:44:49 2013   Info: Create cmdaemon database
Wed Feb 13 13:44:52 2013   Info: Recreate monitoring database
.
.
.
```

4. Start the `cmd` daemon.

```
esms1# /etc/init.d/cmd start
Waiting for CMDaemon to start...                done
```

Note: All slave nodes appear `DOWN` in Bright until you restart the `cmd` service on each slave node.

3.24 Resizing Partitions on the CIMS

If the CIMS was not configured as an HA system and is being integrated into an HA system, then you must resize the `/cm` partition to accommodate the required Distributed Replicated Block Device (DRBD) partitions. If DRBD partitions are already defined, do not perform this procedure.

Procedure 37. Resizing partitions on a CIMS

1. Log in to the CIMS as `root`.

```
remote% ssh root@esms1
```

2. Determine which devices holds the `/cm` partition.

```
esms1# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/sda5       177G  3.1G  165G   2% /
devtmpfs         32G  240K   32G   1% /dev
tmpfs            32G     0   32G   0% /dev/shm
/dev/sda1       473M   22M  427M   5% /boot
/dev/sdb3       3.3T   30G  3.1T   1% /cm
/dev/sda3        61G  180M   57G   1% /tmp
/dev/sdb1       962G  373M  913G   1% /var
/dev/sdb2       9.4G  155M  8.8G   2% /var/lib/mysql/cmdaemon_mon
```

3. Backup the existing `/cm` partition to a tarball in `/cm-backup.tar.gz`.

```
esms1# tar zcf cm-backup.tar.gz /cm
tar: Removing leading `/' from member names
tar: Removing leading `/' from hard link targets
esms1# ls -l cm-backup.tar.gz
-rw-r--r-- 1 root root 16384685013 Sep 19 14:25 cm-backup.tar.gz
```

4. Use the `parted` utility to verify where `/cm` is mounted on `/dev/sdb` (`/dev/sdb` was determined to hold the `/cm` partition from step 2.

```
esms1# parted /dev/sdb
GNU Parted 2.3
Using /dev/sdb
Welcome to GNU Parted! Type 'help' to view a list of commands.
(parted) p
Model: DELL PERC H710P (scsi)
Disk /dev/sdb: 4723GB
Sector size (logical/physical): 512B/512B
Partition Table: gpt

Number  Start   End     Size    File system  Name                         Flags
 1      17.4kB  1049GB  1049GB  ext3         /var
 2      1049GB  1059GB  10.2GB  ext3         /var/lib/mysql/cmdaemon_mon
 3      1059GB  4723GB  3665GB  ext3         /cm

(parted) quit
esms1#
```

5. Shut down all slave nodes to free `/cm/shared` which is NFS® mounted on all slave nodes. This example has only one slave node named `eslogin1`.

```
esms1# cmsh
[esms1]% device
[esms1->device]% status
eslogin1 ............. [   UP   ]
esms1 ................... [   UP   ]
sw-1ge .................. [  DOWN  ]
[esms1->device]% shutdown eslogin1
eslogin1: Shutdown in progress ...
[esms1->device]%
Wed Sep 19 14:28:20 2012 [notice] esms1: eslogin1 [  DOWN  ]
[esms1->device]% power status
ipmi0 ................... [   OFF   ] eslogin1
ipmi0 ................... [   ON    ] esms1
No power control ......... [ UNKNOWN ] sw-1ge
[esms1->device]% quit
```

6. Shut down the CMDaemon (`cmd`).

```
 esms1# /etc/init.d/cmd stop
 Waiting for CMDaemon (4838) to terminate... done
```

7. Use `lsof` to determine if `/cm` is being used.

```
esms1# lsof /cm
COMMAND  PID USER   FD   TYPE DEVICE SIZE/OFF      NODE NAME
slapd   3475 ldap  txt    REG   8,19  2949776 159072337 /cm/local/apps/openldap/sbin/slapd
slapd   3475 ldap  mem    REG   8,19   441348 159072328 /cm/local/apps/openldap/lib/libldap_r-2.4.so.2.8.3
slapd   3475 ldap  mem    REG   8,19    81962 159072318 /cm/local/apps/openldap/lib/liblber-2.4.so.2.8.3
slapd   3475 ldap  mem    REG   8,19 10036285 159065221 /cm/local/apps/openldap/db4/lib/libdb-4.6.so
conmand 5035 root  txt    REG   8,19   387897 159121453 /cm/local/apps/conman/sbin/conmand
conmand 5035 root  mem    REG   8,19   781050 159072826 /cm/local/apps/freeipmi/1.1.3/lib/libipmiconsole.so.2.2.1
conmand 5035 root  mem    REG   8,19  6524146 159072821 /cm/local/apps/freeipmi/1.1.3/lib/libfreeipmi.so.12.0.2
conmand 5035 root    5rR  REG   8,19      414 159121420 /cm/local/apps/conman/etc/conman.conf
```

8. step 7 shows that `ldap` and `conman` are using the `/cm` partition. Stop the `ldap` and `conman` services. Because `/cm` contains `/cm/shared`, which is NFS exported, stop the `nfsserver` service, as well.

```
esms1# /etc/init.d/ldap status
Checking for service ldap:                                            running
esms1# /etc/init.d/ldap stop
Shutting down ldap-server                                             done
esms1# /etc/init.d/conman stop
Stopping ConMan: conmand                                              done
esms1# /etc/init.d/nfsserver stop
Shutting down kernel based NFS server: nfsd statd mountd              done
```

9. Unmount `/cm` and run `parted` to resize the `/cm` partition by removing it and creating it with a smaller size.

   a. Unmount `/cm`.

```
esms1# umount /cm
```

   b. Start `parted` and list the existing partitions

```
esms1# parted /dev/sdb
GNU Parted 2.3
Using /dev/sdb
Welcome to GNU Parted! Type 'help' to view a list of commands.
(parted) p
Model: DELL PERC H710P (scsi)
Disk /dev/sdb: 4723GB
Sector size (logical/physical): 512B/512B
Partition Table: gpt

Number  Start   End     Size    File system  Name                         Flags
 1      17.4kB  1049GB  1049GB  ext3         /var
 2      1049GB  1059GB  10.2GB  ext3         /var/lib/mysql/cmdaemon_mon
 3      1059GB  4723GB  3665GB  ext3         /cm

(parted)
```

   c. Remove the `/cm` partition.

```
(parted) rm 3
(parted) p
Model: DELL PERC H710P (scsi)
Disk /dev/sdb: 4723GB
Sector size (logical/physical): 512B/512B
Partition Table: gpt

Number  Start   End     Size    File system  Name                         Flags
 1      17.4kB  1049GB  1049GB  ext3         /var
 2      1049GB  1059GB  10.2GB  ext3         /var/lib/mysql/cmdaemon_mon

(parted)
```

d. Make a new smaller sized `/cm` partition and quit.

```
(parted) mkpart /cm 1059GB 3930GB
(parted) p
Model: DELL PERC H710P (scsi)
Disk /dev/sdb: 4723GB
Sector size (logical/physical): 512B/512B
Partition Table: gpt

Number  Start   End     Size    File system  Name                         Flags
 1      17.4kB  1049GB  1049GB  ext3         /var
 2      1049GB  1059GB  10.2GB  ext3         /var/lib/mysql/cmdaemon_mon
 3      1059GB  3930GB  2871GB  ext3         /cm

(parted) quit
Information: You may need to run /etc/fstab.
```

10. Run `makefs.ext3` on the device that contained `/cm` (`/dev/sdb3` in this example).

```
esms1# mkfs.ext3 /dev/sdb3
mke2fs 1.41.9 (22-Aug-2009)
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
175243264 inodes, 700972288 blocks
35048614 blocks (5.00%) reserved for the super user
First data block=0
Maximum filesystem blocks=4294967296
21392 block groups
32768 blocks per group, 32768 fragments per group
8192 inodes per group
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376, 294912, 819200, 884736, 1605632, 2654208,
        4096000, 7962624, 11239424, 20480000, 23887872, 71663616, 78675968,
        102400000, 214990848, 512000000, 550731776, 644972544

Writing inode tables:    10/21392
done
Creating journal (32768 blocks): done
Writing superblocks and filesystem accounting information: done
```

11. Mount the `/cm` partition.

```
esms1# mount /cm
esms1# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/sda5       177G   19G  150G  11% /
devtmpfs         32G  244K   32G   1% /dev
tmpfs            32G     0   32G   0% /dev/shm
/dev/sda1       473M   22M  427M   5% /boot
/dev/sda3        61G  180M   57G   1% /tmp
/dev/sdb1       962G  373M  913G   1% /var
/dev/sdb2       9.4G  155M  8.8G   2% /var/lib/mysql/cmdaemon_mon
/dev/sdb3       2.6T  202M  2.5T   1% /cm
```

12. Restore `/cm` from the backup tarball.

```
esms1# cd /cm
esms1:/cm # cp /root/cm-backup.tar.gz .
esms1:/cm # tar zxf cm-backup.tar.gz
esms1:/ # ls /cm
CLUSTERMANAGERID  conf    local       node-installer  shared
README            images  lost+found  nodeinstaller
```

13. Start `nfsserver` and `cmd`.

```
esms1:/ # /etc/init.d/nfsserver start
Starting kernel based NFS server: mountd statd nfsdrpc.nfsd: address family inet6 not
supported by protocol TCP
 sm-notify                                                            done
esms1:/ # /etc/init.d/cmd start
Waiting for CMDaemon to start...                                      done
```

14. Boot the slave nodes.

```
esms1:/ # cmsh
[esms1]% device
[esms1->device]% list
Type                   Hostname (key)   MAC                Category         Ip
      Network        PowerDistributio
---------------------- ---------------- ------------------ ---------------- --------------- -------------
EthernetSwitch         sw-1ge           00:00:00:00:00:00                   10.141.253.1    esmaint-net
MasterNode             esms1            D4:AE:52:B5:E2:64                   10.141.255.254  esmaint-net
PhysicalNode           eslogin1         D4:AE:52:B5:A4:68  eslogin          10.141.0.1      esmaint-net
[esms1->device]% power status
ipmi0 .................... [   OFF   ] eslogin1
ipmi0 .................... [   ON    ] esms1
No power control ......... [ UNKNOWN ] sw-1ge

[esms1->device]% power -n eslogin1 on
ipmi0 .................... [   ON    ] eslogin1
[esms1->device]%
Wed Sep 19 15:16:08 2012 [notice] esms1: eslogin1 [     INSTALLING      ] (nod
e installer started)
[esms1->device]%
Wed Sep 19 15:16:38 2012 [notice] esms1: eslogin1 [ INSTALLER_CALLINGINIT ] (s
witching to local root)
[esms1->device]%
Wed Sep 19 15:17:35 2012 [notice] esms1: eslogin1 [   UP   ]
[esms1->device]% status
eslogin1 ..................[   UP   ]
esms1 .................... [   UP   ]
sw-1ge ................... [  DOWN  ] health check failed
Wed Sep 19 15:18:01 2012 [notice] eslogin1: Check 'DeviceIsUp' is in state PASS on
 eslogin1

[esms1->device]% pexec -n eslogin1 "df -h"

[eslogin1] :
Filesystem         Size  Used Avail Use% Mounted on
/dev/sda5          767G  3.0G  725G   1% /
devtmpfs            32G  192K   32G   1% /dev
tmpfs               32G     0   32G   0% /dev/shm
/dev/sda3           31G  659M   28G   3% /tmp
/dev/sda2           61G  601M   57G   2% /var
master:/cm/shared  2.6T   31G  2.5T   2% /cm/shared
master:/home       177G   19G  150G  11% /home

[esms1->device]% quit
```

15. Create new `drbd` partitions in the free space of `/dev/sdb`

a. Start parted and list partitions on /dev/sdb.

```
esms1:/ # parted /dev/sdb
GNU Parted 2.3
Using /dev/sdb
Welcome to GNU Parted! Type 'help' to view a list of commands.
(parted) p
Model: DELL PERC H710P (scsi)
Disk /dev/sdb: 4723GB
Sector size (logical/physical): 512B/512B
Partition Table: gpt

Number  Start   End     Size    File system  Name                         Flags
 1      17.4kB  1049GB  1049GB  ext3         /var
 2      1049GB  1059GB  10.2GB  ext3         /var/lib/mysql/cmdaemon_mon
 3      1059GB  3930GB  2871GB  ext3         /cm

(parted)
```

b. Make a 20GB, /drbd1 partition with an ext2 file system.

```
(parted) mkpart
Partition name?  []? /drbd1
File system type?  [ext2]?
Start? 3930GB
End? 3950GB
(parted) p
Model: DELL PERC H710P (scsi)
Disk /dev/sdb: 4723GB
Sector size (logical/physical): 512B/512B
Partition Table: gpt

Number  Start   End     Size    File system  Name                         Flags
 1      17.4kB  1049GB  1049GB  ext3         /var
 2      1049GB  1059GB  10.2GB  ext3         /var/lib/mysql/cmdaemon_mon
 3      1059GB  3930GB  2871GB  ext3         /cm
 4      3930GB  3950GB  20.0GB               /drbd1
```

c. Make a 1GB, /drbd2 partition.

```
(parted) mkpart
Partition name?  []? /drbd2
File system type?  [ext2]?
Start? 3950GB
End? 3951GB
```

d. Make a 1GB, /drbd3 partition with an ext2 file system.

```
(parted) mkpart
Partition name?  []? /drbd3
File system type?  [ext2]?
Start? 3951GB
End? 3952GB
```

e. Make a `16GB`, `/drbd4` partition.

```
(parted) mkpart
Partition name?  []? /drbd4
File system type?  [ext2]?
Start? 3952GB
End? 3968GB
```

f. Make a `/drbd5` partition with the remaining space (in this example `755GB`).

```
(parted) mkpart
Partition name?  []? /drbd4
File system type?  [ext2]?
Start? 3968GB
End? 4723GB

(parted) quit
Information: You may need to update /etc/fstab.
```

16. Show free disk blocks and files.

```
esms1:/ # df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/sda5       177G   19G  150G  11% /
devtmpfs         32G  264K   32G   1% /dev
tmpfs            32G     0   32G   0% /dev/shm
/dev/sda1       473M   22M  427M   5% /boot
/dev/sda3        61G  180M   57G   1% /tmp
/dev/sdb1       962G  349M  913G   1% /var
/dev/sdb2       9.4G  156M  8.8G   2% /var/lib/mysql/cmdaemon_mon
/dev/sdb3       2.6T   31G  2.5T   2% /cm
```

17. Make an `ext3` file system on `/dev/sdb4`.

```
esms1:/ # mkfs.ext3 /dev/sdb4
```

18. Make as `ext3` file system on `/dev/sdb5`.

```
esms1:/ # mkfs.ext3 /dev/sdb5
```

19. Make as `ext3` file system on `/dev/sdb6`.

```
esms1:/ # mkfs.ext3 /dev/sdb6
```

20. Make as `ext3` file system on `/dev/sdb7`.

```
esms1:/ # mkfs.ext3 /dev/sdb7
```

21. Make as `ext3` file system on `/dev/sdb8`.

```
esms1:/ # mkfs.ext3 /dev/sdb8
```

22. Verify the partitions are correct.

```
esms1:/ # parted /dev/sdb
GNU Parted 2.3
Using /dev/sdb
Welcome to GNU Parted! Type 'help' to view a list of commands.
(parted) p
Model: DELL PERC H710P (scsi)
Disk /dev/sdb: 4723GB
Sector size (logical/physical): 512B/512B
Partition Table: gpt

Number  Start   End     Size    File system  Name                         Flags
 1      17.4kB  1049GB  1049GB  ext3         /var
 2      1049GB  1059GB  10.2GB  ext3         /var/lib/mysql/cmdaemon_mon
 3      1059GB  3930GB  2871GB  ext3         /cm
 4      3930GB  3950GB  20.0GB               /drbd1
 5      3950GB  3951GB  999MB                /drbd2
 6      3951GB  3952GB  1000MB               /drbd3
 7      3952GB  3968GB  16.0GB               /drbd4
 8      3968GB  4723GB  755GB                /drbd5

(parted) quit
```

23. Create mount points and mount the new `drbd` partitions.

```
esms1# mkdir -p /drbd1 /drbd2 /drbd3 /drbd4 /drbd5
esms1# mount /dev/sdb4 /drbd1
esms1# mount /dev/sdb5 /drbd2
esms1# mount /dev/sdb6 /drbd3
esms1# mount /dev/sdb7 /drbd4
esms1# mount /dev/sdb8 /drbd5
esms1:/ # df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/sda5       177G   19G  150G  11% /
devtmpfs         32G  264K   32G   1% /dev
tmpfs            32G     0   32G   0% /dev/shm
/dev/sda1       473M   22M  427M   5% /boot
/dev/sda3        61G  180M   57G   1% /tmp
/dev/sdb1       962G  349M  913G   1% /var
/dev/sdb2       9.4G  156M  8.8G   2% /var/lib/mysql/cmdaemon_mon
/dev/sdb3       2.6T   31G  2.5T   2% /cm
/dev/sdb4        19G  173M   18G   1% /drbd1
/dev/sdb5       938M   18M  874M   2% /drbd2
/dev/sdb6       939M   18M  875M   2% /drbd3
/dev/sdb7        15G  166M   14G   2% /drbd4
/dev/sdb8       693G  198M  658G   1% /drbd5
esms1:/ # exit
```

3.25 Configuring DHCP to Allow Requests from Unknown Nodes

By default, the CIMS node is configured to ignore PXE boot requests from nodes with unknown MAC addresses. If your CIMS administration network (`esmaint-net`) contains only DMP nodes, you can configure the Dynamic Host Configuration Protocol (DHCP) server to allow the CIMS to answer PXE boot requests from nodes with unknown MAC addresses.

Note: Consult your site's security policy before you enable this feature.

Procedure 38. Configuring DHCP to allow requests from unknown nodes

1. Edit `/cm/local/apps/cmd/etc/cmd.conf`.
2. Set `LockDownDhcpd = false`
3. Save your changes and exit.

3.26 Changing the CIMS Firewall Configuration

The CIMS runs the Shorewall Firewall package. Configuration files are located in `/etc/shorewall` (such as the firewall rules in `/etc/shorewall/rules`).

By default, the CIMS allows ICMP traffic from the external interface (`site-admin-net`) and SSH traffic over ports 22 and 8081.

Note: Port 8081 (SSL) must be open to use the Bright Cluster Management GUI (`cmgui`) from an external server.

Depending on site requirements, the default firewall settings may need to be modified. If changes are made to the Shorewall configuration, you must restart the `shorewall` service using the following command.

```
esms1# /etc/init.d/shorewall restart
```

CDL Administration Tasks [4]

4.1 Creating a CDL Node in Bright Cluster Manager®

The easiest way to add a new slave node is to clone an existing node that is configured and fully functional in Bright Cluster Manager® (Bright). When you do not have a functioning CDL node, you must clone the default node (`node001`) created during the CIMS installation process.

Note: In this guide, some examples are left-justified to fit command lines or display output on a single line. Left-justification has no special significance.

Procedure 39. Creating a CDL node in Bright

Note: The following procedures use the Bright management shell (`cmsh`). They may also be performed using the Bright GUI (`cmgui`).

The `cmsh` command prompt displays an asterisk (`*`) when you have uncommitted changes. Be sure to commit your changes using the `commit` command before exiting `cmsh`, or your changes will be lost. When using the `cmgui`, be sure to click the **Save** button as needed to save and commit your changes.

1. Log in to the CIMS as `root` and start `cmsh`.

```
esms1# cmsh
[esms1]%
```

2. Enter `device` mode.

```
[esms1]% device
[esms1->device]%
```

3. List the available devices.

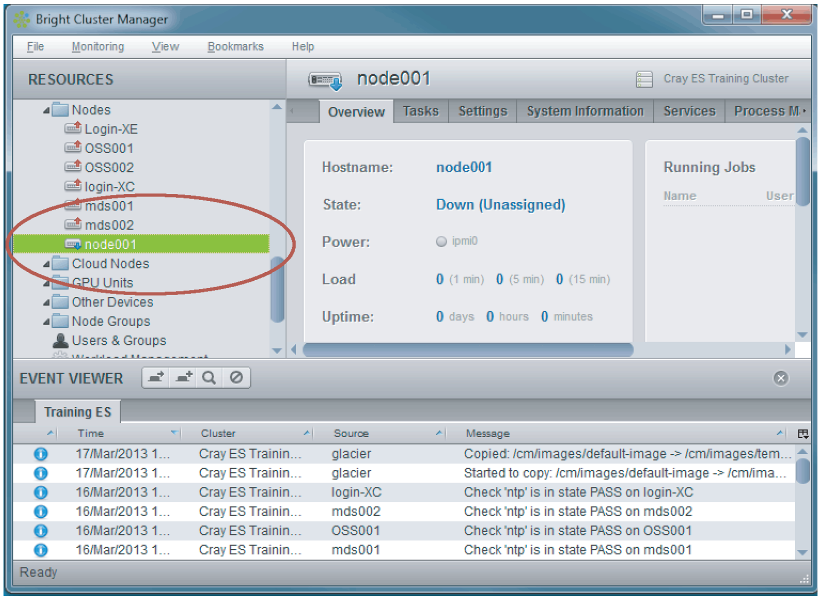
```
[esms1->device]% list
Type                   Hostname (key)   MAC                Category   Ip              Network
---------------------- ---------------- ------------------ ---------- --------------- --------------
EthernetSwitch         switch01         00:00:00:00:00:00             10.141.253.1    esmaint-net
MasterNode             esms1            78:2B:CB:40:CE:CA             10.141.255.254  esmaint-net
PhysicalNode           node001          00:00:00:00:00:00  default    10.141.0.1      esmaint-net
```

4. Clone an existing node such as the default node. This example creates a new CDL node named `eslogin1`.

```
[esms1->device]% clone node001 eslogin1
Base name mismatch, IP settings will not be modified!
```

Note: When the CIMS is installed, Bright creates a default node, `node001`, which is placed in the `default` category and uses the default slave image (`/cm/images/default-image`). This image is assigned to the newly cloned node.

Figure 43. Default Node in Bright



Hostname: node001

State: Down (Unassigned)

Power: ipmi0

Load 0 (1 min) 0 (5 min) 0 (15 min)

Uptime: 0 days 0 hours 0 minutes

Time	Cluster	Source	Message
17/Mar/2013 1...	Cray ES Trainin...	glacier	Copied: /cm/images/default-image -> /cm/images/tem...
17/Mar/2013 1...	Cray ES Trainin...	glacier	Started to copy: /cm/images/default-image -> /cm/ima...
16/Mar/2013 1...	Cray ES Trainin...	login-XC	Check 'ntp' is in state PASS on login-XC
16/Mar/2013 1...	Cray ES Trainin...	mds002	Check 'ntp' is in state PASS on mds002
16/Mar/2013 1...	Cray ES Trainin...	OSS001	Check 'ntp' is in state PASS on OSS001
16/Mar/2013 1...	Cray ES Trainin...	mds001	Check 'ntp' is in state PASS on mds001

Note: When repeating this procedure for additional CDL nodes, clone the first fully configured and functional CDL node (`eslogin1`) instead of the default node (`node001`).

5. Change the interface settings for the new (cloned) node.

   a. Switch to `interfaces` mode and list interfaces on `eslogin1`.

```
[esms1->device*[eslogin1*]]% interfaces
[esms1->device*[eslogin1*]->interfaces]% list
Type         Network device name  IP               Network
------------ -------------------- ---------------- ----------------
bmc          ipmi0                10.148.0.1       ipmi-net
physical     BOOTIF [prov]        10.141.0.1       esmaint-net
```

b. Set the `BOOTIF` and `ipmi0` interface addresses for the new node. These addresses must be different from those used by the default or original node.

```
[esms1->device*[eslogin1*]->interfaces]% set bootif ip 10.141.0.2
[esms1->device*[eslogin1*]->interfaces*]% set ipmi0 ip 10.148.0.2
[esms1->device*[eslogin1*]->interfaces*]% list
Type         Network device name  IP               Network
------------ -------------------- ---------------- ----------------
bmc          ipmi0                10.148.0.2       ipmi-net
physical     BOOTIF [prov]        10.141.0.2       esmaint-net
```

c. Set up the `ib-net` network and interface.

```
[esms1->device*[eslogin1*]->interfaces*]% add physical ib0
[esms1->device*[eslogin1*]->interfaces*[ib0*]]% set network ib-net
[esms1->device*[eslogin1*]->interfaces*[ib0*]]% set ip 10.149.0.2
[esms1->device*[eslogin1*]->interfaces[ib0]]% show
Parameter                      Value
------------------------------ ------------------------------------------------
Additional Hostnames
Card Type
DHCP                           no
IP                             10.149.0.2
MAC                            00:00:00:00:00:00
Network                        ib-net
Network device name            ib0
Revision
Speed
Type                           physical
```

d. Commit your changes.

```
[esms1->device*[eslogin1*]->interfaces*[ib0*]]% commit
```

e. Exit `ib0`.

```
[esms1->device[eslogin1]->interfaces[ib0]]% exit
```

f. Check the results.

```
[esms1->device[eslogin1]->interfaces]% list
Type         Network device name  IP               Network
------------ -------------------- ---------------- ----------------
bmc          ipmi0                10.148.0.2       ipmi-net
physical     BOOTIF [prov]        10.141.0.2       esmaint-net
physical     ib0                  10.149.0.2       ib-net
```

g. Exit `interface` mode and return to `device` mode.

```
[esms1->device[eslogin1]->interfaces]% exit
```

h. Display the status of the new node.

```
[esms1->device[eslogin1]]% status
eslogin1 ............... [  DOWN  ]  (Unassigned)
```

Note: The node is unassigned because the MAC address has not been set in Bright.

6. Set the MAC address for the CDL node (`eth0` on `esmaint-net`).

```
[esms1->device[eslogin1]]% set mac MACaddress
```

7. Set the management network to `esmaint-net`.

```
[esms1->device[eslogin1*]]% set managementnetwork esmaint-net
```

8. Commit your changes and exit `cmsh`.

```
[esms1->device*[eslogin1*]]% commit
[esms1->device[eslogin1]]% quit
esms1#
```

4.2 Configuring Network Parameters for the Site User Network

Before using a CDL node, you must configure the site network that is used by slave CDL nodes and set up the network parameters for each node.

Procedure 40. Setting network parameters for `site-user-net`

Note: This procedure uses the network name `site-user-net`. Substitute the name of your external user (site) network for user access.

1. Log in to the CIMS as `root` and run the `cmsh` command.

```
esms1# cmsh
[esms1]%
```

2. Switch to `network` mode:

```
[esms1]% network
[esms1->network]%
```

3. Display the existing networks.

```
[esms1->network]% list
Name (key)       Type         Netmask bits     Base address     Domain name          IPv6
---------------- ------------ ---------------- ---------------- -------------------- ----
esmaint-net      Internal     16               10.141.0.0       esmaint-net.cluster  no
globalnet        Global       16               0.0.0.0          cm.cluster           no
ib-net           Internal     16               10.149.0.0       ib-net.cluster       no
ipmi-net         Internal     16               10.148.0.0       ipmi.net.cluster     no
site-admin-net   External     24               aaa.bbb.ccc.ddd  your.domain.com      no
```

4. Determine whether a `site-user-net` exists on the CIMS.

   a. If a `site-user-net` already exists on the CIMS, proceed to step 7.

   b. Create `site-user-net` by cloning the `site-admin-net` network.

```
[esms1->network]% clone site-admin-net site-user-net
```

5. The cloned network inherits the same settings as the original network (`site-admin-net`). You must change several settings for `site-user-net`: base address, broadcast address, domain name, gateway, and (if necessary) netmask bits.

a. Display the existing settings.

```
[esms1->network*[site-user-net*]% show
Parameter                      Value
------------------------------ ---------------------
Base address                   aaa.bbb.ccc.ddd
Broadcast address              aaa.bbb.255.255
Domain Name                    your.domain.com
Dynamic range end              0.0.0.0
Dynamic range start            0.0.0.0
Gateway                        aaa.bbb.ccc.ddd
IPv6                           no
Lock down dhcpd                no
MTU                            1500
Management allowed             no
Netmask bits                   24
Node booting                   no
Notes                          <0 bytes>
Revision
Type                           External
name                           site-user-net
```

b. Change the base address.

```
[esms1->network*[site-user-net*]% set baseaddress site-user-netBaseAddress
```

c. Change the broadcast address.

```
[esms1->network*[site-user-net*]% set broadcastaddress site-user-netBroadcastAddress
```

d. Change the domain name.

```
[esms1->network*[site-user-net*]% set domainname site-user-netDomainName
```

e. Change the gateway.

```
[esms1->network*[site-user-net*]% set gateway site-user-netGateway
```

f. If necessary, change the netmask bits.

```
[esms1->network*[site-user-net*]% set netmaskbits NN
```

6. Commit your changes.

```
[esms1->network*[site-user-net*]% commit
```

7. Switch to `device` mode.

```
[esms1->network[site-user-net]% device
```

8. Add an interface to the `site-user-net` network. This example shows the host name `eslogin1`, the Ethernet port `eth2`, and the example IP address aaa.bbb.ccc.ddd. Substitute your CDL node's host name and IP address when configuring the `eth2` interface.

Important: If necessary, specify `eth0` instead of `eth2`.

```
[esms1->device]% addinterface -n eslogin1 physical eth2 site-user-net aaa.bbb.ccc.ddd
```

Note: You must repeat this step for each CDL node that is added to the `site-user-net` network.

9. Commit your changes.

```
[esms1->device*[eslogin1*]]% commit
```

10. Show the interfaces on `eslogin1`.

```
[esms1->device% use eslogin1
[esms1->device[eslogin1]]% interfaces; list
Type         Network device name  IP               Network
------------ ------------------- ---------------- ----------------
bmc          ipmi0                10.148.0.37      ipmi-net
physical     BOOTIF [prov]        10.141.0.37      esmaint-net
physical     eth2                 aaa.bbb.ccc.ddd  site-user-net
physical     ib0                  10.149.0.37      ib-net
```

11. Display the existing networks.

```
[esms1->device[eslogin1]->interfaces]% network list
Name (key)       Type         Netmask bits     Base address     Domain name          IPv6
---------------- ------------ ---------------- ---------------- -------------------- ----
esmaint-net      Internal     16               10.141.0.0       esmaint-net.cluster  no
globalnet        Global       16               0.0.0.0          cm.cluster           no
ib-net           Internal     16               10.149.0.0       ib-net.cluster       no
ipmi-net         Internal     16               10.148.0.0       ipmi-net.cluster     no
site-admin-net   External     24               aaa.bbb.ccc.ddd  your.domain.com     no
site-user-net    External     24               aaa.bbb.ccc.ddd  your.domain.com     no
[esms1]%
```

12. Exit `cmsh`.

```
[esms1->device[eslogin1]->interfaces]% quit
esms1#
```

4.3 Creating the Workload Manager Network (`wlm-net`)

The workload manager network (`wlm-net`) connects the CDL nodes to a switch or gateway and then to the internal login nodes on the Cray system.

Procedure 41. Creating the workload manager network (`wlm-net`)

1. Log in to the CIMS as `root` and run the `cmsh` command.

```
esms1# cmsh
[esms1]%
```

2. Switch to `network` mode:

```
[esms1]% network
[esms1->network]%
```

3. Display the existing networks.

```
[esms1->network]% list
Name (key)       Type         Netmask bits     Base address     Domain name          IPv6
---------------- ------------ ---------------- ---------------- -------------------- ----
esmaint-net      Internal     16               10.141.0.0       esmaint-net.cluster  no
globalnet        Global       16               0.0.0.0          cm.cluster           no
ib-net           Internal     16               10.149.0.0       ib-net.cluster       no
ipmi-net         Internal     16               10.148.0.0       ipmi-net.cluster     no
site-admin-net   External     24               aaa.bbb.ccc.ddd  your.domain.com      no
site-user-net    External     24               aaa.bbb.ccc.ddd  your.domain.com      no
[esms1->network]%
```

4. Create `wlm-net` by cloning the `site-admin-net` network.

```
[esms1->network]% clone site-admin-net wlm-net
[esms1->network*[wlm-net*]%
```

5. The cloned network inherits the same settings as the original network (`site-admin-net`). You must change the several settings for the new `wlm-net`: base address, broadcast address, domain name, gateway, and (if necessary) netmask bits.

   a. Display the existing settings.

```
[esms1->network*[wlm-net*]% show
Parameter                      Value
------------------------------ ----------------------
Base address                   aaa.bbb.ccc.ddd
Broadcast address              aaa.bbb.255.255
Domain Name                    your.domain.com
Dynamic range end              0.0.0.0
Dynamic range start            0.0.0.0
Gateway                        aaa.bbb.ccc.ddd
IPv6                           no
Lock down dhcpd                no
MTU                            1500
Management allowed             no
Netmask bits                   24
Node booting                   no
Notes                          <0 bytes>
Revision
Type                           External
name                           wlm-net
```

   b. Change the base address.

```
[esms1->network*[wlm-net*]% set baseaddress wlm-netBaseAddress
```

   c. Change the broadcast address.

```
[esms1->network*[wlm-net*]% set broadcastaddress wlm-netBroadcastAddress
```

   d. Change the domain name.

```
[esms1->network*[wlm-net*]% set domainname wlm-netDomainName
```

   e. Change the gateway.

```
[esms1->network*[wlm-net*]% set gateway wlm-netGateway
```

f. If necessary, change the netmask bits.

```
[esms1->network*[wlm-net*]% set netmaskbits NN
```

6. Commit your changes.

```
[esms1->network*[wlm-net*]% commit
[esms1->network[wlm-net]%
```

7. Verify the `wlm-net` network settings.

```
[esms1->network[wlm-net]]% show
Parameter                      Value
------------------------------ ------------------------------------
Base address                   10.150.0.0
Broadcast address              10.150.255.255
Domain Name                    your.domain.com
Dynamic range end              0.0.0.0
Dynamic range start            0.0.0.0
Gateway                        aaa.bbb.ccc.ddd
IPv6                           no
Lock down dhcpd                yes
MTU                            1500
Management allowed             no
Netmask bits                   24
Node booting                   no
Notes                          <0 bytes>
Revision
Type                           External
name                           wlm-net
[esms1->network[wlm-net]]%
```

8. Switch to `device` mode.

```
[esms1->network[wlm-net]% device
[esms1->device]%
```

9. Add an interface to the `wlm-net` network. This example shows the host name `eslogin1`, the Ethernet port `eth1`, and the example IP address 10.150.0.1. Substitute your CDL node's host name and IP address when configuring the `eth1` interface.

   Important: If necessary, specify `eth3` instead of `eth1`.

```
[esms1->device]% addinterface -n eslogin1 physical eth1 wlm-net 10.150.0.1
```

   Note: You must repeat this step for each CDL node that is added to the `wlm-net` network.

10. Commit your changes.

```
[esms1->device*[eslogin1*]% commit
```

11. Show the interfaces on `eslogin1`.

```
[esms1->device[eslogin1]% interfaces; list
Type         Network device name  IP               Network
------------ -------------------- ---------------- ----------------
bmc          ipmi0                10.148.0.37      ipmi-net
physical     BOOTIF [prov]        10.141.0.37      esmaint-net
physical     eth1                 10.150.0.1       wlm-net
physical     eth2                 aaa.bbb.ccc.ddd  site-admin-net
physical     ib0                  10.149.0.37      ib-net
[esms1->device*[eslogin1]->interfaces]%
```

12. Display the existing networks.

```
[esms1->device[eslogin1]->interfaces]% network list
Name (key)       Type         Netmask bits     Base address     Domain name          IPv6
---------------- ------------ ---------------- ---------------- -------------------- ----
esmaint-net      Internal     16               10.141.0.0       esmaint-net.cluster  no
globalnet        Global       16               0.0.0.0          cm.cluster           no
ib-net           Internal     16               10.149.0.0       ib-net.cluster       no
ipmi-net         Internal     16               10.148.0.0       ipmi-net.cluster     no
site-admin-net   External     24               aaa.bbb.0.0      your.domain.com      no
site-user-net    External     24               aaa.bbb.0.0      your.domain.com      no
wlm-net          External     24               10.150.0.1       your.domain.com      no
```

13. Exit `cmsh`.

```
[esms1->device[eslogin1]->interfaces]% quit
esms1#
```

4.4 Configuring Bright Categories for the CDL Nodes

A Bright category controls which software image is used for nodes in that category. During the installation, default categories for each type of login node are created, (`esLogin-XE` and `esLogin-XC`).

> **Note:** The default category was assigned to the first CDL node when it was cloned.

The following procedure describes how to customize the `esLogin-XC` category (substitute your site CDL category). The default category for CDL nodes must have a software image and default gateway configured.

> **Note:** Optionally, you may want to modify the default disk setup XML file or the finalize script for your site configuration.

Procedure 42. Configure category settings for the CDL image

1. Log into the CIMS as `root`.
2. Run the `cmsh` command.

```
esms1# cmsh
[esms1]%
```

3. Switch to `category` mode and list categories and associated software images.

```
[esms1]% category
[esms1->category]% list
Name (key)               Software image
------------------------ ------------------------
default                  default-image
esLogin-XC               default-image
esLogin-XE               default-image
```

4. Use the `esLogin-XC` category (substitute your site CDL category).

```
[esms1->category]% use esLogin-XC
[esms1->category[esLogin-XC]]%
```

5. Set the default gateway for the `esLogin-XC` category. For *gatewayIP*, use the IP address of your site's gateway (usually on `site-user-net`).

```
[esms1->category*[esLogin-XC*]]% set defaultgateway gatewayIP
```

6. Assign a CDL software image (*imagename*) to the `esLogin-XC` category.

```
[esms1->category*[esLogin-XC*]]% set softwareimage imagename
[esms1->category*[esLogin-XC*]]% commit
```

Important: Files created or modified by a finalize script must be listed in the `excludelistupdate` exclude list for the category. Software updates will over write customized files if the files are not specified in an exclude list for the category. Customized files must also be specified in the `excludelistgrab`, and `excludelistgrabnew` exclude lists to prevent customized files from being copied to the CIMS.

7. (Optional) Change the Bright finalize script for this category. Bright runs the finalize script during node provisioning (node installation) just before turning control over to the software image initialization process.

   Note: The settings in:

   `/opt/cray/esms/cray-es-finalize-scripts-XX/default/eslogin_finalize.sh`

   were added to the `esLogin-XC` (or `esLogin-XE`) category by `ESLinstall`. Changes to `eslogin_finalize.sh` do not occur until they are saved in `cmgui`, or committed using `cmsh`, and the node is rebooted.

   a. Copy the `eslogin_finalize.sh` file.

```
[esms1->category[esLogin-XC]]% quit
esms1# cd /opt/cray/esms/cray-es-finalize-scripts-XX
esms1# mkdir -p etc
esms1# cp -p default/eslogin_finalize.sh etc/site.eslogin_finalize.sh
```

b. (Optional) Edit the `site.eslogin_finalize.sh` file to make any adjustments.

Note: A finalize script (run before `init`) is used to set a file configuration or to initialize special hardware, sometimes after a hardware check. It is run in order to make software or hardware work before, or during the later `init` stage of boot. Use a finalize script to execute commands before `init`, and the commands cannot be stored persistently anywhere else, or it is needed because a choice between (otherwise non-persistent) configuration files must be made based on the hardware before `init` starts.

```
esms1# vi etc/site.eslogin_finalize.sh
esms1# cmsh
[esms1->category]% category use esLogin-XC
[esms1->category[esLogin-XC]]% set finalizescript /opt/cray/esms/cray-es-finalize-scripts-XX\
/etc/site.eslogin_finalize.sh
[esms1->category*[esLogin-XC*]]% commit
```

c. Confirm the finalize script.

```
[esms1->category[esLogin-XC]]% get finalizescript
```

8. (Optional) Change the disk partitions sizes for the CDL node.

Note: The following partition sizes were added to the `esLogin-XC` (or `esLogin-XE`) category from `/opt/cray/esms/cray-es-diskpartitions-XX/default/eslogin-diskfull.xml`. Changes to `eslogin-diskfull.xml` do not occur until they are saved in `cmgui`, or committed using `cmsh`, and the node is rebooted.

```
swap - 64 GB
/tmp - 32 GB
/var - 64 GB
/ - Remainder of disk
```

a. Quit `cmsh` and copy XML configuration file.

```
[esms1->category[esLogin-XC]]% quit
esms1# cd /opt/cray/esms/cray-es-diskpartitions-XX
esms1# mkdir -p etc
esms1# cp -p default/eslogin-diskfull.xml etc/site.eslogin-diskfull.xml
```

Important: If the default disk setup XML files are updated in a ESM release and the site disk setup XML files have been customized, system administrators must compare the newly released disk setup XML files with the current production disk setup XML files, and merge the changes manually. After the changes have been merged, you must load the updated disk setup file into the Bright database for the node category and reboot the nodes that use that category.

b. Edit the `site.eslogin-diskfull.xml` file to change partition sizes or configuration.

```
esms1# vi  etc/site.eslogin-diskfull.xml
esms1# cmsh
[esms1->category]% category use esLogin-XC
[esms1->category*[esLogin-XE*]]% set disksetup /opt/cray/esms/cray-es-diskpartitions-XX/etc/\
site.eslogin-diskfull.xml
esms1->category[esLogin-XC]]% commit
```

c. Confirm the disk setup is loaded.

```
[esms1->category[esLogin-XC]]% get disksetup
```

4.5 Configuring Kdump on CDL Nodes (SLES)

Kdump is configured on a DMP system by modifying the configuration files on CDL systems. Dump files from slave nodes are stored either on the CIMS using NFS®, or on the slave node local disk. To save dump files to a local disk on a slave node, create a persistent `/var/crash` partition.

Procedure 43. Configuring kdump on CDL nodes (SLES)

1. Log in to the CIMS as `root`.
2. Choose a slave node that you can use to test the kdump procedure (in this example `eslogin1`) and clone that slave node's software image. This example clones `ESL-XE-2.1.0-201309252116` to `ESL-XE-2.1.0-kdump`.

```
esms1# cp -pr /cm/images/ESL-XE-2.1.0-201309252116 /cm/images/ESL-XE-2.1.0-kdump
esms1# cmsh
esms1% softwareimage
[esms1->softwareimage]% clone ESL-XE-2.1.0-201309252116 ESL-XE-2.1.0-kdump
[esms1->softwareimage*[ESL-XE-2.1.0-kdump*]]%
```

3. Commit your changes.

```
[esms1->softwareimage*[ESL-XE-2.1.0-kdump*]]% commit
```

4. **Create a test category to configure kdump**

   Switch to `category` mode to create a test category.

```
[esms1->->softwareimage[ESL-XE-2.1.0-kdump]]% category
[esms1->category]%
```

5. Clone an existing CDL category to create a test category.

   Note: Be sure to clone the functioning `esLogin-XE` or `esLogin-XC` category to an `esLogin-XE-test` or `esLogin-XC-test` category. These categories have different configurations and software images and are **not** interchangeable. This procedure creates an `esLogin-XE-test` category.

```
[esms1->category]% clone esLogin-XE esLogin-XE-test
[esms1->category*[esLogin-XE-test*]%
```

6. Assign the kdump CDL image (`ESL-XE-2.1.0-kdump`) to the test category.

```
[esms1->category*[esLogin-XE-test]*]% set softwareimage ESL-XE-2.1.0-kdump
```

7. Add `/var/crash` to the exclude lists for the `esLogin-XC-test`category. The `vi` editor launches which enables you to edit each of the exclude list files.

   Add `- /var/crash/*` to the following exclude lists:

```
[esms1->category*[esLogin-XE-test]*]% set excludelistsyncinstall
[esms1->category*[esLogin-XE-test]*]% set excludelistupdate
[esms1->category*[esLogin-XE-test]*]% set excludelistgrab
[esms1->category*[esLogin-XE-test]*]% set excludelistgrabnew
```

8. Save each file and commit your changes.

```
[esms1->category*[esLogin-XE-test*]% commit
[esms1->category[esLogin-XE-test]%
```

9. Assign the test category and test image to the test node (`eslogin1`) and commit your changes.

```
[esms1->category[esLogin-XE-test]]% device use eslogin1
[esms1->device[eslogin1]]% set category esLogin-XE-test
[esms1->device*[eslogin1*]]% commit
[esms1->device[eslogin1]]%
```

10. If you are saving kdump crash files to the slave node local disk, add the following lines to the slave node's finalize script. This command opens the `vi` editor.

```
[esms1->device[eslogin1]]% set finalizescript

DEV=$( awk -- '{ if ($2 == "/localdisk/var/crash") { print $1; exit 0 } }' < /proc/mounts )
[ -n "$DEV" ] && e2label $DEV crash
```

11. Commit your changes.

```
[esms1->device*]]% commit
```

12. Set the storage location for crash dumps.

    - If crash dumps will be saved to the CIMS proceed to step 13.
    - If crash dumps will be saved to the slave node's local disk, proceed to step 14.

13. **Save crash files to `/var/crash` on the primary CIMS**

a. Use `fsexports` to determine whether the CIMS is exporting `/var/crash`.

```
[esms1->device]]% use esms1
[esms1->device[esms1]]% fsexports
[esms1>device[esms1]->fsexports]% list
Name (key)                                   Path
-------------------------------------------- -------------------------------
/cm/shared@esmaint-net                       /cm/shared
/home@esmaint-net                            /home
/var/spool/burn@esmaint-net                  /var/spool/burn
/cm/node-installer/certificates@esmaint-net  /cm/node-installer/certificates
/cm/node-installer@esmaint-net               /cm/node-installer
/var/crash@esmaint-net                       /var/crash
```

b. Export `/var/crash` from the CIMS and configure it so that slave nodes can access it.

```
[esms1->device[esms1]->fsexports]% add /var/crash
[esms1->device*[esms1*]->fsexports*[/var/crash*]]% set name /var/crash@esmaint.net
[esms1->device*[esms1*]->fsexports*[/var/crash*]]% set extraoptions no_subtree_check
[esms1->device*[esms1*]->fsexports*[/var/crash*]]% set hosts esmaint-net
[esms1->device[esms1]*]->fsexports*[/var/crash*]]% set write yes
[esms1->device*[esms1*]->fsexports*[/var/crash*]]% commit
```

c. Exit `cmsh`.

```
[esms1->device[esms1]->fsexports[/var/crash]]% quit
esms1#
```

d. Update the exports.

```
esms1# exportfs -a
```

14. Use the `chroot` shell, edit the `/boot/pxelinux.cfg/default` file for kdump test image created in step 2 (`ESL-XE-2.1.0-kdump`).

a. Quit `cmsh`.

```
[esms1->device[esms1]]% quit
```

b. Use the `chroot` shell to edit the kdump test image.

```
esms1# chroot /cm/images/ESL-XE-2.1.0-kdump
esms:/>vi /boot/pxelinux.cfg/default
```

c. Edit `/boot/pxelinux.cfg/default` file.

d. Scroll down and locate the following line:

```
# End of documentation, configuration follows:
```

e. Enter the following lines in the `default` configuration file:

```
LABEL kdump
KERNEL vmlinuz
IPAPPEND 3
APPEND initrd=initrd crashkernel=512M CMDS console=tty0 console=ttyS1,115200n8 CMDE
MENU LABEL ^KDUMP      - Normal boot mode with kdump
MENU DEFAULT
```

f. Examine the other `LABEL` entries in the `default` configuration file and remove the line: `MENU DEFAULT`.

g. Exit and save the file.

h. Verify that the `/var/crash` partition exists in the `ESL-XE-2.1.0-kdump` image.

15. Edit the `/etc/sysconfig/kdump` file and modify the following lines:

```
esms1:/> vi /etc/sysconfig/kdump
```

a. Scroll down and locate the `KDUMP_SAVEDIR` entry:

If you want to save crash dump files using NFS to `/var/crash` on the CIMS, modify the `KDUMP_SAVEDIR` line as follows:

```
KDUMP_SAVEDIR="nfs://master/var/crash/"
```

If you want to save crash dump files to the local disk, modify `KDUMP_SAVEDIR` as follows:

```
KDUMP_SAVEDIR="file:///var/crash"
```

Note: Create a persistent partition (`/var/crash`) in the disk setup XML file for the kdump test category (`esLogin-XE-test`). Creating a separate partition for crash dumps on the slave node software image prevents `/var` from filling up and causing problems for the operating system.

b. Locate `KDUMP_DUMPLEVEL` and change it to:

```
KDUMP_DUMPLEVEL=27
```

c. Locate `KDUMP_CONTINUE_ON_ERROR` and change it to:

```
KDUMP_CONTINUE_ON_ERROR="true"
```

d. Locate `KDUMP_NETCONFIG` and change it to you `esmaint-net` interface, `eth0` or `eth2`):

```
KDUMP_NETCONFIG="eth0:dhcp"
```

e. Exit and save the file.

16. Enable the `kdump` service.

```
esms1:/> chkconfig --set boot.kdump on
```

17. Verify that `/lib/mkinitrd/scripts/setup-storage.sh` and `setup-kdumpfs.sh` exist.

    a. If these files do not exist, copy them from the CIMS to `/lib/mkinitrd/scripts/` in the `/cm/images/ESL-XE-2.1.0-kdump` image. You must exit the `chroot` shell to do this step.

```
esms1:/> exit
esms1# cp -p /lib/mkinitrd/scripts/setup-storage.sh /cm/images/ESL-XE-2.1.0-kdump/lib/mkinitrd/scripts
esms1# cp -p /lib/mkinitrd/scripts/setup-kdumpfs.sh
/cm/images/ESL-XE-2.1.0-kdump/lib/mkinitrd/scripts
```

    b. Return the `chroot` shell in the ESL image.

```
esms1# chroot /cm/images/ESL-XE-2.1.0-kdump
```

    c. Run `mkinitrd_setup` to update symbolic links in `/lib/mkinitrd/setup` and `/lib/mkinitrd/boot`.

```
esms1:/> mkinitrd_setup
Scanning scripts ...
Resolve dependencies ...
Install symlinks in /lib/mkinitrd/setup ...
Install symlinks in /lib/mkinitrd/boot ...
esms1:/lib/mkinitrd/scripts>
```

18. Exit the `chroot` shell.

```
esms1:/> exit
esms1#
```

19. **Reboot the test node and run kdump**

    a. Start a console window on the test slave node (`eslogin1`).

```
esms1# cmsh
[esms1]% device; use eslogin1
[esms1->device[eslogin1]]% rconsole
```

    b. Reboot the test node (`eslogin1`).

```
eslogin1: reboot
eslogin1: Reboot in progress ...
```

    c. When the node reboots, initiate kdump.

```
 esms1#  ssh eslogin1
eslogin1# echo c > /proc/sysrq-trigger
```

> **Note:** If dumping over NFS, the dump file should be created in `/var/crash` on the CIMS node. If dumping to the slave node's local disk, the dump file should be created in `/var/crash` on the slave node's local disk.

20. Make the kdump image the default image for all CDL nodes.

a. Start cmsh and assign the test node (eslogin1) to the default CDL category esLogin-XE.

```
 esms1#  cmsh
[esms1]% device; use eslogin1
[esms1->device[eslogin1]]% set category esLogin-XE
[esms1->device*[eslogin1*]]% commit
```

b. Switch to category mode and configure the default esLogin-XE category to use the kdump software image.

```
[esms1->device[eslogin1]]% category
[esms1->category]% use esLogin-XE
[esms1->category[esLogin-XE]% set softwareimage ESL-XE-2.1.0-kdump
```

21. Reboot all of the nodes in the esLogin-XE category, so that they use the kdump software image.

```
[esms1->category[esLogin-XE]% device
[esms1->device]% reboot -c esLogin-XE
eslogin001: Reboot in progress ...
```

22. Exit cmsh.

```
[esms1->device]% quit
```

4.6 Creating a kdump Crash Partition on a Slave Node Local Disk

If the slave node does not already have a /var/crash partition, then you must create a persistent partition (/var/crash) on a slave node's disk setup to store kdump crash files.

Procedure 44. Create a kdump /var/crash partition on a slave node

1. Log in to the CIMS as root and run the cmsh command.

```
esms1# cmsh
[esms1]%
```

2. Clone the working category used or the slave node to create a test category. This procedure creates a category named esLogin-XE-test.

```
esms1# category
[esms1->category]% clone esLogin-XE esLogin-XE-test
[esms1->category*[esLogin-XE-test*]]%
```

3. Edit the disk setup XML file for the test category.

```
[esms1->category*[esLogin-XE-test*]]% set disksetup
```

The `vi` editor starts which enables you to edit the setup XML file. Scroll down in the disk setup XML file and create a new `/var/crash` disk partition.

```
...
<partition id="a3">
    <size>10G</size>
    <type>linux</type>
    <filesystem>ext3</filesystem>
    <mountPoint>/var/crash</mountPoint>
    <mountOptions>defaults,noatime,nodiratime</mountOptions>
</partition>

...
```

4. Commit your changes.

```
[esms1->category*[esLogin-XE-test*]]% commit
[esms1->category[esLogin-XE-test]]%
```

5. Reboot the slave node (in this example `eslogin1`) to re-partition the disk.

   Note: When rebooting a system, it is helpful to start a remote console shell.

   In a new window log in to the CIMS as `root`, start `cmsh`, and launch a remote console on `eslogin1` while you reboot.

```
esms1# cmsh
[esms1]% device; use eslogin1
[esms1->device[eslogin1]]% rconsole
```

   In a another window, reboot the slave node. The node installer will recognize the disk setup has changed, and re-partition the disks.

```
[esms1->category[esLogin-XE-test]]% device; use eslogin1
[esms1->device[eslogin1]]% reboot
```

6. Enter `quit` to exit `cmsh`.

7. When the node reboots, SSH to the node and verify that the `/var/crash` partition was created.

```
esms1# ssh eslogin1
Last login: Thu May 23 08:09:22 2013
eslogin1# df
Filesystem        1K-blocks     Used Available Use% Mounted on
/dev/sda1          19685912  9735588   8950324  53% /
udev               65879960      200  65879760   1% /dev
tmpfs              65879960        0  65879960   0% /dev/shm
/dev/sda7         189409992   191948 179596496   1% /local
/dev/sda3           1969424    35784   1833596   2% /tmp
/dev/sda2          19685656   654584  18031088   4% /var
/dev/sda6          17718140   176196  16641900   2% /var/crash
master:/cm/shared 125991776 60142976  59448768  51% /cm/shared
master:/home      217873344 56468864 150337120  28% /home
```

4.7 Seting CDL Device Parameters

When you add a new CDL node to Bright, it must be assigned to a Bright category (`esLogin-XE` or `esLogin-XC`, for example) that configures node-specific device information.

> **Note:** The physical node and network interface information should already exists in Bright.

Procedure 45. Setting CDL slave node parameters in Bright

1. Log in to the CIMS as `root` and run the `cmsh` command.

```
esms1# cmsh
[esms1]%
```

2. Switch to `device` mode:

```
[esms1]% device
[esms1->device]%
```

3. Add the new node to the `esLogin-XC` category.

   > **Note:** This procedure uses the example host name `eslogin1` and the category name `esLogin-XC`. Substitute your actual CDL host name and the category name used in the previous procedure.

```
[esms1->device]% use eslogin1
[esms1->device[eslogin1]]% set category esLogin-XE
[esms1->device[eslogin1*]]% commit
[esms1->device[eslogin1]]%
```

4. Set the rack information (device height, position in the rack, and rack index). This example assumes that the device height is 2U, its position in the rack is `0`, and the rack index is `0`. Substitute the actual values for your CDL node.

```
[esms1->device[eslogin1]]% set deviceheight 2
[esms1->device[eslogin1*]]% set deviceposition 0
[esms1->device[eslogin1*]]% set rack 1
```

5. Commit your device changes.

```
[esms1->device[eslogin1*]]% commit
[esms1->device[eslogin1]]%
```

6. Exit `cmsh`.

```
[esms1->device[eslogin1]]% quit
esms1#
```

4.8 Configuring eswrap

The eswrap utility is a wrapper that lets users access a subset of Cray Linux Environment (CLE) and Programming Environment (PE) commands from a CDL node. eswrap uses Secure Shell (ssh) to launch the wrapped command on the Cray system, then displays the output on the CDL node so that it appears to the user that the wrapped command is actually running on the CDL node.

Running eswrap creates a symbolic link for each wrapped command in the directory /opt/cray/eslogin/eswrap/default/bin. Each symbolic link points to the eswrap command, so that running a wrapped command (such as apstat) actually runs eswrap with the wrapped command as an argument. eswrap uses ssh to run the command on the specified node of the Cray system (by default, the internal login node with the host name login, unless the $ESWRAP_LOGIN environment variable specifies a different node).

The initialization file eswrap.ini controls the list of wrapped commands. An administrator can edit this file to include or exclude SLURM commands, Application Level Placement Scheduler (ALPS) commands, STAT (Stack Trace Analysis Tool) commands, Cluster Compatibility Mode (CCM) commands, aprun, qsub, and selected Cray CLE commands.

> **Note:** See the eswrap(8) man page for more information on the eswrap configuration variables, including which commands are enabled by default. Use the following commands to display the image-specific version of this CDL man page:

```
esms1# cd /cm/images/imagename/opt/cray/eslogin/eswrap/default/man/man8
esms1# man ./eswrap.8
```

Procedure 46. Configuring eswrap

> **Note:** You must execute the following steps as root whenever the eswrap.ini is modified.

1. Use chroot to change to the root directory of the CDL image. For *imagename*, substitute the directory name of the CDL image.

```
esms1# chroot /cm/images/imagename
esms1:/>
```

2. Edit the eswrap.ini configuration file to enable (wrap) the necessary commands for your environment. Refer to Support for Native SLURM on page 157 for information about support for native SLURM.

```
esms1:/> vi /opt/cray/eslogin/eswrap/eswrap.ini
```

3. Run the eswrap command.

```
esms1:/> /opt/cray/eslogin/eswrap/default/bin/eswrap --install
```

4. Exit the `chroot` environment.

```
esms1:/> exit
esms1#
```

> **Note:** Use this procedure to rerun `eswrap --install` to update the links for the wrapped commands after changes are made to the `eswrap.ini` file.

4.8.1 Support for Native SLURM

The ESL software now supports the Simple Linux™ Utility for Resource Management (SLURM) by wrapping related commands with the native SLURM architect. If any of these commands are installed on the CDL node, they are moved out of the way before they are wrapped to prevent them from appearing in any paths.

> **Important:** to support native SLURM, the latest version of `eswrap` no longer performs the `eswrap --install` automatically. This is because the path environment is not valid during the RPM install but is outside the RPM scripts. You must run `/opt/cray/eslogin/eswrap/default/bin/eswrap --install` from a `chroot` shell in the ESL image after verifying that `/opt/cray/eslogin/eswrap/eswrap.ini` is correct in the image. A new `/opt/cray/eslogin/eswrap/default/etc/eswrap.ini` file includes a `slurm` option. You must merge this file with `/opt/cray/eslogin/eswrap/default/eswrap.ini`.

If `slurm=true` is set in the `eswrap.ini` file, the following commands are wrapped when `eswrap --install` runs. If `slurm=false` is set in the `eswrap.ini` file, the following commands are unwrapped and any commands that were moved out of the way are restored when `eswrap --install` runs:

```
salloc     scontrol    smap           sshare
sattach    diag        sprio          sstat
sbatch     sinfo       squeue         strigger
sacct      sbcast      sjobexitmod    sreport
sview      sacctmgr    scancel        sjstat
srun
```

4.9 Configuring a CDL Node to Mount an External Lustre® File System

This section describes how to configure a CDL node to mount a Lustre file system.

Procedure 47. Configuring a CDL node to mount an external Lustre file system

Note: This procedure modifies the software image *imagename*, to mount a Lustre file system which is mounted as `/scratch` on the Lustre MDS server at IP address 10.149.0.1 to the local mount point on the CDL of `/lus/scratch`.

1. Make a mount point in the CDL software image.

```
esms1# chroot /cm/images/imagename
esms1:/> mkdir -p /lus/scratch
esms1:/> exit
```

2. Use the `cmsh imageupdate` command to update what is on the running node from *imagename*. The command performs a dry run, then use `-w` to perform the actual update.

```
esms1# cmsh
[esms1]% device use eslogin1
[esms1->device[eslogin1]]% imageupdate
Performing dry run (use synclog command to review result, then pass -w to \
perform real update)...
[esms1->device[eslogin1]]% imageupdate -w
Mon Mar  4 14:08:26 2013 [notice] esms1: Provisioning started: sending \
esms1:/cm/images/imagename to eslogin1:/, mode UPDATE, dry run = no
```

3. Start a remote console on `eslogin1`.

```
[esms1->device[eslogin1]]% rconsole
```

4. Start a new `cmsh` session and reboot `eslogin1` to add the new mount point.

```
esms1# cmsh
[esms1]% device use eslogin1
[esms1->device[eslogin1]]% reboot
```

5. After `eslogin1` reboots, login as `root` and enter the following commands to mount the file system:

```
esms1# ssh root@eslogin1
eslogin1# mount -t lustre -o rw,flock,lazystatfs 10.149.0.1@o2ib:/scratch /lus/scratch
```

6. Verify file system mounted.

```
eslogin1# mount | grep lustre
10.149.0.1@o2ib:/scratch on /lus/scratch type lustre (rw,flock,lazystatfs)

eslogin1# df /lus/scratch
Filesystem               1K-blocks      Used   Available     Use% Mounted on
10.149.0.1@o2ib:/scratch 15611116960    922104 14829205576   1%   /lus/scratch
```

4.10 Mounting a Lustre® File System on a CDL Node

Procedure 48. Mounting a Lustre file system on a CDL node

1. Use the `chroot` shell to make a mount point in the CDL software image (in this example `ESL-XC-1.3.0-201309252103`).

```
esms1# chroot /cm/images/ESL-XC-1.3.0-201309252103
esms1:/> mkdir -p /lus/scratch
esms1:/> exit
```

2. Update the CDL nodes with the modified `ESL-XC-1.3.0-201309252103` image.

   a. Start the `cmsh`.

```
esms1# cmsh
```

   b. Go into `device` mode.

```
[esms1]% device
```

   c. Update the image for the CDL node (in this example, `eslogin1)`.

```
[esms1->device]% imageupdate -n eslogin1
Performing dry run (use synclog command to review result, then pass -w to perform real update)...
[esms1->device]%
...
[esms1->device]% imageupdate -w -n eslogin1
```

   d. Exit `cmsh`.

```
[esms1->device]% quit
```

3. Use SSH to log in to the CDL node (`eslogin1`).

```
esms1# ssh eslogin1
Last login: Fri Apr 15 11:28:06 2013 from esms1.cm.cluster
eslogin1#
```

4. Mount the file system on the CDL node (`eslogin1`).

   Note: Add the following `mount` command and file system information to `/etc/fstab` . 10.149.0.2 is the IP address of the `esfs-mds001` node on `ib-net`.

```
eslogin1# mount -t lustre -o rw,flock,lazystatfs 10.149.0.2@o2ib:/scratch /lus/scratch
```

5. Verify the `scratch` file system is mounted.

```
eslogin1# mount | grep lustre
10.149.0.1@o2ib:/scratch on /lus/scratch type lustre (rw,flock,lazystatfs)

eslogin1# df /lus/scratch
Filesystem               1K-blocks      Used   Available   Use% Mounted on
10.149.0.1@o2ib:/scratch 15611116960    922104 14829205576   1% /lus/scratch
```

4.11 Setting Up Exclude Lists

Exclude lists may be configured for the `esLogin-XC`, `esLogin-XE`, `esFS-MDS`, or `esFS-OSS` categories. Files must be synchronized by pushing them from software image on the CIMS node to the slave node, or pulling them from the slave node to the CIMS node.

There are three exclude lists for pushing from the CIMS node to the slave node which are `excludelistfullinstall`, `excludelistsyncinstall`, and `excludelistupdate`. These lists contains files that will **not** be pushed to the slave node during software image installation. Two exclude lists control how files are pulled from the slave node to the CIMS software image which are `exludelistgrab`, `excludelistgrabnew`.

Important: Files created or modified by a finalize script must be listed in the `excludelistupdate` exclude list for the category. Software updates will over write customized files if the files are not specified in an exclude list for the category. Customized files must also be specified in the `excludelistgrab`, and `excludelistgrabnew` exclude lists to prevent customized files from being copied to the CIMS.

`excludelistfullinstall` — Push

During a full software image installation at boot time, **all** files from the software image in the CIMS are pushed to the slave node unless they are included in the `excludelistfullinstall` exclude list.

`excludelistsyncinstall` — Push

During a sync software image installation at boot time, **all** files from the software image on the CIMS are pushed to the slave node unless they are entered in the `excludelistsyncinstall` exclude list.

`excludelistupdate` — Push

If the node is already booted, running the `cmsh imageupdate` command will push all files from the slave node software image on the CIMS to the software image **on the running node**, except those entered on the `excludelistupdate` exclude list.

`excludelistgrab` — Pull

Using the `cmsh grabimage` command, or `cmgui` **Grab to Image** button synchronizes files **from** the slave node **to** its existing software image, unless the files or directories are entered in the `excludelistgrab` exclude list.

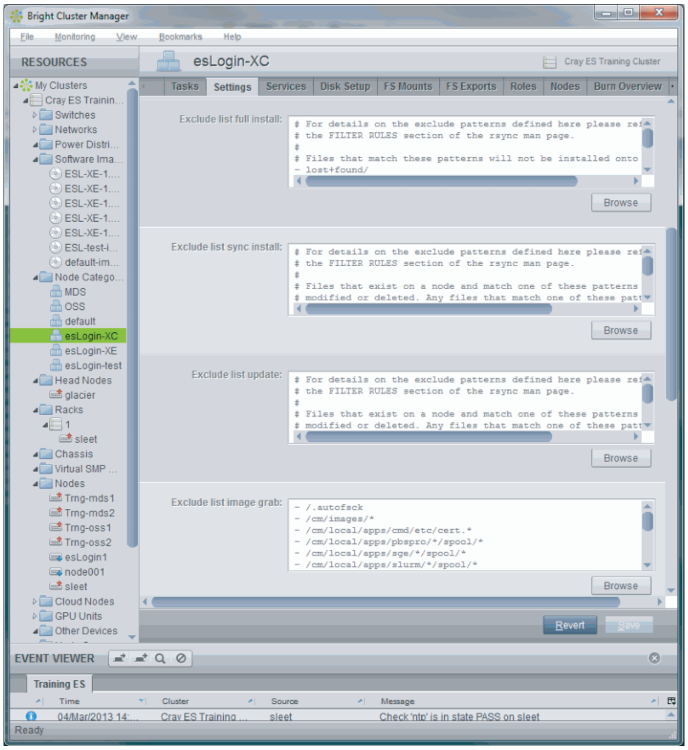
`excludelistgrabnew` — Pull

Running the `cmsh grabimage -n` *newimage* command synchronizes files from the slave node to a new software image, unless the files or directories are entered in the `excludelistgrabnew` exclude list.

Important: Be sure to configure the `excludelistgrab` and `excludelistgrabnew` exclude lists to exclude all network file systems such as NFS®, Lustre®, or GPFS™ file systems.

Figure 44 shows the category exclude lists under the `cmgui` **Node Category->Settings** tab.

Figure 44. Setting up Exclude Lists in cmgui



Exclude list full install:

```
# For details on the exclude patterns defined here please ref
# the FILTER RULES section of the rsync man page.
#
# Files that match these patterns will not be installed onto
- lost+found/
```

Exclude list sync install:

```
# For details on the exclude patterns defined here please ref
# the FILTER RULES section of the rsync man page.
#
# Files that exist on a node and match one of these patterns
# modified or deleted. Any files that match one of these patt
```

Exclude list update:

```
# For details on the exclude patterns defined here please ref
# the FILTER RULES section of the rsync man page.
#
# Files that exist on a node and match one of these patterns
# modified or deleted. Any files that match one of these patt
```

Exclude list image grab:

```
- /.autofsck
- /cm/images/*
- /cm/local/apps/cmd/etc/cert.*
- /cm/local/apps/pbspro/*/spool/*
- /cm/local/apps/sge/*/spool/*
- /cm/local/apps/slurm/*/spool/*
```

```
04/Mar/2013 14:   Cray ES Training ...   sleet   Check 'ntp' is in state PASS on sleet
```

4.11.1 Check Exclude Lists

Each of the exclude lists has specific comments about the pre-configured exclusions. To check what is currently in one of the pre-configured exclude lists, run the following `cmsh` command or use the `cmgui` to select a node category from the resource tree, then select the **Settings** tab.

```
esms1# cmsh -c "category use esLogin-XC; get excludelistfullinstall"
# For details on the exclude patterns defined here please refer to
# the FILTER RULES section of the rsync man page.
#
# Files that match these patterns will not be installed onto the node.
- lost+found/
- /proc/*
- /sys/*
```

4.11.2 Changing Exclude Lists

To change an exclude list, run this command. It will open an editor so you can make changes to the list.

```
esms1# cmsh -c "category use esLogin-XC; set excludelistfullinstall; commit"
```

4.11.3 Exclude User Home Directories

If user home directories in /home/users are mounted from an NFS server, then add /home/users/* to excludelistfullinstall, excludelistsyncinstall, and excludelistupdate, to prevent those directories from being removed when synchronizing from a software image to an CDL node.

If user home directories in /home/users are mounted from an NFS server and also mount a Lustre file system in /lus/scratch, then add /home/users/* and /lus/scratch to the excludelistgrab and excludelistgrabnew exclude lists. This prevents a grabimage command from copying all of the files from a remote file server to the software image.

```
/home/users/*
/lus/scratch
```

CLFS Administration Tasks [5]

5.1 Recommended MDS/MGT Volume Size

Cray recommends an MGT volume size of 100MB.

5.2 Configuring CLFS Failover (`esfsmon`)

The Lustre® file system uses multiple Cray CLFS server nodes to supply data storage services to provide a unified view of a cluster file system. As such, there are multiple points of failure. However, there are also multiple routes for data flow and multiple services that can respond to I/O service requests in the event of failure.

As file system infrastructures become very large and complex, failures are inevitable. Failures are detected by hardware, software, or firmware within components or system that comprise the Lustre file system. Generally, a good failover strategy is based on the expectation that failures are spread over time fairly evenly and that there is a reasonable amount of time for human intervention to correct failures (e.g., hard drive failures and replacements).

Cray's failover strategy is that the normal mode of operations is to have the whole system functional and running without on-going errors. When a failure occurs, the automated failover mechanisms move operations in the failed path to other functional resources and provide notification to the system administrator. After the system is running in a failed over state, subsequent failures are detected and additional notifications are sent, however, additional failover operations are not executed without human intervention. When multiple failures occur in short periods of time, the primary cause may be difficult to identify without significant investigation. Continued automatic failover actions may lead to catastrophic file system failures.

5.2.1 Storage Configuration Overview

Multiple Lustre file systems are supported on external storage nodes.

The resiliency features in CLFS node failover ensure that under normal conditions, failures will not result in the loss of access to the file system or the loss of data. Those features, described below in detail, include:

- OSS path redundancy to the storage arrays via failover driver software
- Rebuilding RAID after a disk failure

- Failing over OSTs when an OSS suffers various types of failures
- MDT failover when an MDS suffers a failure
- Loss of an LNET router network connection

5.2.2 Failover Conditions

The following conditions trigger a failover action. After a failure monitor-only mode (RUNSAFE) is activated.

- Power failure of a node
- Failure to TCP ping the node
- Failure of a node to LNET ping at least one other node
- Failure of a node to have the expected complement of mounts available

5.2.3 Failover Functional Tests

Functional tests are performed on all nodes by category. See `esfsmon healthcheck` on page 168 for more information about node categories.

- All nodes in a particular category are tested in parallel
  - Failed nodes are not tested
  - Some tests do not apply to the standby MDS node unless it is acting as the primary
- Test descriptions
  - **DRAC function** Verify connectivity with the DRAC by checking power status of each node.
  - **IP connectivity with CIMS** Ping each node from the CIMS over the management network.
  - **LNET ping** MDS nodes will attempt to LNET ping two OSS nodes. OSS nodes will attempt to ping two MDS nodes, if available, or the MDS and an OSS node. Failure of both ping attempts is a failure. Status of the IB port is also checked.
  - **Lustre Mounts** Check that the appropriate lustre mounts are mounted.

5.2.4 HA/Failover of I/O Paths for Servers Connected to Storage Arrays

The driver for the RAID arrays supports path failover when redundant paths between an OSS and its attached array fails. When the path failure has been corrected, failback is automatic.

5.2.5 Disk Failure and Rebuild: RAID Hardware Capability

Disk failure detection and automatic rebuild of the replaced drive are features of the RAID array in each LUN. The only manual portion of the repair process is the physical replacement of the failed disk drive.

5.2.6 Failover Features and Bright Monitoring

Bright software provides a monitoring framework that enables administrators to:

- Inspect monitoring data to the required level for existing resources
- Configure gathering of monitoring data for new resources
- See current and past problems or abnormal behavior
- Notice trends that help the administrator predict likely future problems
- Manage current and likely future problems by triggering alerts, taking necessary actions to improve the situation, or investigate further

CLFS failover under Bright Cluster Manager® (Bright) consists of five parts: a monitor script, an action script, a failback command, a configuration file, and the `lustre_control` utility.

- `esfsmon_healthcheck` is the monitoring script which resides in `/cm/local/apps/cmd/scripts/healthchecks` on the CIMS node. The `esfsmon_healthcheck` monitoring script is configured as the `esfsmon` monitoring `healthcheck` in Bright. A separate `esfsmon` monitor process runs for each Lustre file system. See Configuring the `esfsmon healthcheck` Monitor on page 169 for more information about `esfsmon_healthcheck` monitoring. The monitoring process runs on the CIMS as a Bright `healthcheck` every 120 seconds by default and can be reconfigured. See Tuning the `esfsmon:`*filesystem* Check Interval on page 177 for more information about changing the `healthcheck` monitoring interval. The `esfsmon_healthcheck` monitoring script executes commands on the CIMS and all monitored nodes via the Bright daemon (CMDaemon) to assess the ability of each node to serve the Lustre file system. Status messages are sent to both the Bright software and `/var/log/messages` on the CIMS.

- `esfsmon_action` is the action script which resides in `/cm/local/apps/cmd/scripts/action` on the CIMS and is configured as the `esfsmon_action` monitoring action in Bright.`esfsmon_action` runs on the CIMS as a Bright healthcheck action when the `esfsmon healthcheck` reports a failure, and takes appropriate failover action if the `esfsmon healthcheck` is not in `RUNSAFE` mode. `esfsmon_action` executes `lustre_control` failover on the CIMS to affect MDS or OSS failover. Status messages are sent to both the Bright software and `/var/log/messages`.

- `esfsmon_failback` is the failback command which runs on the CIMS to bring previously failed CLFS server nodes back to service after any faults have been corrected.
- `esfsmon.conf` is the configuration file that contains environmental variables and file system definitions used by `esfsmon`.
- `lustre_control` runs on the CIMS to perform the failover and failback of the Lustre assets.

5.2.6.1 esfsmon healthcheck

The testing sequence of the `esfsmon healthcheck` monitor is as follows:

- Validate configuration
  - Need at least one MDS and two OSS nodes for failover to be active.
  - No monitoring will be performed until the `esfsmon healthcheck` discovers at least one active MDS and two active OSS nodes.
  - Check to see if monitoring should be suspended. Existence of `/var/esfsmon/esfsmon_suspend_`*filesystem* file indicates a suspended mode. This is entered automatically during the failover process to prevent false positive error indications.
- Check for degraded nodes
  - Degraded nodes indicate that a failover action has taken place but has not been resolved so monitor-only mode is used. If there are any nodes in the `esfs-mds-failed-`*filesystem* or `esfs-oss-failed-`*filesystem* categories, degraded nodes exist.
  - Continuing to failover nodes may cascade into a catastrophic configuration where the CLFS becomes unusable. Failed nodes should be addressed and returned to service as soon as possible.
- Functional testing by node category. Nodes must be in the Bright categories shown below:
  - `esfs-mds-`*filesystem* All MDS nodes in *filesystem*
  - `esfs-mds-fo-`*filesystem* All Standby MDS nodes in *filesystem*
  - `esfs-oss-even-`*filesystem* All even numbered OSS nodes in *filesystem*
  - `esfs-oss-odd-`*filesystem* All odd numbered OSS nodes in *filesystem*
  - `esfs-mds-failed-`*filesystem* All MDS nodes that have failed over in *filesystem*
  - `esfs-oss-failed-`*filesystem* All OSS nodes that have failed over in *filesystem*

5.2.7 Configuring the `esfsmon  healthcheck` Monitor

The `esfsmon healthcheck` monitor is installed as a master node `healthcheck` in Bright by Cray. It is available to monitor any Lustre file system whose MDS and OSS servers are managed by a CIMS server running Bright. The following procedures describe how to configure `esfsmon` to monitor a Lustre file system and how to view the `esfsmon` configuration.

5.2.7.1 Installing `esfsmon_healthcheck` and `esfsmon_action` Scripts

Before `esfsmon` can be configured and used, the `esfsmon_healthcheck` and `esfsmon_action` scripts must be installed into Bright Cluster Manager. The following procedure installs the `esfsmon_healthcheck` and `esfsmon_action` scripts in Bright Cluster Manager. This must be done only once, regardless of the number of Lustre file systems that will be monitored.

Procedure 49. Installing `esfsmon_healthcheck` and `esfsmon_action`

1. Log in to the CIMS as `root` and start`cmsh`.

```
esms1# cmsh
[esms1]%
```

2. Switch to `monitoring` mode and add `esfsmon`.

```
[esms1]% monitoring healthchecks
[esms1->monitoring->healthchecks]% add esfsmon
[esms1->monitoring->healthchecks*[esfsmon*]]% show
Parameter                      Value
------------------------------ ---------------
Class of healthcheck           misc
Command
Description
Disabled                       no
Extended environment           no
Name                           esfsmon
Notes                          <0 bytes>
Only when idle                 no
Parameter permissions          optional
Revision
Sampling method                samplingonnode
State flapping count           7
Timeout                        5
Valid for                      node,headnode
```

3. Set the command.

```
[esms1->monitoring->healthchecks]% set command
/cm/local/apps/cmd/scripts/healthchecks/esfsmon_healthcheck
[esms1->monitoring->healthchecks*[esfsmon*]]% set description "esFS Lustre Filesystem Monitor"
[esms1->monitoring->healthchecks*[esfsmon*]]% set parameterpermissions required
[esms1->monitoring->healthchecks*[esfsmon*]]% set timeout 120
[esms1->monitoring->healthchecks*[esfsmon*]]% show
Parameter                      Value
------------------------------ ------------------------------------------------------------
Class of healthcheck           misc
Command                        /cm/local/apps/cmd/scripts/healthchecks/esfsmon_healthcheck
Description                    esFS Lustre Filesystem Monitor
Disabled                       no
Extended environment           no
Name                           esfsmon
Notes                          <0 bytes>
Only when idle                 no
Parameter permissions          required
Revision
Sampling method                samplingonnode
State flapping count           7
Timeout                        120
Valid for                      node,headnode
```

4. Commit your changes.

```
[esms1->monitoring->healthchecks*[esfsmon*]]% commit
[esms1->monitoring->healthchecks[esfsmon]]%
```

5. Configure `sfsmon_action`.

```
[esms1->monitoring->healthchecks[esfsmon]]% monitoring actions
[esms1->monitoring->actions]% add esfsmon_action
[esms1->monitoring->actions*[esfsmon_action*]]% show
Parameter                      Value
------------------------------ -------------------
Command
Description
Name                           esfsmon_action
Revision
Run on                         headnode
Timeout                        5
isCustom                       yes
```

6. Set the command and parameters.

```
[esms1->monitoring->actions*[esfsmon_action*]]% set command
/cm/local/apps/cmd/scripts/actions/esfsmon_action
[esms1->monitoring->actions*[esfsmon_action*]]% set timeout 660
[esms1->monitoring->actions*[esfsmon_action*]]% set description "Action for esfsmon failures"
[esms1->monitoring->actions*[esfsmon_action*]]% show
Parameter                      Value
------------------------------ --------------------------------------------------
Command                        /cm/local/apps/cmd/scripts/actions/esfsmon_action
Description                    Action for esfsmon failures
Name                           esfsmon_action
Revision
Run on                         headnode
Timeout                        660
isCustom                       yes
```

7. Commit your changes.

```
[esms1->monitoring->actions*[esfsmon_action*]]% commit
[esms1->monitoring->actions[esfsmon_action]]%
```

5.2.8 Configure `esfsmon.conf`

The `esfmon.conf` file configures `esfsmon` to monitor a file system (in this example, the file system is `scratch`).

Edit the `esfmon.conf` and make the following changes:

`ESFSMON_STATE_DIR=/var/esfsmon`

Path to `esfsmon` operational state (DO NOT CHANGE!)

`ESFSMON_DATA_DIR=/tmp/esfsmon`

Path to `esfsmon` operational data (DO NOT CHANGE!)

`ESFSMON_LUSTRE_CONTROL=/opt/cray/esms/cray-lustre-control-XX/bin/lustre_control`

Full path to `lustre_control`

`ESFSMON_SUSPEND_BASE=$ESFSMON_STATE_DIR/esfsmon_suspend_`

Flag indicating that `esfsmon` is in a suspended state. Existence of this file indicates suspended state. Each `esfsmon` instance will append the Lustre file system name to the file.

`ESFSMON_RUNSAFE_BASE=$ESFSMON_STATE_DIR/esfsmon_runsafe_`

Flag indicating that `esfsmon` is in a monitor-only (`RUNSAFE`) mode. Existence of this file indicates monitor-only (`RUNSAFE`) mode. Each `esfsmon` instance will append the Lustre file system name to the file.

`ESFSMON_MDS_FO_DISABLED_BASE=$ESFSMON_STATE_DIR/esfsmon_mds_fo_disabled_`

Flag indicating that MDS fail over (FO) is disabled. Existence of this file indicates MDS FO is disabled. Each `esfsmon` instance will append the Lustre file system name to the file.

`ESFSMON_FO_DATA_BASE=$ESFSMON_STATE_DIR/esfsmon_fo_`

This file contains the host name of the failed node. Each `esfsmon` instance will append the Lustre file system name to the file.

`ESFSMON_LOG_FREQ_BASE=$ESFSMON_STATE_DIR/esfsmon_log_freq_`

The following control logging frequency to prevent filling the `syslog` if problems are not corrected quickly. The `ESFSMON_LOG_FREQ` contains parameters for how often to log. Valid frequencies are:

```
1. 0m = always log
2. 1 = log first time only - this is the default
3. xm = log every 'x' minutes
4. xh = log every 'x' hours
5. xd = log every 'x' days
```

`ESFSMON_DEBUG_BASE=$ESFSMON_STATE_DIR/esfsmon_debug_`

Flag indicating whether to run debug mode or not. Each `esfsmon` instance will append the Lustre file system name to the file.

`ESFSMON_MDS_NODE_scratch=lustre01-mds001`

MDS node for each file system. Variable name is `ESFSMON_MDS_NODE_`*filesystem*=*failover-mds-hostname*.

`ESFSMON_MDS_CAT_scratch=esfs-mds-scratch`

MDS node category for each file system.

`ESFSMON_MDS_FO_NODE_scratch=lustre01-mds002`

MDS failover node for each file system. Variable name is `ESFSMON_MDS_FO_NODE_`*filesystem*=*failover-mds-hostname*.

`ESFSMON_MDS_FO_CAT_scratch=esfs-mds-fo-scratch`

MDS failover node category for each file system.

`ESFSMON_MDS_FAILED_CAT_scratch=esfs-mds-failed-scratch`

MDS failed node category for each file system.

`ESFSMON_OSS_EVEN_CAT_scratch=esfs-oss-even-scratch`

OSS even numbered node category for each file system.

`ESFSMON_OSS_ODD_CAT_scratch=esfs-oss-odd-scratch`

OSS odd numbered node category for each file system.

`ESFSMON_OSS_FAILED_CAT_scratch=esfs-oss-failed-scratch`

OSS failed node category for each file system.

`ESFSMON_BASENAME_scratch=lustre01-`

CLFS node base name for each file system. Variable name is `ESFSMON_BASENAME_`*filesystem*=*base-hostname*. For example, `lustre1-mds001` and `lustre1-oss001` have a basename of `lustre1-`.

`CMSH="/cm/local/apps/cmd/bin/cmsh -c"`

Command path and argument to run `cmsh` commands.

5.2.9 Activating `esfsmon`

Before activating `esfsmon` in Bright, it is important that the file system-specific support files are in place. These include the `esfsmon` suspend and `RUNSAFE` control files in `/var/esfsmon` for the file system being monitored. Without these in place, an inadvertent failover may be attempted when `esfsmon` is activated for the file system.

The following files need to be in place on the CIMS, before configuring `esfsmon` for a file system.

- `/var/esfsmon/esfsmon_suspend_`*filesystem* — This file suspends monitoring of *filesystem*
- `/var/esfsmon/esfsmon_runsafe_`*filesystem* — This file puts `efsmon` into RUNSAFE (monitor only) mode of *filesystem*

5.2.10 Configuring `esfsmon` `healthcheck` in Bright

Procedure 50. Configuring `esfsmon` `healthcheck` in Bright

1. Log in to the CIMS as `root` and run the `cmsh` command.

```
esms1# cmsh
[esms1]%
```

2. Enter `healthcheck` configuration mode for the CIMS.

```
[esms1]% monitoring setup healthconf headnode
[esms1->monitoring->setup[HeadNode]->healthconf]%
```

3. From this prompt you can list what `healthchecks` are currently configured with the `list` command.

```
[esms1->monitoring->setup[HeadNode]->healthconf]% list
HealthCheck              HealthCheck Param  Check Interval
------------------------ ------------------ ------------------------
DeviceIsUp                                  120
ManagedServicesOk                           120
chrootprocess                               900
cmsh                                        1800
diskspace                2% 10% 20%         1800
exports                                     1800
failedprejob                                900
failover                                    1800
interfaces                                  1800
ldap                                        1800
mounts                                      1800
mysql                                       1800
ntp                                         300
oomkiller                                   1800
schedulers                                  1800
smart                                       1800
[esms1->monitoring->setup[MasterNode]->healthconf]%
```

4. Use the following commands to add a monitor for a file system named `scratch`. The first command adds another instance of `esfsmon` without any parameters. This is a base which we will configure for `scratch`. Note that none of these configuration activities take effect until we commit them to the Bright database with the `cmsh` `commit` command.

```
[esms1->monitoring->setup[HeadNode]->healthconf]% add esfsmon
[esms1->monitoring->setup*[HeadNode*]->healthconf*[esfsmon*]]% show
Parameter                      Value
------------------------------ ------------------------------------------------
Check Interval                 120
Disabled                       no
Fail Actions
Fail severity                  10
GapThreshold                   2
HealthCheck                    esfsmon
HealthCheckParam
LogLength                      3000
Only when idle                 no
Pass Actions
Stateflapping Actions
Store                          yes
ThresholdDuration              1
Unknown Actions
Unknown severity               10
[hopms->monitoring->setup*[HeadNode*]->healthconf*[esfsmon*]]%
```

5. Set the fail action and the healthcheck parameters to `scratch`.

```
[esms1->monitoring->setup*[HeadNode*]->healthconf*[esfsmon*]]% set checkinterval 60
[esms1->monitoring->setup*[HeadNode*]->healthconf*[esfsmon*]]% set failactions esfsmon_action
[esms1->monitoring->setup*[HeadNode*]->healthconf*[esfsmon*]]% set healthcheckparam scratch
[esms1->monitoring->setup*[HeadNode*]->healthconf*[esfsmon*]]% show
Parameter                      Value
------------------------------ ------------------------------------------------
Check Interval                 120
Disabled                       no
Fail Actions                   enter: esfsmon_action()
Fail severity                  10
GapThreshold                   2
HealthCheck                    esfsmon
HealthCheckParam               scratch
LogLength                      3000
Only when idle                 no
Pass Actions
Stateflapping Actions
Store                          yes
ThresholdDuration              1
Unknown Actions
Unknown severity               10
[hopms->monitoring->setup*[HeadNode*]->healthconf*[esfsmon*]]% commit
[hopms->monitoring->setup[HeadNode]->healthconf[esfsmon]]% quit
esms#
```

6. The `esfsmon` monitor for the `scratch` file system is setup but is suspended due to the existence of the`/var/esfsmon/esfsmon_suspend_scratch` file. Activate monitoring the scratch file system by removing

`/var/esfsmon/esfsmon_suspend_scratch`. To enable failover action to take place, remove the `/var/esfsmon/esfsmon_runsafe_scratch` file.

5.2.11 Controlling the Bright Cluster Manager Failover Monitor (`esfsmon`)

The Bright failover monitor and failover action are controlled by the existence or non-existence of the following files in the `/var/esfsmon` directory on the CIMS:

- `esfsmon_suspend_`*filesystem*
  - If present, monitoring of file system is suspended.
  - Set by the `esfsmon_action` script during failover to prevent false positive failure indications.
  - Set by the `esfsmon_failback` script during failback to prevent false positive failure indications.
  - May be set by the administrator to manually suspend monitoring. If manually set, it must be manually removed.
- `esfsmon_runsafe_`*filesystem*
  - If present, monitoring of *filesystem* is in `RUNSAFE` mode.
  - Errors will be reported but no failover action will be performed.
  - Set automatically by the monitor when failures compromise the ability to perform a failover.
  - May be set by the administrator to manually enter `RUNSAFE` mode.
  - If set, it must be manually removed to de-activate `RUNSAFE` mode and enable failover action.
- `esfsmon_mds_fo_disabled_`*filesystem*
  - If present, failover of MDS nodes is disabled.
  - Set automatically by the monitor if a standby MDS node is not present or if the primary MDS node has failed over to the standby MDS node.
  - May be set by the administrator to manually disable MDS failover.
  - If set, it must be manually removed to enable MDS failover.

5.2.12 Avoiding Inadvertent Failover Operations

In order to ensure that inadvertent failover actions are avoided, the administrator should suspend `esfsmon` by touching `/var/esfsmon/esfsmon_suspend_`*filesystem* during operations where any of the following may occur.

- Powering off or powering on a node
- Loss of InfiniBand® connectivity to a node
- Loss of Lustre mounts or change in the number of Lustre mounts from the normal value
- Performing a manual failover

Remove the `/var/esfsmon/esfsmon_suspend_`*filesystem* file to resume failover monitoring when the above conditions no longer apply.

5.2.13 Tuning the `esfsmon:`*filesystem* Check Interval

The `esfsmon` monitor is configured in Bright as the `esfsmon` health check on the CIMS. It takes a file system name as a parameter. Each `esfsmon` monitor will be named `esfsmon:`*filesystem* within Bright and can be tuned separately. The following commands will list the current check intervals (in seconds) of the master node health checks. The suggested check interval for `esfsmon` is 120 seconds and should not be changed without consulting Cray.

Procedure 51. Tuning the `esfsmon:`*filesystem* check interval

1. Log in to the CIMS as `root` and run the `cmsh` command.

```
esms1# cmsh
[esms1]%
```

2. Show health check intervals for the CIMS.

```
[esms1]% monitoring setup healthconf headnode
[esms1->monitoring->setup[HeadNode]->healthconf]% list
HealthCheck              HealthCheck Param  Check Interval
------------------------ ------------------ ------------------------
DeviceIsUp                                  120
ManagedServicesOk                           120
cmsh                                        1800
esfsmon                  scratch1           120
esfsmon                  scratch2           120
exports                                     1800
failedprejob                                900
failover                                    1800
ldap                                        1800
mounts                                      1800
mysql                                       1800
[hopms->monitoring->setup[MasterNode]->healthconf]% quit
esms:#
```

3. To change the interval of the `esfsmon:`*filesystem*, perform the following commands: (using the `scratch1` file system and setting the interval to 160 seconds in this example).

```
esms# cmsh
[esms1]% monitoring setup healthconf headnode
[esms1->monitoring->setup[HeadNode]->healthconf]% set esfsmon:scratch1 checkinterval 160
[esms1->monitoring->setup*[HeadNode*]->healthconf*]% commit
[esms1->monitoring->setup[HeadNode]->healthconf]% quit
esms#
```

5.2.14 Returning a Node to the CLFS Service

Once a node has been failed over it will no longer be monitored. The failover action moves the failed node to an internal failed node category and sets flags on the takeover node to indicate it is now serving extra file system targets.

To return a node to service the administrator must execute the `esfsmon_failback` command with the failed node host name as the sole argument. The `esfsmon_failback` command performs the following operations.

- Verifies that the node being restored is currently in the failed node category
- Moves the node to the proper active node category
- Calls `lustre_control` to failback the Lustre targets

The file system will be in `RUNSAFE` (monitor-only) mode. To enable automated failover, you must remove the `/var/esfsmon/esfsmon_runsafe_`*filesystem* file for the file system.

5.2.15 OSS Failover

A custom monitor script runs periodically on the CIMS as a Bright healthcheck to verify the operational health of all CLFS nodes. Each OSS has three primary functions, the first two of which are absolutely required for proper CLFS operation:

- Communicating with other nodes in the LNET InfiniBand fabric
- Mounting OSTs and providing file system services for them
- Communicating with a management server via TCP/IP. Loss of IP communication would not necessarily require a failover action, depending on site policies.

When the monitor is operating, any hardware or software event that prevents the OSS from performing its primary functions will trigger an automated failover process that attempts to move the OSTs to a designated failover OSS that can continue to provide file system services for the OSTs.

5.2.15.1 Failover Actions

The underlying mechanism supporting failover of OSTs from one OSS to another is the format on each OST that specifies another OSS as a failed node. Custom health checks in Bright verify the basic functions listed above and if a failure is detected or if an OSS fails to respond to the Bright queries, the CIMS monitor script will shutdown power for the failed OSS, which un-mounts its OSTs, and then call `lustre_control` to perform a failover of the OSTs. Note that this typically doubles the OST load on the failover OSS.

5.2.15.2 Corrective Actions

The actions required after an OSS failover are to determine the cause of the failure and correct it. Log entries by Bright and the monitor script should point toward the primary cause.

5.2.15.3 Recovery Actions

Once the OSS has been repaired or patched and is ready for service, its OSTs should be un-mounted from the failover OSS and re-mounted on their home OSS. This can be done with the `esfsmon_failback` command and typically can be done with the file system up and active.

It is highly recommended that the `esfsmon_failback` command be used to recover the previously failed OSS back into the system. The `esfsmon_failback` script takes the OSS host name as an argument and performs the necessary OST unmounts and re-mount operations via the `lustre_control` utility. It also performs all the administrative housekeeping to put the OSS back into the correct node category so it will be monitored again.

Once the OSS is returned to service, the administrator needs to remove the `/var/esfsmon/esfsmon_runsafe_`*filesystem* file to return the monitor to an active failover mode.

5.2.16 MDT/MGS Failover

At a high level, the primary functions of the metadata server (MDS) and metadata targets, which are storage devices (MDT), are the same as those of the OSS: Communicating on two networks (LNET and IP) and mounting and providing file system services for disks formatted for Lustre. The only difference is that the disks are the MDT and the MGS volumes (MGT). Cray recommends that MGT volumes are at least 100MB.

When the `esfsmon` monitor is operating, any hardware or software event that prevents the MDS from performing its primary function, trigger an automated failover process that attempts to move the MDTs to a designated failover MDS that can continue to provide file system services for the MDTs.

5.2.16.1 Failover Actions

The designation in format of a *failnode* is as described above for OSS except in this case the MDT is formatted, typically to reference a standby MDS or another active MDS. Failure monitoring with Bright queries and the CIMS monitor script is the same as described above for OSS. An MDS failure also triggers the CIMS to initiate a power reset followed by a call to the standby or designated MDS to mount the MDT(s) of the failed MDS.

5.2.16.2 Corrective Actions

The action required after an MDS failover are to determine the cause of the failure and correct it. Log entries by Bright and the monitor script should point toward the primary cause.

5.2.16.3 Recovery Actions

Once the MDS has been repaired or patched and is ready for service, its MDT(s) should be un-mounted from the failover MDS and re-mounted on their home MDSs. This can be done with the `esfsmon_failback` command and can often be done while the file system is mounted and in use by clients.

It is highly recommended that the `esfsmon_failback` command be used to recover the previously failed MDS back into the system. The `esfsmon_failback` script takes the MDS host name as an argument and performs the necessary unmount and re-mount operations via the `lustre_control` utility. It also performs all the administrative housekeeping to put the MDS back into the correct node category so it will be monitored again.

After the MDS is returned to service, the administrator must remove the `/var/esfsmon/esfsmon_runsafe_`*filesystem* file to return the monitor to an active failover mode.

5.2.16.4 MGS Failover

Most configurations feature a merged MDS and MGS server, with separate disks for MGT and MDT. All of the MDS discussion applies equally to MGS failover with the added requirement for different formatting. Specifically the MGT LUN itself does not specify a failnode parameter. Since it is the repository for configuration data of the file system, it does not need to report its new location and is functional by simply being re-mounted on a failover server. However, the corollary requirement to this one is that every other CLFS node (OST and MDT) in the configuration must be aware of this new location.

This is done by adding a second (i.e. alternate) `mgsnode` parameter to the format of every OST and MDT which points to the MGS/MDS failover node. Finally, MGS failover can take significantly longer than MDS failure alone or OSS failures because every client in the configuration must become aware of the new MGS node address. For large configurations this may exceed existing timeout values.

5.3 Configuring Kdump on CentOS™ (Optional)

Kdump is configured on a DMP system by modifying the configuration files on CDL systems. Dump files from slave nodes are stored either on the CIMS using NFS™, or on the slave node local disk. To save dump files to a local disk on a slave node, create a persistent `/var/crash` partition.

Procedure 52. Configuring kdump on CentOS

1. Log in to the CIMS as `root`.
2. Chose a slave node that you can use to test the kdump procedure (in this example `esfs-oss1`) and clone that slave node's software image. This example clones `ESF-XX-2.1.0-201309252230` to `ESF-XX-2.1.0-kdump`.

```
esms1# cd /cm/images
esms1# cp -pr ESF-XX-2.1.0-201309252230 ESF-XX-2.1.0-kdump
esms1# cmsh
[esms1%] softwareimage
[esms1->softwareimage]% clone ESF-XX-2.1.0-201309252230 ESF-XX-2.1.0-kdump
```

3. Commit your changes.

```
[esms1->->softwareimage*[ESF-XX-2.1.0-kdump*]]% commit
[esms1->->softwareimage[ESF-XX-2.1.0-kdump]]%
```

4. **Create a test category to configure kdump**

   Switch to `category` mode to create a test category.

```
[esms1->->softwareimage[ESF-XX-2.1.0-kdump]]% category
[esms1->category]%
```

5. Clone the production `esFS-OSS` or `esFS-MDS` category to create a test category.

   Note: Be sure to clone the production `esFS-OSS` category to an `OSS-test` category, and the production `esFS-MDS` category to an `MDS-test` category. These categories have different configurations and **are not interchangeable**. The `ESF-XX-2.1.0-kdump` software image **is** interchangeable for both node types. This procedure creates an `OSS-test` category.

```
[esms1->category]% clone esFS-OSS OSS-test
[esms1->category*[OSS-test*]%
```

6. Assign the kdump `esFS-OSS` software image (`ESF-XX-2.1.0-kdump`) to the `OSS-test` category.

```
[esms1->category*[OSS-test*]% set softwareimage ESF-XX-2.1.0-kdump
```

7. Add `/var/crash` to the exclude lists for the `ESF-XX-2.1.0-kdump` image. The `vi` editor launches which enables you to edit each of the exclude list files.

   Add `- /var/crash/*` to the list of excluded files:

```
[esms1->category*[OSS-test*]% set excludelistsyncinstall
[esms1->category*[OSS-test*]% set excludelistupdate
[esms1->category*[OSS-test*]% set excludelistgrab
[esms1->category*[OSS-test*]% set excludelistgrabnew
```

8. Save each file and commit your changes.

```
[esms1->category*[OSS-test*]% commit
[esms1->category[OSS-test]%
```

9. Assign the `OSS-test` test category to the test node (`esfs-oss1`) and commit your changes.

```
[esms1->category[OSS-test]]% device use esfs-oss1
[esms1->device[esfs-oss1]]% set category OSS-test
[esms1->device*[esfs-oss1*]]% commit
[esms1->device[esfs-oss1]]%
```

10. If you are saving kdump crash files to the slave node local disk, add the following lines to the slave node's finalize script. This command opens the `vi` editor.

```
[esms1->device[esfs-oss1]]% set finalizescript

DEV=$( awk -- '{ if ($2 == "/localdisk/var/crash") { print $1; exit 0 } }' < /proc/mounts )
[ -n "$DEV" ] && e2label $DEV crash
```

11. Commit your changes.

```
[esms1->device*]]% commit
```

12. **Set the storage location for crash dumps**

    If crash dumps will be saved to the CIMS proceed to step 13.

    If crash dumps will be saved to the slave node's local disk, proceed to step 14.

13. **Save crash files to `/var/crash` on the primary CIMS**

a. Use `fsexports` to determine whether the CIMS is exporting `/var/crash`.

```
[esms1->device]]% use esms1
[esms1->device[esms1]]% fsexports
[esms1->device[esms1]->fsexports]% list
Name (key)                                   Path
-------------------------------------------- -------------------------------
/cm/shared@esmaint-net                       /cm/shared
/home@esmaint-net                            /home
/var/spool/burn@esmaint-net                  /var/spool/burn
/cm/node-installer/certificates@esmaint-net  /cm/node-installer/certificates
/cm/node-installer@esmaint-net               /cm/node-installer
/var/crash@esmaint-net                       /var/crash
```

b. Export `/var/crash` from the CIMS and configure it so that slave nodes can access it.

```
[esms1->device[esms1]->fsexports]% add /var/crash
[esms1->device*[esms1*]->fsexports*[/var/crash*]]% set name /var/crash@esmaint-net
[esms1->device*[esms1*]->fsexports*[/var/crash*]]% set extraoptions no_subtree_check
[esms1->device*[esms1*]->fsexports*[/var/crash*]]% set hosts esmaint-net
[esms1->device[esms1]*]->fsexports*[/var/crash*]]% set write yes
[esms1->device*[esms1*]->fsexports*[/var/crash*]]% commit
```

c. Exit `cmsh`.

```
[esms1->device[esms1]->fsexports[/var/crash]]% quit\
esms1#
```

d. Update the exports.

```
esms1# exportfs -a
```

14. Use the `chroot` shell, edit the `/boot/pxelinux.cfg/default` file for kdump test image created in step 2 (`ESF-XX-2.1.0-kdump`).

a. Quit `cmsh`.

```
[esms1->device[esms1]]% quit
```

b. Use the `chroot` shell to edit the kdump test image.

```
esms1# chroot /cm/images/ESF-XX-2.1.0-kdump
esms:/>vi /boot/pxelinux.cfg/default
```

c. Edit `/boot/pxelinux.cfg/default` file.

d. Scroll down and locate the following line:

```
# End of documentation, configuration follows:
```

e. Enter the following lines in the `default` configuration file:

```
LABEL kdump
KERNEL vmlinuz
IPAPPEND 3
APPEND initrd=initrd crashkernel=512M CMDS console=tty0 console=ttyS1,115200n8 CMDE
MENU LABEL ^KDUMP      - Normal boot mode with kdump
MENU DEFAULT
```

f. Examine the other `LABEL` entries in the `default` configuration file and remove the line: `MENU DEFAULT`.

g. Exit and save the file.

15. Verify that `/var/crash` exists in the `ESF-XX-2.1.0-kdump` image and is a directory. If necessary:

```
esms1:/> mkdir /var/crash
esms1:/> ls -l /var/crash
```

16. Edit the `/etc/kdump.conf` file and add or modify the following lines:

```
esms1:/> vi /etc/kdump.conf
```

a. The following lines should be uncommented and all other lines should be commented.

```
path /
core_collector makedumpfile -c --message-level 1 -d 27
link_delay 60
default reboot
```

If you want to save crash dump files to the local add this line to the `kdump.conf` file. If the file system type is `ext4`, then replace `ext3` with `ext4`.

```
ext3 LABEL=crash
```

Note: Create a persistent partition (`/var/crash`) in the disk setup XML file for the kdump test category (`ESF-XX-2.1.0-kdump`). Creating a separate partition for crash dumps on the slave node software image prevents `/var` from filling up and causing problems for the operating system.

b. Exit and save the file.

17. Enable the `kdump` service.

```
esms1:/> chkconfig kdump on
```

18. Exit the `chroot` shell.

```
esms1:/> exit
esms1#
```

19. **Reboot the test node and run kdump**

a. Start a console window on the test slave node (`esfs-oss1`).

```
esms1# cmsh
[esms1]% device; use esfs-oss1
[esms1->device[esfs-oss1]]% rconsole
```

b. Reboot the test node (`esfs-oss1`).

```
esfs-oss1: reboot
esfs-oss1: Reboot in progress ...
```

c. When the node reboots, initiate kdump.

```
 esms1#  ssh esfs-oss1
esfs-oss1#echo c > /proc/sysrq-trigger
```

Note: If dumping over NFS to the CIMS, the dump file is created in `/var/crash` on the CIMS node. If dumping to the slave node's local disk, the dump file is created in `/var/crash` on the slave node's local disk.

20. Make the kdump image the default image for all CDL nodes.

a. Start `cmsh` and assign the test node (`esfs-oss1`) to the default `esFS-OSS`.

```
 esms1#  cmsh
[esms1]% device use esfs-oss1
[esms1->device[esfs-oss1]]% set category esFS-OSS
[esms1->device*[esfs-oss1*]]% commit
```

b. Switch to `category` mode and configure the default `esFS-OSS` category to use the kdump software image.

```
[esms1->device[esfs-oss1]]% category
[esms1->category]% use esFS-OSS
[esms1->category[esFS-OSS]% set softwareimage ESF-XX-2.1.0-kdump
```

21. Reboot all of the nodes in the `esFS-OSS` category, so that they use the kdump software image.

```
[esms1->category[esFS-OSS]% device
[esms1->device]% reboot -c esFS-OSS
esfs-oss1: Reboot in progress ...
```

22. Exit `cmsh`.

```
[esms1->device]% quit
```

23. If necessary, repeat Procedure 52 on page 181 to configure a kdump image for MDS nodes.

5.4 Configuring a NetApp™ Storage System

Note: The instructions in this section apply for both SAS (Serial Attached SCSI) and Fibre Channel (FC) RAIDs and supersede the documentation supplied by the RAID manufacturer.

Use the SANtricity™ storage management software from NetApp, Inc. to manage external NetApp RAID storage devices. SANtricity is provided as a separate package and is installed from a CD on the CIMS. The RAID controllers are set to IP addresses on the `esmaint-net` network in the 10.141.100.xxx range. See Figure 2 and CIMS Network Configuration on page 25.

5.4.1 Installing SANtricity Storage Manager Software for NetApp Devices

The SANtricity software is generally preinstalled and the SANtricity media is shipped with the system. However, if the CIMS does not have the software installed, you can install it. The SANtricity SMClient executable is found in `/opt/SMgr/client`.

Procedure 53. Installing SANtricity storage management software

1. Log in to the CIMS as `root`.
2. If you are installing from the SANtricity CD, insert it into the CIMS CD drive and mount it.

```
esms1# mount /dev/cdrom /media/cdrom
mount: block device /dev/sr0 is write-protected, mounting read-only
```

Or, if you are installing from the `SMIA-LINUXX64-10.80.A0.47.bin` file, copy `SMIA-LINUXX64-10.80.A0.47.bin` to `/root/release`.

```
esms1# cp ./SMIA-LINUX-10.70.A0.25.bin /root/release/
```

3. Set the `DISPLAY` environment variable.

```
esms1# export DISPLAY=:0.0
```

4. Verify that the X Window System is functioning by launching `xterm` or executing the `xlogo` utility.

```
esms1# xterm
```

Exit the `xterm` window.

5. Run the executable file.

If you are installing from the CD:

```
esms1# /bin/bash /media/cdrom/Linux*x86_64/install/SMIA-LINUXX64-10.80.A0.47.bin
```

Or, if you are installing from a directory:

```
esms1# /root/release/SMIA-LINUXX64-10.80.A0.47.bin
/root/release/SMIA-LINUXX64-10.80.A0.47.bin
Preparing to install...
Extracting the JRE from the installer archive...
Unpacking the JRE...
Extracting the installation resources from the installer archive...
Configuring the installer for this system's environment...

Launching installer...
```

6. Click **Next**. The **License Agreement** window displays.
7. Accept the license agreement and click **Next**. The **Select Installation Type** window displays.
8. Click **Typical (Full Installation)**, then click **Next**.

   The **Multipathing Driver Warning** window displays.
9. Click **OK**. The **Pre-Installation Summary** window displays.
10. Click **Install**.

    The **Installing SANtricity** window displays and shows the installation progress. When the installation completes, an **Install Complete** window appears.
11. Click **Done**. The SANtricity client is installed in `/usr/bin/SMclient` and is currently running.
12. Close the file browser and eject the CD.

```
esms1# eject
```

5.4.2 Configuring LUNs for NetApp Devices

Create a Volume Group and the LUNs that are members of it.

Procedure 54. Creating a volume group for NetApp devices

You must be logged on to the CIMS as `root`.

1. Start the SANtricity software.

```
esms1# /usr/bin/SMclient
```

   The **SANtricity Storage Manager** window displays.

2. If the **Select Addition Method** window displays, choose one of the following options; otherwise, skip to step 3:

   - **Automatic** — Select this option if you did not assign IP addresses to the storage array controllers using a serial connection. The SANtricity software automatically detects the available controllers, in-band, using the Fibre Channel or InfiniBand link.

- **Manual** — Select this option if `esmaint-net` IP addresses are assigned to the RAID controllers. Refer to IP address scheme discussed in CIMS Network Configuration on page 25. Figure 2 shows how RAID controllers are connected to the `es-maint` network.

Note: The rest of this procedure assumes that you selected the **Manual** option.

3. Double-click the name for the Storage Array that you want to configure. The **Array Management** window displays.
4. Click the **Logical/Physical** tab.
5. Right-click **Unconfigured Capacity** and select **Create Volume**. The **Create Volume** wizard displays.
6. Click **Next** on the **Introduction (Create Volume)** window.
7. Select the **Manual** option on the **Specify Volume Group (Create Volume)** window.
8. Select the tray, and desired slots, and click **Add**.
9. Verify that the RAID level is correct (for example RAID 5).
10. Click **Calculate Capacity**.
11. Click Next on the **Specify Volume Group (Create Volume)** window.

    When you create the first Volume Group, you are prompted to create the first volume.

Procedure 55. Creating and configuring volumes for NetApp devices

1. Enter a new volume capacity.
2. Specify units as GB or MB.
3. Enter a name.
4. Select the **Customize Settings** option.
5. Click **Next** in the **Specify Capacity/Name (Create Volume)** window.
6. Verify the settings on the **Customize Advanced Volume Parameters (Create Volume)** window. These settings are used for the all of the LUNs.
    - For **Volume I/O characteristics type**, verify that **File System** is selected.
    - For **Preferred Controller Ownership**, verify that **Slot A** is selected. This places the LUN on the A Controller.
7. Click **Next** in the **Customize Advanced Volume Parameters (Create Volume)** window.

8. In the **Specify Volume to LUN Mapping** window, select the **Default mapping** option.
9. If not configuring multipath, select **Host type**, and select **Linux™** from the drop-down menu. If you intend to configure multipath, set **Host type** to **Linux (DM-MP)**.
10. Click **Finish** in the **Specify Volume to LUN Mapping** window.
11. When prompted to create more LUNs in the **Creation Successful (Create Volume)** window, select **Yes** unless this is the last volume you are creating. If this is the last volume, select **No** and skip to step 15.
12. In the **Allocate Capacity (Create Volume)** window, verify that **Free Capacity** is selected on **Volume Group 1 (RAID 5)**.
13. Click **Next** in the **Allocate Capacity (Create Volume)** window.
14. Repeat step 1 through step 13 to create all of the volumes.
15. Click **OK** in the **Completed (Create Volume)** window.
16. Create a hot spare. The hot spare provides a ready backup if any of the drives in the Volume Group fail.
    a. Right-click on a drive in the right portion of the window and select **Hot Spare Coverage**.
    b. Select the **Manually Assign Individual Drives** option.
    c. Click **OK**.
    d. Click **Close**.
17. Exit the tool.

5.4.3 Host Mappings

If you are configuring multipath, and are experiencing errors from NetApp™ storage devices such as `Volume not on preferred path due to AVT/RDAC failover`, be sure to set the host mappings parameter to **Linux (DM-MP)** or **Linux** (on older firmware). Use the SANtricity™ Storage Manager Software command **Host Mappings->Default Group->Change Default Host Operating System** to configure the host mappings setting.

5.4.4 Configuring Remote Logging of NetApp™ Storage System Messages

NetApp storage systems use Simple Network Management Protocol (SNMP) to provide boot RAID messages on the `esmaint-net` network. Configure the community settings for the RAID device using the serial console connection (a custom cable is shipped with NetApp devices for this purpose). Make the console connection in a similar manner to how you configure a switch. (See Adding a Managed Switch or Device to the Bright Configuration on page 111.) Refer to your NetApp storage system documentation for more information.

5.4.5 Add a NetApp RAID Storage System to Bright

RAID devices are added as type `genericdevice` in `cmsh` or as **Other** devices using the `cmgui`. The procedure below shows how to add a RAID device to Bright using `cmsh`.

Procedure 56. Adding a NetApp RAID storage system to Bright

1. Install the SANtricity (`SMclient`) software on the CIMS. Refer to Installing SANtricity Storage Manager Software for NetApp Devices on page 186.
2. Set the RAID controller IP addresses to valid `esmaint-net` addresses (in the 10.141.100.xxx range). Refer to IP address scheme discussed in CIMS Network Configuration on page 25. Figure 2 shows how RAID controllers are connected to the `esmaint-net` network.
3. Log in to the CIMS as `root` and run `cmsh`.

```
esms1# cmsh
[esms1]%
```

4. Switch to `device` mode.

```
[esms1]% device
```

5. Add the NetApp RAID controller(s) under **Other** devices in the `cmgui` resource tree, or as a `genericdevice` in `cmsh`. This procedure adds a NetApp 3992 controller A for example.

```
[esms1->network[storage-net]]% device
[esms1->device]% add genericdevice netapp3992-cntrlA
```

6. Set the device information for model, rack number, device height in rack units, and device U position in the rack.

```
[esms1->device*[netapp3992-cntrlA*]]% set model LSI3992
[esms1->device*[netapp3992-cntrlA*]]% set rack rack_num
[esms1->device*[netapp3992-cntrlA*]]% set deviceheight rack_units
[esms1->device*[netapp3992-cntrlA*]]% set deviceposition rack_position
```

7. Set the RAID controller Ethernet port IP address on the `esmaint-net`, for example 10.141.100.10.

```
[esms1->device*[netapp3992-cntrlA*]]% set ip controller_ip_address
```

8. Set MAC address for the RAID controller Ethernet port.

```
[esms1->device*[netapp3992-cntrlA*]]% set mac MAC_address
```

9. Set the network to `esmaint-net`.

10. Set power control to `custom` (power is controlled from the SANtricity client software).

```
[esms1->device*[netapp3992-cntrlA*]]% set powercontrol custom
```

11. (Optional) Add notes for this controller. The following command opens the `vi` editor where notes can be added for this device. For example: `oss001 connection to RAID controller A, Even LUNs`.

```
 [esm1->device*[netapp3992-cntrlA*]]% set notes
```

12. Show the controller settings.

```
 [esm1->device*[netapp3992-cntrlA*]]% show
Parameter                      Value
------------------------------ ------------------------------------
Activation                     Tue, 14 May 2013 08:20:30 CDT
Additional Hostnames
Container index                0
Custom ping script
Custom ping script argument
Custom power script
Custom power script argument
Device height                  4
Device position                30
Ethernet switch
Hostname                       netapp3992-cntrlA
Ip                             10.141.100.10
Mac                            00:0B:5F:CE:2F:40
Model
Network                        esmaint-net
Notes                          <47 bytes>
Partition                      base
Power control                  custom
PowerDistributionUnits
Rack                           1
Revision
Tag                            00000000a000
Type                           GenericDevice
Userdefined1
Userdefined2
```

5.5 Rediscovering the New LUNs

This procedure causes the CLFS to rediscover the new LUNs created in Procedure 55 on page 188.

Procedure 57. Rebooting the CLFS and verifying LUNs are recognized

1. Log in to the CIMS as the `root`.
2. Use SSH to log in to the CLFS nodes and enter the following command to ensure that the LUNs are recognized:

```
esms1# ssh esfs-oss001
```

3. Reboot the node or probe the SCSI bus to verify the LUNs are available to the MDS or OSS node.

   Note: Two paths to LUN 5 (`/dev/sdg` and `/dev/sdm`) indicate multipath is enabled.

```
[root@esfs-oss001 ~]# lsscsi
[0:2:0:0]    disk    DELL     PERC H710P       3.13  /dev/sda
[5:0:0:0]    cd/dvd  PLDS     DVD+-RW DS-8A8SH KD51  /dev/sr0
[7:0:0:0]    disk    LSI      INF-01-00        0780  /dev/sdb
[7:0:0:1]    disk    LSI      INF-01-00        0780  /dev/sdc
[7:0:0:2]    disk    LSI      INF-01-00        0780  /dev/sdd
[7:0:0:3]    disk    LSI      INF-01-00        0780  /dev/sde
[7:0:0:4]    disk    LSI      INF-01-00        0780  /dev/sdf
[7:0:0:5]    disk    LSI      INF-01-00        0780  /dev/sdg
[8:0:0:0]    disk    LSI      INF-01-00        0780  /dev/sdh
[8:0:0:1]    disk    LSI      INF-01-00        0780  /dev/sdi
[8:0:0:2]    disk    LSI      INF-01-00        0780  /dev/sdj
[8:0:0:3]    disk    LSI      INF-01-00        0780  /dev/sdk
[8:0:0:4]    disk    LSI      INF-01-00        0780  /dev/sdl
[8:0:0:5]    disk    LSI      INF-01-00        0780  /dev/sdm
```

4. List the disk devices by using the `fdisk` command to verify that the LUNs (volumes) are configured.

```
[root@esfs-oss001 ~]# fdisk -l
```

5.6 Partitioning the LUNs

After you finish creating, formatting, and zoning the LUNs on the RAID, you must partition them. Refer to the NetApp documentation for the SANtricity Storage Manager software for more information.

5.7 Adding Nodes to CLFS Categories

Each CLFS slave node must be added to Bright and assigned to the `esFS-MDS` or `esFS-OSS` category to configure node-specific device information. The physical node and network interface information should already exist in the Bright database.

> **Note:** This procedure adds MDS nodes to the `esFS-MDS` category. Repeat this procedure to add OSS nodes to the `esFS-OSS` category.

Procedure 58. Adding nodes to a CLFS category

1. Log in to the CIMS as `root` and run `cmsh`.

```
esms1# cmsh
[esms1]%
```

2. Switch to `device` mode:

```
[esms1]% device
```

3. Add the new node to the `esFS-MDS` category.

   > **Note:** This procedure uses the example host name `esfs-mds001` and the category name `esFS-MDS`. Substitute your actual CLFS node host name and the category name used in the previous procedure.

```
[esms1->device]% use esfs-mds001
[esms1->device[esfs-mds001]]% set category esFS-MDS
[esms1->device[esfs-mds001*]]%
```

4. Set the rack information (device height, position in the rack, and rack number). This example assumes that the device height is 2U, its position in the rack is `12`, and the rack number is `1`. Substitute the actual values from your CLFS node position.

```
[esms1->device[esfs-mds001*]]% set deviceheight 2
[esms1->device[esfs-mds001*]]% set deviceposition 12
[esms1->device[esfs-mds001*]]% set rack 1
```

5. Commit your device changes.

```
[esms1->device[esfs-mds001*]]% commit
[esms1->device[esfs-mds001]]%
```

6. Repeat step 3 through step 5 to add each MDS node to the `esFS-MDS` category and each OSS node to the `esFS-OSS` category.

7. Check the MDS and OSS categories to verify they are configured properly.

```
[esms1->device[esfs-mds001]]% category
[esms1->category]]% list
Name (key)               Software image
------------------------ ------------------------
default                  default-image
default-diskless         default-image
esFS-MDS                 ESF-XX-2.1.0-201309252230
esFS-OSS                 ESF-XX-2.1.0-201309252230
esLogin-XC               ESL-XC-1.0.2-2013022113+
esLogin-XE               ESL-XE-1.1.1_CLE4.1


[esms1->category]% usedby esFS-MDS
Category used by the following:
Type             Name                     Parameter                Autochange
---------------- ------------------------ ------------------------ ------------
Device           esfs-mds001              category                 no
Device           esfs-mds002              category                 no


[esms1->category]% usedby esFS-OSS
Category used by the following:
Type             Name                     Parameter                Autochange
---------------- ------------------------ ------------------------ ------------
Device           esfs-oss001              category                 no
Device           esfs-oss002              category                 no
Device           esfs-oss003              category                 no
Device           esfs-oss004              category                 no
```

8. Exit `cmsh`.

```
[esms1->category]% quit
esms1#
```

5.8 Configuring Bright Categories for CLFS Nodes

Note: Use Procedure 59 on page 194 to customize the Bright `esFS-MDS` and `esFS-OSS` categories for MDS and OSS nodes. Then use Procedure 58 on page 193 to add CLFS nodes to the Bright category.

The `default` category is assigned to the first CLFS node when it was cloned. The `esFS-MDS` and `esFS-OSS` categories must be assigned the software image created during installation. You must also define the default gateway, default disk partitions, and finalize script for your site configuration.

Procedure 59. Configuring Bright CLFS categories

Note: This procedure customizes the `esFS-MDS`category for your site configuration. Repeat this procedure to customize the `esFS-OSS` category.

1. Log in to the CIMS as `root` and run `cmsh`.

```
esms1# cmsh
[esms1]%
```

2. Switch to `category` mode and list categories and associated software images.

```
[esms1]% category
[esms1->category]% list
Name (key)                Software image
------------------------ ------------------------
default                   default-image
default-diskless          default-image
esFS-MDS                  default-image
esFS-OSS                  default-image
esLogin-XC                ESL-XC-1.0.2-2013022113+
esLogin-XE                ESL-XE-1.1.1_CLE4.1
```

3. Assign the CLFS image (`ESF-XX-2.1.0-201309252230`) created by `ESFinstall`, to the `esFS-MDS` category.

```
[esms1->category]% use esFS-MDS
[esms1->category[esFS-MDS]]% set softwareimage ESF-XX-2.1.0-201309252230
[esms1->category*[esFS-MDS*]]%
```

4. Continue at step 5 if configuring the `esFS-OSS` category. For the `esFS-MDS` category, set the default gateway so that MDS nodes can contact an external LDAP server on `site-user-net`. For *gateway*, use the IP address of your site's gateway (on `site-user-net`).

```
[esms1->category*[esFS-MDS*]]% set defaultgateway gateway
```

5. Commit the changes.

```
[esms1->category*[esFS-MDS*]]% commit
[[esms1->category[esFS-MDS]]%
```

6. Configure the esFS-MDS or esFS-OSS category with the proper disk partition sizes and configuration.

   Note: A custom disk partition layout can be applied using an XML schema to a category of nodes such as esFS-MDS or esFS-OSS. A disk partition layout that is applied to an individual node within a category overrides the category setting. Add <blockdev> XML entries to the site.esfs-diskfull.xml file if there are several LUNs on a SAS RAID that are used for MDTs. The XML file currently defines /dev/sda through /dev/sdz.

   Changes made to the esfs-diskfull.xml file do not occur until they are saved in cmgui, or committed in cmsh, and the CLFS node is rebooted. Bright detects that the partitioning has changed and invokes a FULL install. (Bright also ignores the NOSYNC install mode and will repartition the drives on other CLFS nodes in the category as well.)

   Older model CLFS nodes can use esfs-small-diskfull.xml for disk partitioning to accommodate smaller hard drives.

   Important: If the default disk setup XML files are updated in a ESM release and the site disk setup XML files have been customized, system administrators must compare the newly released disk setup XML files with the current production disk setup XML files, and merge the changes manually. After the changes have been merged, you must load the updated disk setup file into the Bright database for the node category and reboot all the nodes that use that category.

   a. Quit cmsh and copy the default XML configuration to an etc directory to prevent it from being overwritten during software updates.

```
[esms1->category[esFS-MDS]]% quit
esms1# cd /opt/cray/esms/cray-es-diskpartitions-XX
esms1# mkdir -p etc
esms1# cp -p default/esfs-diskfull.xml etc/site.esfs-diskfull.xml
```

   b. Edit the site.esfs-diskfull.xml file to change partition sizes or configuration.

```
esms1# vi etc/site.esfs-diskfull.xml
```

   c. Save the changes and return to cmsh.

7. Set the disk setup parameter for the category and commit the changes.

```
esms1# cmsh
[esms1]% category use esFS-MDS
[esms1->category[esFS-MDS]]% set disksetup /opt/cray/esms/cray-es-diskpartitions-XX\
/etc/site.esfs-diskfull.xml
[esms1->category*[esFS-MDS*]]% commit
```

8. Confirm your changes to the site.esfs-diskfull.xml script.

```
[esms1->category[esFS-MDS]]% get disksetup
```

9. Repeat this procedure to configure the `esFS-OSS` category.

   Note: You must also configure the CLFS node finalize scripts.

10. Refer to Adding Nodes to CLFS Categories on page 193 to add CLFS nodes to the `esFS-MDS` and `esFS-OSS` categories.

5.9 Configuring Lustre® File Systems on CLFS Nodes

This section describes how to configure Lustre file systems on CLFS nodes from the CIMS.

Procedure 60. Configuring Lustre file systems on CLFS nodes from the CIMS

1. Log in to the CIMS as `root`.

2. Copy `/opt/cray/esms/cray-lustre-control-XX/default/etc/example.fs_defs` to `/opt/cray/esms/cray-lustre-control-XX/etc/scratch.fs_defs` to prevent it from being overwritten during software updates.

```
esms1# mkdir -p /opt/cray/esms/cray-lustre-control-XX/etc
esms1# cd /opt/cray/esms/cray-lustre-control-XX/etc
esms1# cp -p /opt/cray/esms/cray-lustre-control-XX/default/etc/example.fs_defs scratch.fs_defs
```

3. Display the Lustre network identifier (NID) map information to include in the `scratch.fs_defs` file.

```
esms1# lustre_control dump_nid_map -w esfs-mds00[1-2],esfs-oss00[1-4]
Performing 'dump_nid_map' from esms1 at Thu Jan 31 14:47:49 CST 2013

Hostname to LNET nid mapping for the nodes:
esfs-mds001,esfs-mds002,esfs-oss001,esfs-oss002,esfs-oss003,esfs-oss004
nid_map: nodes=esfs-mds00[1-2]  nids=10.149.0.[1-2]@o2ib
nid_map: nodes=esfs-oss00[1-4]  nids=10.149.0.[3-6]@o2ib
```

4. To configure persistent device names for the RAID disk devices you configured in step 6, Cray recommends that you use the `/dev/disk/by-id/` persistent

device names. To determine the persistent drive names for the devices you configured in step 6, use SSH to log in to the MDS or OSS node and list the contents of the `/dev/disk/by-id` directory.

```
esms1# ssh esfs-mds001
Last login: Fri Apr 19 11:08:03 2013 from esms1.cm.cluster
[root@esfs-mds001 by-id]# ls -l /dev/disk/by-id
total 0
lrwxrwxrwx 1 root root  9 Apr 18 21:14 scsi-3600508e000000000faef8330f46c9c09 -> ../../sda
lrwxrwxrwx 1 root root 10 Apr 18 21:14 scsi-3600508e000000000faef8330f46c9c09-part1 -> ../../sda1
lrwxrwxrwx 1 root root 10 Apr 18 21:14 scsi-3600508e000000000faef8330f46c9c09-part2 -> ../../sda2
lrwxrwxrwx 1 root root  9 Apr 18 16:43 scsi-3600a0b800026cfe400002dfd4becf544 -> ../../sdb
lrwxrwxrwx 1 root root  9 Apr 18 21:14 wwn-0x600508e000000000faef8330f46c9c09 -> ../../sda
lrwxrwxrwx 1 root root 10 Apr 18 21:14 wwn-0x600508e000000000faef8330f46c9c09-part1 -> ../../sda1
lrwxrwxrwx 1 root root 10 Apr 18 21:14 wwn-0x600508e000000000faef8330f46c9c09-part2 -> ../../sda2
lrwxrwxrwx 1 root root  9 Apr 18 16:43 wwn-0x600a0b800026cfe400002dfd4becf544 -> ../../sdb
```

Note: The persistent device name for `sdb` is `scsi-3600a0b800026cfe400002dfd4becf544`. Enter the value in the device configuration section of `scratch.fs_defs`.

Important: For a multipath configuration, device names should link to a logical alias under `/dev/mapper/`*alias* . This can be configured in the node finalize script either for the node, or the node category (such as `eslogin-XC`). Multipath configuration device names can also be configured as a `dm-uuid` path name such as `/dev/disk/by-id/dm-uuid-mpath-`*wwid*. Either option in step 4 is a link that points to the `/dev/dm-`*x* device.

5. Edit the `scratch.fs_defs` file to set values.

```
esms1# vi /opt/cray/esms/cray-lustre-control-XX/etc/scratch.fs_defs
```

6. Modify the `fs_name`, `nid_map`, `mds`, `mgt`, `ost`, and `stripe_count` settings in the `scratch.fs_defs` file.

   a. Enter the `fs_name:` (such as `scratch`).

```
# file system name - must be 8 characters or less
fs_name: scratch
```

   b. Enter the `nid_map` information obtained in step 3.

```
nid_map: nodes=esfs-mds00[1-2] nids=10.149.0.[2-3]@o2ib
nid_map: nodes=esfs-oss00[1-4] nids=10.149.0.[4-7]@o2ib
```

   c. Enter the `mdt` and `mgt` definitions and disk device name(s) for your system obtained from step 4. Include the failover node definition (`fo_node`) if configuring a failover system. If there is no failover node definition, remove this line.

> **Note:** In this example, the metadata target (MDT) and management target (MGT) functions share the same CLFS node (`esfs-mds001`).

```
## MDT
## MetaData Target
mdt: node=esfs-mds001
     dev=/dev/disk/by-id/scsi-xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
     fo_node=esfs-mds002

## MGT
## Management Target
mgt: node=esfs-mds001
     dev=/dev/disk/by-id/scsi-xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
     fo_node=esfs-mds002
```

7. Enter the `ost` definitions and disk device name(s) for your system obtained from step 4. Include the failover node definition (`fo_node`) if configuring a failover system. If there is no failover node definition, remove this line.

```
## OST
## Object Storage Target(s)
ost: node=esfs-oss001
     dev=/dev/disk/by-id/scsi-xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
     fo_node=esfs-oss002

ost: node=esfs-oss003
     dev=/dev/disk/by-id/scsi-xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
     fo_node=esfs-oss004
```

8. Exit and save the `scratch.fs_defs` file and proceed to Configuring Lustre® File Systems on MDS and OSS Nodes on page 199.

5.10 Configuring Lustre® File Systems on MDS and OSS Nodes

Procedure 61. Configuring Lustre file systems on MDS and OSS nodes

1. From the CIMS as `root`, install the Lustre file system definitions.

```
esms1# cd /opt/cray/esms/cray-lustre-control-XX/etc
esms1# lustre_control install scratch.fs_defs
Performing 'install' from esms1 at Mon Apr 22 14:38:42 CDT 2013
Parsing file system definitions file: scratch.fs_defs
Parsed file system definitions file: scratch.fs_defs
The 'scratch' file system definitions were successfully installed!
```

2. Format the file system on `scratch`.

```
esms1# lustre_control reformat -f scratch
Performing 'reformat' from esms1 at Mon Apr 22 14:42:52 CDT 2013

About to reformat all targets for the following file system(s):
scratch

Continue? (y|n|q)
y
```

3. Start the Lustre file system `scratch`.

```
esms1# lustre_control start -p -f scratch
```

4. Check the status of the `scratch` file system.

```
esms1# lustre_control status -f scratch
Performing 'status' from esms1 at Mon Apr 22 14:44:14 CDT 2013

File system: scratch
Device             Host         Mount           OST Active     Recovery Status
MGS                esfs-mds001  Mounted         N/A            Unknown
MGS*               esfs-mds002  Unmounted       N/A            N/A
scratch-MDT0000    esfs-mds001  Mounted         N/A            INACTIVE
scratch-MDT0000*   esfs-mds002  Unmounted       N/A            N/A
scratch-OST0000    esfs-oss1    Mounted         Active         INACTIVE
scratch-OST0000*   esfs-oss2    Unmounted       Active         N/A
.
.
.
```

5.11 Creating a Generic CLFS Node in Bright Cluster Manager®

The easiest way to add a new slave node is to clone an existing node that is configured and fully functional in Bright Cluster Manager® (Bright). When you do not have a functioning CLFS node, you must clone the default node (`node001`) created during the CIMS installation process.

Note: In this guide, some examples are left-justified to fit command lines or display output on a single line. Left-justification has no special significance.

Procedure 62. Creating a CLFS node in Bright

Note: The following procedures use the Bright management shell (`cmsh`). They may also be performed using the Bright GUI (`cmgui`).

The `cmsh` command prompt displays an asterisk (`*`) when you have uncommitted changes. Be sure to commit your changes using the `commit` command before exiting `cmsh`, or your changes will be lost. Alternatively, the `cmgui` provides a **Save** button to save and commit your changes.

1. Log in to the CIMS as `root` and run `cmsh`.

```
esms1# cmsh
[esms1]%
```

2. Enter `device` mode.

```
[esms1]% device
[esms1->device]%
```

3. Perform this procedure for each CLFS node. List the available devices.

```
[esms1->device]% list
Type                   Hostname (key)   MAC                Category   Ip              Network
---------------------- ---------------- ------------------ ---------- --------------- --------------
EthernetSwitch         switch01         00:00:00:00:00:00             10.141.253.1    esmaint-net
MasterNode             esms1            78:2B:CB:40:CE:CA             10.141.255.254  esmaint-net
PhysicalNode           node001          00:00:00:00:00:00  default    10.141.0.1      esmaint-net
```

4. If this is the first CLFS node created for the system, you must clone the default node which is `node001` in step 3. This example creates a new CLFS node named `esfs-mds001`.

   Note: When the CIMS software is installed, Bright creates a default node, `node001`, that uses the default slave image in `/cm/images/default-image`. This image is assigned to the newly cloned node.

```
[esms1->device]% device list |grep node001
PhysicalNode        node001       00:00:00:00:00:00  default   10.141.0.1   esmaint-net
[esms1->device]% clone node001 esfs-mds001
Base name mismatch, IP settings will not be modified!
```

   If you have already created a CLFS node, then clone the configured CLFS to create another MDS or OSS node.

   Important: Always make sure that newly cloned nodes boot from `default-image` without errors before you begin other configuration tasks. When repeating this procedure to create additional CLFS nodes, set the newly cloned node category to default and boot the node using the `default-image` to configure the node for Bright.

```
[esms1->device]% clone esfsnode esfs-mds001
Base name mismatch, IP settings will not be modified!
[esms1->device*[esfs-mds001*]]% commit
[esms1->device[esfs-mds001]]% exit
[esms1->device*]% set esfs-mds001 category default
[esms1->device*]% commit
```

5. Change the interface settings for the new (cloned) node.

a. Switch to `interfaces` mode and list interfaces on `esfs-mds001`.

```
[esms1->device]% use esfs-mds001
[esms1->device]% interfaces
[esms1->device[esfs-mds001]->interfaces]% list
Type         Network device name  IP               Network
------------ -------------------- ---------------- ----------------
bmc          ipmi0                10.148.0.1       ipmi-net
physical     BOOTIF [prov]        10.141.0.1       esmaint-net
```

b. Set the `BOOTIF` and `ipmi0` interface addresses for the new node. These addresses must be different from those used by the default or original node.

```
[esms1->device*[esfs-mds001*]->interfaces]% set bootif ip 10.141.0.2
[esms1->device*[esfs-mds001*]->interfaces*]% set ipmi0 ip 10.148.0.2
[esms1->device*[esfs-mds001*]->interfaces*]% list
Type         Network device name  IP               Network
------------ -------------------- ---------------- ----------------
bmc          ipmi0                10.148.0.2       ipmi-net
physical     BOOTIF [prov]        10.141.0.2       esmaint-net
```

c. Configure the `ib-net` network and interface.

Note: Cray recommends that `ib0` on OSS nodes be connected to the IB switch, `ib1` is should not be used, and `ib2` and `ib3` connect to the storage array controllers.

```
[esms1->device*[esfs-mds001*]->interfaces*]% add physical ib0
[esms1->device*[esfs-mds001*]->interfaces*[ib0*]]% set network ib-net
[esms1->device*[esfs-mds001*]->interfaces*[ib0*]]% set ip 10.149.0.2
[esms1->device*[esfs-mds001*]->interfaces[ib0]]% show
Parameter                      Value
------------------------------ ------------------------------------------------
Additional Hostnames
Card Type
DHCP                           no
IP                             10.149.0.2
MAC                            00:00:00:00:00:00
Network                        ib-net
Network device name            ib0
Revision
Speed
Type                           physical
```

d. Commit your changes.

```
[esms1->device*[esfs-mds001*]->interfaces*[ib0*]]% commit
```

e. Exit `ib0`.

```
[esms1->device[esfs-mds001]->interfaces[ib0]]%  exit
```

f. Check the results.

```
[esms1->device[esfs-mds001]->interfaces]% list
Type         Network device name  IP               Network
------------ -------------------- ---------------- ----------------
bmc          ipmi0                10.148.0.2       ipmi-net
physical     BOOTIF [prov]        10.141.0.2       esmaint-net
physical     ib0                  10.149.0.2       ib-net
```

g. Exit `interface` mode and return to `device` mode.

```
[esms1->device[esfs-mds001]->interfaces]% exit
```

h. Display the status of the new node.

```
[esms1->device[esfs-mds001]]% status
esfs-mds001 ............... [   DOWN   ]  (Unassigned)
```

Note: The node is unassigned because the MAC address has not been set in Bright.

6. Set the MAC address for the CLFS node (`eth0` on `esmaint-net`).

```
[esms1->device[esfs-mds001]]% set mac MACaddress
```

7. Set the management network to `esmaint-net`.

```
[esms1->device[esfs-mds001*]]% set managementnetwork esmaint-net
```

8. Commit your changes and quit `cmsh`.

```
[esms1->device*[esfs-mds001*]]% commit
[esms1->device[esfs-mds001]]% quit
esms1#
```

9. If you are configuring an MDS node, refer to Configuring the Site User Network (for MDS Nodes Only) on page 208, to configure network parameters for the `site-user-network`. If you are configuring an OSS node, test-boot the node.

5.12 Configuring Node Finalize Script for MDS Nodes

Prepare the node finalize script for the MDS nodes and load it for the `esFS-MDS` category.

A finalize script (run before `init`) is used to set a file configuration or to initialize special hardware, sometimes after a hardware check. It is run in order to make software or hardware work before, or during the later `init` stage of boot. Use a finalize script to execute commands before `init`, when the commands cannot be stored persistently anywhere else, or when it is needed because a choice between (otherwise non-persistent) configuration files must be made based on the hardware before `init` starts.

Important: Files created or modified by a finalize script must be listed in the `excludelistupdate` exclude list for the category. Software updates will over write customized files if the files are not specified in an exclude list for the category. Customized files must also be specified in the `excludelistgrab`, and `excludelistgrabnew` exclude lists to prevent customized files from being copied to the CIMS.

Procedure 63. Configuring the node finalize script for MDS nodes

Note: The `named`, `nslcd`, `nscd`, and `ldap` services are turned off in the default finalize script for MDS nodes. To enable these services, uncomment the corresponding lines in the finalize script.

1. Log in to the CIMS as `root`.
2. Make a copy of the default MDS finalize script to an `etc` directory to prevent it from being overwritten during software updates.

```
esms1# cd /opt/cray/esms/cray-es-finalize-scripts-XX
esms1# mkdir -p etc
esms1# cp -p default/mds_finalize.sh etc/site.mds_finalize.sh
```

Note: Cray recommends that the subnet manager for the IB fabric should be run on `ib0` of the MDS node(s) for system configurations that have many CLFS file system nodes connected to an IB switch as described in step 3.

3. (Optional) Add/uncomment the following command line if you want to start the IB subnet manager on `ib0` for the `esFS-MDS` category.

```
esms1# vi etc/site.mds_finalize.sh

echo "/usr/sbin/opensm --daemon -g \`/usr/sbin/ibstat mlx4_0 1 | grep GUID | awk '{print \$3}'\`" >>\
 /localdisk/etc/rc.d/rc.local

exit 0
```

4. To configure LDAP, refer to Configure LDAP on MDS Nodes on page 206 after completing this procedure.
5. Run the `cmsh` and set the finalize script for the `esFS-MDS` category.

```
esms1# cmsh
[esms1]% category
[esms1->category]% use esFS-MDS
[esms1->category[esFS-MDS]]% set finalizescript /opt/cray/esms/cray-es-finalize-scripts-XX\
/etc/site.mds_finalize.sh
[esms1->category*[esFS-MDS*]]% commit
[esms1->category[esFS-MDS]]%
```

6. Verify the new lines have been added to the `site.mds_finalize.sh` finalize script.

```
[esms1->category[esFS-MDS]]% get finalizescript
[esms1->category[esFS-MDS]]% quit
```

5.13 Configuring Node Finalize Script for OSS Nodes

Prepare the node finalize script for the OSS nodes and load it for the esFS-OSS category.

Important: Files created or modified by a finalize script must be listed in the excludelistupdate exclude list for the category. Software updates will over write customized files if the files are not specified in an exclude list for the category. Customized files must also be specified in the excludelistgrab, and excludelistgrabnew exclude lists to prevent customized files from being copied to the CIMS.

Procedure 64. Configuring the node finalize script for OSS nodes

1. Log in to the CIMS as root.
2. Make a copy of the default OSS finalize script to an etc directory to prevent it from being overwritten during software updates.

```
esms1# cd /opt/cray/esms/cray-es-finalize-scripts-XX
esms1# mkdir -p etc
esms1# cp -p default/oss_finalize.sh etc/site.oss_finalize.sh
```

3. (Optional) If the OSS node connects to the storage array using InfiniBand® (IB), then start a subnet manager and configure SCSI RDMA protocol (SRP) on the interface that is connected to the storage array controllers.

   a. Edit the site.oss_finalize.sh file add/uncomment the following lines before the exit 0 line.

```
esms1# vi etc/site.oss_finalize.sh
```

   b. Add/uncomment the following lines to disable IB cards which are not present.

```
sed -i -e "s/MTHCA_LOAD=yes/MTHCA_LOAD=no/" /localdisk/etc/infiniband/openib.conf
sed -i -e "s/QIB_LOAD=yes/QIB_LOAD=no/" /localdisk/etc/infiniband/openib.conf
sed -i -e "s/MLX4_EN_LOAD=yes/MLX4_EN_LOAD=no/" /localdisk/etc/infiniband/openib.conf
sed -i -e "s/CXGB3_LOAD=yes/CXGB3_LOAD=no/" /localdisk/etc/infiniband/openib.conf
sed -i -e "s/NES_LOAD=yes/NES_LOAD=no/" /localdisk/etc/infiniband/openib.conf
```

   c. Add/uncomment these lines to configure SRP.

```
# configure SRP for IB connected RAID
sed -i -e "s/SDP_LOAD=yes/SDP_LOAD=no/" /localdisk/etc/infiniband/openib.conf
sed -i -e "s/SRP_LOAD=no/SRP_LOAD=yes/" /localdisk/etc/infiniband/openib.conf
sed -i -e "s/SRP_DAEMON_ENABLE=no/SRP_DAEMON_ENABLE=yes/" /localdisk/etc/infiniband/openib.conf
```

   Note: Cray recommends that ib0 on OSS nodes be connected to the IB switch, ib1 is should not be used, and ib2 and ib3 connect to the storage array controllers.

   d. Add/uncomment the following command line to the end of the site.oss_finalize.sh script (before exit 0 line), to start the IB subnet manager on ib2 (the IB interface connected to the storage array). Change the 2 to designate the IB interface port connected to the storage array.

```
echo "/usr/sbin/opensm --daemon -g \`/usr/sbin/ibstat mlx4_1 2 | grep GUID | awk '{print \$3}'\`" >>\
 /localdisk/etc/rc.d/rc.local

exit 0
```

(Optional)

If both ports of the IB card (mlx4_1 in this example) are connected to storage, then add (or uncomment) a separate line for each port:

```
echo "/usr/sbin/opensm --daemon -g \`/usr/sbin/ibstat mlx4_1 1 | grep GUID | awk '{print \$3}'\`" >>\
 /localdisk/etc/rc.d/rc.local

echo "/usr/sbin/opensm --daemon -g \`/usr/sbin/ibstat mlx4_1 2 | grep GUID | awk '{print \$3}'\`" >>\
 /localdisk/etc/rc.d/rc.local

exit 0
```

4. Run the cmsh and set the finalize script for the esFS-OSS category.

```
esms1# cmsh
[esms1]% category
[esms1->category]% use esFS-OSS
[esms1->category[esFS-OSS]]% set finalizescript\
/opt/cray/esms/cray-es-finalize-scripts-XX/etc/site.oss_finalize.sh
[esms1->category*[esFS-OSS*]]% commit
[esms1->category[esFS-OSS]]%
```

5. Verify the site.oss_finalize.sh finalize script is correct (or, if you added lines in step 3, verify they are present).

```
[esms1->category[esFS-OSS]]% get finalizescript
[esms1->category[esFS-OSS]]% quit
```

6. Verify the lustre service is running for the ESF software image.

   a. Use the chroot shell to open a shell in the CLFS image and verify the lustre is enabled. If the lustre is not enabled, start it with the chkconfig lustre on command.

```
esms1# chroot /cm/images/ESF-XX-2.1.0-201309252230
[root@esms1 /]# chkconfig --list lustre
lustre          0:off   1:off   2:on    3:on    4:on    5:on    6:off
[root@esms1 /]# exit
esms1#
```

   b. Reboot the MDS and OSS nodes with the ESF software image.

5.14 Configure LDAP on MDS Nodes

LDAP is configured in the category finalize script for the MDS node.

Important: Files created or modified by a finalize script must be listed in the `excludelistupdate` exclude list for the category. Software updates will over write customized files if the files are not specified in an exclude list for the category. Customized files must also be specified in the `excludelistgrab`, and `excludelistgrabnew` exclude lists to prevent customized files from being copied to the CIMS.

Procedure 65. Configure LDAP on MDS nodes

1. Log in to the CIMS as `root`.
2. Edit the `site.mds_finalize.sh` script.

```
esms1# cd /opt/cray/esms/cray-es-finalize-scripts-XX/etc
esms1# vi site.mds_finalize.sh
```

3. Enable the name service caching daemon (`nscd`) and the LDAP name service daemon `nslcd`.

   Note: `named`, `nslcd`, `nscd`, and `ldap` are turned off in the default CLFS image.

   Add the following commands to the `site.mds_finalize.sh` file:

```
chkconfig nscd on
service nscd start
chkconfig nslcd on
service nslcd start
```

4. Save `site.mds_finalize.sh` file and exit the editor.
5. Use the `chroot` shell to edit the CLFS software image (in this example, the software image is named ESF-XX-2.1.0-201309252230):

```
esms1# cd /cm/images
esms1# chroot ESF-XX-2.1.0-201309252230
[root@esms1 /]#
```

6. Verify the LDAP service (`ldap`), is turned off in the CLFS software image.

   Note: The MDS should not act as an LDAP server and the following command disables the LDAP server instance. The LDAP client pieces are typically in `/etc/passwd` and `/etc/nsswitch.conf`, and in the pluggable authentication modules (PAM).

```
[root@esms1 /]#chkconfig ldap off
```

7. Edit `/etc/openldap/ldap.conf` file, and uncomment (enable) the `TIMELIMIT 15` line:

```
[root@esms1 /]#cd /etc/openldap
[root@esms1 /]#cp ldap.conf ldap.conf.orig
[root@esms1 /]#vi ldap.conf
TIMELIMIT     15
```

8. Add/edit the following lines and enter the specific IP and base value settings for your site's information structure:

```
   URI ldap://aaa.bbb.ccc.ddd/
   BASE dc=somedomain,dc=somedomain,dc=com
   base ou=people,dc=somedomain,dc=somedomain,dc=com
```

9. Edit `/etc/nslcd.conf` file:

```
[root@esms1 /]#cd /etc
[root@esms1 /]#cp nslcd.conf nslcd.conf.orig
[root@esms1 /]#vi nslcd.conf
```

10. Add/edit the following lines and enter the specific IP and base value settings for your site's information structure:

```
   uri ldap://aaa.bbb.ccc.ddd/
   base dc=somedomain,dc=somedomain,dc=com
   base ou=people,dc=somedomain,dc=somedomain,dc=com
```

11. Exit the `chroot` shell.

12. Reboot all MDS nodes using the ESF-XX-2.1.0-201309252230 software image.

5.15 Configuring the Site User Network (for MDS Nodes Only)

Note: Configure the external site user network (`site-user-net`) which is used by CLFS MDS nodes for authentication services (LDAP, for example) and file permissions (there are no user login accounts on CLFS nodes).

Procedure 66. Configuring the site user network (for MDS nodes only)

1. Log in to the CIMS as `root` and run `cmsh`.

```
esms1# cmsh
[esms1]%
```

2. Switch to `network` mode:

```
[esms1]% network
[esms1->network]%
```

3. Display the existing networks.

```
[esms1->network]% list
Name (key)       Type         Netmask bits     Base address     Domain name          IPv6
---------------- ------------ ---------------- ---------------- ------------------   ----
esmaint-net      Internal     16               10.141.0.0       esmaint-net.cluster  no
globalnet        Global       16               0.0.0.0          cm.cluster           no
ib-net           Internal     16               10.149.0.0       ib-net.cluster       no
ipmi-net         Internal     16               10.148.0.0       ipmi-net.cluster     no
site-admin-net   External     24               aaa.bbb.ccc.ddd  your.domain.com      no
```

4. Determine whether `site-user-net` exists on the CIMS

   a. If a `site-user-net` already exists on the CIMS, proceed to step 5.

b. If there is no site user network, create `site-user-net` by cloning the `site-admin-net` network.

```
[esms1->network]% clone site-admin-net site-user-net
[esms1->network*[site-user-net*]%
```

c. The cloned network inherits the same settings as the original network (`site-admin-net`). You must change several settings for the new `site-user-net`: base address, broadcast address, domain name, gateway, and (if necessary) netmask bits. Display the existing settings.

```
[esms1->network*[site-user-net*]% show
Parameter                      Value
------------------------------ ---------------------
Base address                   aaa.bbb.ccc.ddd
Broadcast address              aaa.bbb.255.255
Domain Name                    your.domain.com
Dynamic range end              0.0.0.0
Dynamic range start            0.0.0.0
Gateway                        aaa.bbb.ccc.ddd
IPv6                           no
Lock down dhcpd                no
MTU                            1500
Management allowed             no
Netmask bits                   24
Node booting                   no
Notes                          <0 bytes>
Revision
Type                           External
name                           site-user-net
```

d. Change the base address.

```
[esms1->network*[site-user-net*]% set baseaddress site-user-netBaseAddress
```

e. Change the broadcast address.

```
[esms1->network*[site-user-net*]% set broadcastaddress site-user-netBroadcastAddress
```

f. Change the domain name.

```
[esms1->network*[site-user-net*]% set domainname site-user-netDomainName
```

g. Change the gateway.

```
[esms1->network*[site-user-net*]% set gateway site-user-netGateway
```

h. If necessary, change the netmask bits.

```
[esms1->network*[site-user-net*]% set netmaskbits NN
```

i. Commit your changes.

```
[esms1->network*[site-user-net*]% commit
```

5. Switch to `device` mode.

```
[esms1->network[site-user-net]% device
```

6. Add an interface to the `site-user-net` network. This example shows the host name `esfs-mds001`, the Ethernet port `eth1`, and the example IP address aaa.bbb.ccc.ddd. Substitute your CLFS node's host name and IP address when configuring the `eth1` interface.

```
[esms1->device]% addinterface -n esfs-mds001 physical eth1 site-user-net aaa.bbb.ccc.ddd
```

Note: You must repeat this step for each CLFS node that is added to the `site-user-net` network.

7. Commit your changes.

```
[esms1->device*]% commit
```

8. Show the interfaces on `esfs-mds001`.

```
[esms1->device]%  use esfs-mds001
[esms1->device[esfs-mds001]% interfaces; list
Type         Network device name  IP               Network
------------ -------------------- ---------------- ----------------
bmc          ipmi0                10.148.0.2       ipmi-net
physical     BOOTIF [prov]        10.141.0.2       esmaint-net
physical     eth1                 aaa.bbb.ccc.ddd  site-user-net
physical     ib0                  10.149.0.2       ib-net
```

9. Display the existing networks.

```
[esms1->device[esfs-mds001]->interfaces]% network list
Name (key)       Type         Netmask bits     Base address     Domain name          IPv6
---------------- ------------ ---------------- ---------------- -------------------- ----
esmaint-net      Internal     16               10.141.0.0       esmaint-net.cluster  no
globalnet        Global       16               0.0.0.0          cm.cluster           no
ib-net           Internal     16               10.149.0.0       ib-net.cluster       no
ipmi-net         Internal     16               10.148.0.0       ipmi-net.cluster     no
site-admin-net   External     24               aaa.bbb.0.0      your.domain.com      no
site-user-net    External     24               aaa.bbb.0.0      your.domain.com      no
```

10. Exit interface mode `cmsh`.

```
[esms1->device[esfs-mds001]->interfaces]% exit
[esms1->device[esfs-mds001]
```

11. Test boot the new node.

```
[esms1->device[esfs-mds001] reboot
```

5.16 Mounting a CLFS Lustre® File System on a Cray CLE System

Procedure 67. Mounting a Lustre file system on a CLE system

1. Add a `node_class` entry for LNET router nodes to `CLEinstall.conf`. The `node_class` entry will be added to `/etc/hosts` when `CLEinstall` is run. In this example, the LNET routers node IDs (NIDs) are `2` and `30`.

   a. Log in to the SMW as `root`.

b. Edit the `/home/crayadm/install.`*xtrel*`/CLEinstall.conf` file so that there will be an `lnet` class created with `nid 2` and `30` as members of that class. After running `CLEinstall`, the new class and its members will be in `/etc/opt/cray/sdb/node_classes` on the `bootroot` and `sharedroot` file systems.

```
smw#  vi /home/crayadm/install.xtrel/CLEinstall.conf

node_class[1]=lnet 2 30
```

c. Save the file and exit.

2. Run `CLEinstall` using the same command line options as if you were performing a software update. Running `CLEinstall` makes the configuration change to the `node_classes` file. After running `CLEinstall`, boot the CLE system before continuing to step 3.

3. Make a mount point in the default view of the `sharedroot`.

```
smw# ssh boot
boot# xtopview
default/:/ # mkdir -p /lus/scratch
```

4. Add `modprobe.conf.local` for login nodes and all service nodes.

   Note: Notice that the line containing `options lnet networks=gni` is commented. The setting of `10.149.1.*` is the site IB network address to be used, but the network must be within 10.149.0.0/16.

```
default:/ # vi /etc/modprobe.conf.local

#options lnet networks=gni
options lnet ip2nets="gni0 10.128.*.*; o2ib 10.149.*.*"
options lnet routes="gni0 10.149.1.[3,31]@o2ib; o2ib [2,30]@gni0"

### LNET options
options lnet check_routers_before_use=1
options lnet avoid_asym_router_failure=1
options lnet dead_router_check_interval=60
options lnet live_router_check_interval=60
options lnet router_ping_timeout=50
```

5. Exit `xtopview`.

```
default:/ # exit
```

6. Create the `lnet` class-specialized files.

```
boot-p1# xtopview -c lnet
class/lnet:/ # ls -l /etc/modprobe.conf.local
lrwxrwxrwx 1 root root 45 Feb  1 08:53 /etc/modprobe.conf.local -> /.shared/base/default/etc/\
modprobe.conf.local
class/lnet:/ # xtspec -c lnet /etc/modprobe.conf.local
class/lnet:/ # ls -l /etc/modprobe.conf.local
lrwxrwxrwx 1 root root 48 Feb  1 09:06 /etc/modprobe.conf.local -> /.shared/base/class/lnet/\
etc/modprobe.conf.local
class/lnet:/ # vi  /etc/modprobe.conf.local
```

Add the local extensions to the `/etc/modprobe.conf.local` file. The two examples below assume that `ib0` on the LNET router nodes is connected to the DMP IB switch. If `ib1` is used, there is a different format.

```
#
# please add local extensions to this file
#
with ib0
### LNET interfaces
options lnet ip2nets="gni0 10.128.*.*; o2ib 10.149.*.*"
### LNET routes for esFS
options lnet routes="gni0 10.149.1.[3,31]@o2ib; o2ib [2,30]@gni0"

with ib1
### LNET interfaces
options lnet ip2nets="gni0 10.128.*.*; o2ib(ib1) 10.149.*.*"
### LNET routes for esFS
options lnet routes="gni0 10.149.1.[3,31]@o2ib; o2ib(ib1) [2,30]@gni0"
```

7. Create node-specialized files for all LNET routers. Repeat steps step 7.a through step 7.d for each LNET router.

   a. Run `xtopview` to get the node view of the `sharedroot` for NID `2`.

```
  boot# xtopview -n 2
```

   b. Create and edit the interface file (example shows `ifcfg-ib0`) for NID `2` with IP address 10.149.0.2. This IP address is the IP address of the `esfs-mds001` node on the `ib-net`.

```
node/2:/ # touch /etc/sysconfig/network/ifcfg-ib0
node/2:/ # xtspec -n 2 /etc/sysconfig/network/ifcfg-ib0
node/2:/ # vi /etc/sysconfig/network/ifcfg-ib0
```

   An example `ifcfg-ib0` file follows:

```
BOOTPROTO='static'
IPADDR=10.149.1.3
NETMASK=255.255.0.0
STARTMODE='onboot'
USERCONTROL='no'
MTU=2044
IPOIB_MODE='connected'
```

   c. Create and edit the `/etc/sysconfig/infiniband` file.

```
node/2:/ # touch /etc/sysconfig/infiniband
node/2:/ # xtspec -n 2 /etc/sysconfig/infiniband
node/2:/ # vi /etc/sysconfig/infiniband
```

   Change the following two variables:

```
ONBOOT=no
SRP_LOAD=yes
```

   to:

```
ONBOOT=yes
SRP_LOAD=no
```

d. Exit xtopview.

```
node/2:/ # exit
boot#
```

8. Update the bootimage so that compute nodes mount the Lustre file system.

a. Update the bootimage /etc/modprobe.conf. This example uses the p1 partition of a CLE system.

```
smw# cd /opt/xt-images/templates/default-p1
smw:/opt/xt-images/templates/default-p1 # vi etc/modprobe.conf
```

Make the following changes to the modprobe.conf file.

```
#options lnet networks=gni
### LNET options
options lnet check_routers_before_use=1
options lnet avoid_asym_router_failure=1
options lnet dead_router_check_interval=60
options lnet live_router_check_interval=60
options lnet router_ping_timeout=50

### LNET interfaces
options lnet ip2nets="gni0 10.128.*.*; o2ib 10.149.*.*"

### LNET routes for esFS
options lnet routes="gni0 10.149.1.2@o2ib; o2ib 1@gni0"
```

b. Make a mount point for the bootimage.

```
smw:/opt/xt-images/templates/default-p1 # mkdir -p lus/scratch
```

c. Update /etc/fstab for bootimage.

```
smw:/opt/xt-images/templates/default-p1 # cd etc
smw:/opt/xt-images/templates/default-p1/etc # cp -p fstab fstab.orig
smw:/opt/xt-images/templates/default-p1/etc # vi fstab
```

Add the following line to /etc/fstab.

```
10.149.0.2@o2ib:/scratch /lus/scratch lustre rw,flock
```

Exit and save the /etc/fstab file.

d. Rebuild the bootimage. This example uses a script created for the BLUE system set.

```
smw# /var/opt/cray/install/shell_bootimage_BLUE.sh -c
```

9. Update the esFS-MDS and esFS-OSS category finalize scripts.

a. Log in to the CIMS as root.

b. Edit the site.mds_finalize.sh script.

```
esms1# cd /opt/cray/esms/cray-es-finalize-scripts-XX/etc
esms1# vi site.mds_finalize.sh
```

c. Add the entry before the `exit 0` line. This example uses the IP address 10.149.1.3 for NID 2 and 10.149.1.31 for NID 30.

```
echo "options lnet routes=\"gni0 10.149.1.[3,31]@o2ib\" >> /localdisk/etc/modprobe.d/cray.conf
```

step 9.c requires that `/etc/modprobe.d/cray.conf` file exist in the CLFS node image. You may need to create (`touch`) the `/etc/modprobe.d/cray.conf` file to create it in the CLFS node image.

d. Exit and save the `site.mds_finalize.sh` script.

e. Update the `esFS-MDS` category with the new finalize script.

```
esms1# cmsh
[esms1]% category
[esms1->category]% use esFS-MDS
[esms1->category[esFS-MDS]]% set finalizescript /opt/cray/esms/cray-es-finalize-scripts-XX/\
etc/site.mds_finalize.sh
[esms1->category*[esFS-MDS*]]% commit
```

f. Verify the finalize script.

```
[esms1->category[esFS-MDS]]% get finalizescript
```

g. Repeat step 9 to update the `esFS-OSS` category finalize script.

h. Quit `cmsh`.

```
[esms1->category[esfs-mds]]% quit
```

10. Unmount the Lustre clients and stop the Lustre file system.

a. Unmount CDL Lustre clients.

```
eslogin1# umount /lus/scratch
```

b. Stop Lustre file system.

```
esms1# lustre_control status -f scratch
esms1# lustre_control stop -f scratch
```

11. Reboot MDS and OSS node(s).

```
esms1# cmsh
esms1# device
esms1# foreach esfs-mds001,esfs-mds002,esfs-oss1,esfs-oss002,esfs-oss003,esfs-oss004 (reboot)
esfs-mds001: Reboot in progress ...
esfs-mds002: Reboot in progress ...
```

Note: Wait for each all MDS and OSS nodes to reboot before continuing. Use Bright `cmgui` to open remote consoles for each node to monitor to reboot process.

12. Exit `cmsh` and start the Lustre file system.

```
[esms1]% exit
esms1# lustre_control start -f scratch
Performing 'start' from esms1 at Wed Apr 24 16:06:55 CDT 2013

Operating on file system - "scratch"
Verifying network connectivity between "esms1" and "esfs-mds001"...
.
.
.
```

13. Either configure LDAP on MDS nodes or execute the following command on the `esfs-mds001` node after starting Lustre file system to disable upcall and make the MDS use the UID/GID supplied by the client. Refer to Configure LDAP on MDS Nodes on page 206 for more information about configuring LDAP after completing this procedure.

```
esms1# ssh esfs-mds001
esf1-mds001# echo NONE > /proc/fs/lustre/mdt/scratch-MDT0000/identity_upcall
```

14. Exit to the CIMS.

```
esf1-mds001# exit
esms1#
```

15. Use `ssh` to log in to `eslogin1` and mount the Lustre client.

```
esms1# ssh eslogin1
eslogin1# mount -t lustre -o rw,flock,lazystatfs 10.149.0.2@o2ib:/scratch /lus/scratch
```

16. Reboot Cray CLE system. The compute nodes will mount the Lustre file system as specified in the boot image `/etc/fstab` file.

17. Mount the Lustre file system on the Cray CLE login node.

    Note: Include this `mount` command in the `/etc/fstab` file.

```
smw# ssh boot
boot# ssh login
login# mount -t lustre -n -o rw,flock,lazystatfs 10.149.0.2@o2ib:/scratch /lus/scratch
```

5.17 Configuring Multipath on CLFS nodes

All CLFS nodes configured for multipath have a connection to each storage array controller. Additional configuration is required to support multipath. Specific WWID values must be added to the `multipaths {}` section of the `/etc/multipath.conf` file to make sure that devices have the same name every time the node boots.

Note: If the node is not cabled for multipath, then do not need to perform the multipath configuration described in Procedure 68 on page 216.

Procedure 68. Configuring multipath on CLFS nodes

1. After `ESFinstall` has completed, the `multipathd` service must be enabled for the software image.

```
esms1# chroot /cm/images/ESFimage
[root@esms1/]# chkconfig multipathd on
```

2. Copy `multipath.conf.cray` to `/etc` in the ESF software image.

```
esms1# cp -p /opt/cray/esfs/cray-esf-multipath-XX\
/default/etc/multipath.conf.cray /etc/multipath.conf
```

3. Exit the `chroot` shell.

```
esms1# exit
esms1#
```

4. Identify the disk names for multipath on the MDS nodes. Boot the MDS 1 node and use SSH to login.

```
esms1# ssh mds001
Last login: Tue Jun 11 15:42:52 2013 from esms1.cm.cluster
[root@mds001 ~]#
```

5. Use `multipath` command to display the disk devices.

```
mds001# multipath -ll
mpatha (360080e50002f82ca000002ca5102bcc4) dm-0 LSI,INF-01-00
size=2.2T features='2 pg_init_retries 50' hwhandler='1 rdac' wp=rw
|-+- policy='round-robin 0' prio=6 status=active
| `- 0:0:0:0 sda 8:0  active ready running
`-+- policy='round-robin 0' prio=1 status=enabled
  `- 0:0:1:0 sdb 8:16 active ghost running
```

6. In this example, the WWID of 360080e50002f82ca000002ca5102bcc4 is the device which we want to label as `mdt0` instead of `mpatha`.

7. On some systems, the disk device may need to be modified using the `parted` command to remove unneeded partitions. Identify which disk device (`/dev/sda` form) corresponds to this WWID.

```
mds001# ls -l /dev/disk/by-id | grep scsi-360080e50002f82ca000002ca5102bcc4
lrwxrwxrwx 1 root root  9 Jun 10 09:28 scsi-360080e50002f82ca000002ca5102bcc4 -> ../../sda
[root@mds001 ~]# parted /dev/sda
GNU Parted 2.1
Using /dev/sda
Welcome to GNU Parted! Type 'help' to view a list of commands.

(parted) print
Model: LSI INF-01-00 (scsi)
Disk /dev/sda: 2398GB
Sector size (logical/physical): 512B/512B
Partition Table: gpt

Number  Start   End     Size    File system     Name       Flags
 1      17.4kB  20.5GB  20.5GB  ext3            /
 2      20.5GB  22.5GB  2048MB  ext3            /var
 3      22.5GB  24.6GB  2048MB  ext3            /tmp
 4      24.6GB  41.0GB  16.4GB  linux-swap(v1)  /dev/sda4
 5      41.0GB  2398GB  2357GB  ext3            /local
```

8. Remove all partitions so that Lustre® can use the entire device. This example pauses after removing partitions 2 through 5 to show that only one partition is left.

```
(parted) rm 5
(parted) rm 4
(parted) rm 3
(parted) rm 2
(parted) p
Model: LSI INF-01-00 (scsi)
Disk /dev/sda: 2398GB
Sector size (logical/physical): 512B/512B
Partition Table: gpt

Number  Start   End     Size    File system  Name  Flags
 1      17.4kB  20.5GB  20.5GB  ext3         /

(parted) rm 1
(parted) p
Error: /dev/sda: unrecognised disk label
(parted) quit
Information: You may need to update /etc/fstab.
```

Note: The MDS nodes are ready for a reboot after step 16 below is complete.

9. Exit the MDS node SSH login and repeat step 4 for the other MDS node to identify the disk names for multipath.

10. Identify the disk names for multipath on the OSS nodes. Boot each OSS node and use SSH to login.

```
esms1# ssh oss001
Last login: Tue Jun 11 15:45:32 2013 from esms1.cm.cluster
[root@oss001 ~]#
```

11. Display the disk devices with the `multipath` command.

```
[root@oss001 ~]# multipath -llmpatha (360080e50001f8c64000000b4513098b2) dm-2 LSI,INF-01-00
size=7.3T features='3 queue_if_no_path pg_init_retries 50' hwhandler='1 rdac' wp=rw
|-+- policy='round-robin 0' prio=6 status=active
| `- 7:0:0:5 sdg 8:96  active ready running
`-+- policy='round-robin 0' prio=1 status=enabled
  `- 8:0:0:5 sdm 8:192 active ghost running
mpathb (360080e50001f87c8000000b951309893) dm-3 LSI,INF-01-00
size=7.3T features='3 queue_if_no_path pg_init_retries 50' hwhandler='1 rdac' wp=rw
|-+- policy='round-robin 0' prio=6 status=active
| `- 8:0:0:4 sdl 8:176 active ready running
`-+- policy='round-robin 0' prio=1 status=enabled
  `- 7:0:0:4 sdf 8:80  active ghost running
mpathc (360080e50001f8c64000000ae51309849) dm-1 LSI,INF-01-00
size=7.3T features='3 queue_if_no_path pg_init_retries 50' hwhandler='1 rdac' wp=rw
|-+- policy='round-robin 0' prio=6 status=active
| `- 7:0:0:3 sde 8:64  active ready running
`-+- policy='round-robin 0' prio=1 status=enabled
  `- 8:0:0:3 sdk 8:160 active ghost running
.
.
.
```

12. On some systems, the disk devices may need to be modified with the `parted` command to remove unneeded partitions. Identify which disk device (`/dev/sda` form) relates to this WWID.

```
[root@oss001 ~]# ls -l /dev/disk/by-id | grep scsi-360080e50001f8c64000000b4513098b2
lrwxrwxrwx 1 root root  9 Jun  3 14:40 scsi-360080e50001f8c64000000b4513098b2 -> ../../sdm

[root@oss001 ~]# parted /dev/sdm
GNU Parted 2.1
Using /dev/sda
Welcome to GNU Parted! Type 'help' to view a list of commands.

(parted) print
Model: LSI INF-01-00 (scsi)
Disk /dev/sdm: 2398GB
Sector size (logical/physical): 512B/512B
Partition Table: gpt

Number  Start   End     Size    File system     Name       Flags
 1      17.4kB  20.5GB  20.5GB  ext3            /
 2      20.5GB  22.5GB  2048MB  ext3            /var
 3      22.5GB  24.6GB  2048MB  ext3            /tmp
 4      24.6GB  41.0GB  16.4GB  linux-swap(v1)  /dev/sda4
 5      41.0GB  2398GB  2357GB  ext3            /local
```

13. Remove all partitions so that Lustre can use the entire device. This example pauses after removing partitions 2 through 5 to show that only one partition is left.

```
(parted) rm 5
(parted) rm 4
(parted) rm 3
(parted) rm 2
(parted) p
Model: LSI INF-01-00 (scsi)
Disk /dev/sdm: 2398GB
Sector size (logical/physical): 512B/512B
Partition Table: gpt

Number  Start   End     Size    File system  Name  Flags
 1      17.4kB  20.5GB  20.5GB  ext3         /

(parted) rm 1
(parted) p
Error: /dev/sdm: unrecognised disk label
(parted) quit
Information: You may need to update /etc/fstab.
```

14. Exit the OSS node SSH login and repeat step 10 for the other OSS nodes to identify the disk names for multipath.

15. The OSS nodes are ready for a reboot after step 16 below is complete.

16. After the disk names for multipath have been identified, edit the comment section near the end of the node finalize scripts for both `esFS-MDS` `esFS-OSS` categories. Adding specific WWID values to the `multipaths {}` section of the `/etc/multipaths.conf` file ensures that the device has the same name every time the node boots. Also, you can specify a label for each disk, such as `/dev/mapper/ost5` or `/dev/mapper/mdt0`, then use that label for the Lustre configuration file.

```
cat << EOMP >> /localdisk/etc/multipath.conf
multipaths {
   multipath {
      wwid  360080e500017c6e40000093e51af554f
      alias mgt
   }
   multipath {
      wwid  360080e500017c57200000b0451af54ba
      alias mdt
   }
}

EOMP
```

17. Reboot all MDS and OSS nodes which were configured with multipath.

18. Confirm that the MDT device `/dev/mapper/mdt0` is available on the MDS nodes.

```
esms1# ssh mds001 fdisk -l /mapper/mdt0
```

19. Confirm that all of the OST devices `/dev/mapper/ost*` devices are available on the OSS nodes.

```
esms1# ssh oss001 fdisk -l /dev/mapper/ost0
esms1# ssh oss001 fdisk -l /dev/mapper/ost1
esms1# ssh oss001 fdisk -l /dev/mapper/ost2
esms1# ssh oss001 fdisk -l /dev/mapper/ost3
esms1# ssh oss001 fdisk -l /dev/mapper/ost4
esms1# ssh oss001 fdisk -l /dev/mapper/ost5
```

20. When configuring the Lustre `fs_defs` file, the disk device name `"/dev/mapper/mdt0"` can be used for the MDT and MGT and `"/dev/mapper/ost0"` can be used for OST0. Similarly for the other OST devices, but the example below shows how to have `/dev/mapper/ost[0-5]` reference the appropriate devices with even numbered OST devices on `oss002` and odd numbered OST devices on `oss001`.

```
## MDT
## MetaData Target
mdt: node=mds001
     dev=/dev/mapper/mdt0
     fo_node=mds002

## MGT
## Management Target
mgt: node=mds001
     dev=/dev/mapper/mdt0
     fo_node=mds002


## Object Storage Target(s)
ost: node=oss00[2,1]
     dev=/dev/mapper/ost[0-5]
     fo_node=oss00[1,2]
```

5.18 Migrating from Lustre® 1.8.x to 2.4

⚠ **Caution:** The CIMS must be running the most recent released version of ESM software (ESM-XX-2.1.0) in order to migrate from Lustre 1.8 to 2.4.

This document details the format differences between Lustre 1.8.x and 2.4, their purpose, and the process of upgrading from 1.8.x to 2.4.

5.18.1 Related Publications

The following documents contain additional information that may be helpful:

- *Managing Lustre for the Cray Linux Environment (CLE)* (S–0010)
- *Installing Lustre File System by Cray (CLFS) Software* (S–2521)

Note: The Bright administration guide and user guides are stored on the CIMS node (as Adobe® Acrobat® PDF files) in the `/cm/shared/docs/cm` directory.

5.18.2 Introduction

Lustre 2.4 represents a significant advance in Lustre design with the addition of many new features and support for future improvements. To accommodate the new features, 2.4 uses a somewhat different on-disk file system format than the one used by 1.8.x. The format differences are limited to Lustre's internal metadata about the file system. They do not affect the format or storage of user data. The format differences fall into two categories: those related to file identifiers (FIDs) that replace inodes in some cases and those related to quota support.

Lustre 2.4 provides tools to add the new metadata structures used by 2.4 to an existing 1.8.x file system. Some of these tools run automatically when the 2.4 servers are started; some require the administrator to perform explicit upgrade operations at the time 2.4 is installed.

5.18.3 FIDS

A file identifier (FID), is a unique identifier for a Lustre file or object. It is independent of the back end file system, for example, `ldiskfs`. In Lustre 1.8.x, inodes are used to uniquely identify the objects belonging to a file. In Lustre 2.4, FIDs replace inodes for this purpose. The drawback of using inodes is that a file's inode can change over the life of the file. For example, when a file is restored from a file level backup, it will be assigned a new inode/generation number. Afterwards, Lustre 1.8.x can no longer locate its objects. FIDs, on the other hand, never change once assigned. Following restore from a file level backup, the FIDs are still correct and Lustre 2.4 can locate its objects. Lustre 2.4, in addition to supporting the device level backup of 1.8.x, also supports file level backup and restore. Lustre 2.4 still uses inodes internally to interact with the `ldiskfs` back end file system.

To facilitate this interaction, Lustre 2.4 maintains a map of FIDs to inodes. This map is called the Object Index (OI). When upgrading from 1.8.x to 2.4 the OI must be created through a process called OI Scrub. The OI Scrub occurs automatically when a 1.8.x formatted file system without an OI is mounted by 2.4 servers. An OI Scrub may also be triggered if Lustre discovers a missing or bad FID to inode mapping during normal operation. Finally, an OI Scrub can be started manually by running `lfsck`.

`lfsck` checks and repairs errors in the OI. The OI maintains the FID to inode mapping, the inode to FID mapping is stored in the inode itself. The FID of the object identified by the inode is stored in the extended attributes area of the inode known as linkEA. The inode also contains the FID of the file's parent directory. This feature is known as FID-in-dirent. The linkEA and FID-in-dirent information enables Lustre to efficiently generate full path names from the inode. These names are used in POSIX style path name permission checks, to produce better error messages, and to support changelog applications like `lustre_rsync`.

Storing the parent FID in the inode also improves the performance of readdir and other directory operations. Unlike the OI, which Lustre 2.4 requires, the FID information in the inode is optional. If the FID information in the inode is missing, then directory lookup performance is affected and changelog features will not be fully supported, but otherwise Lustre will be totally functional. The FID information is optional, and the upgrade process to add FID information to the inode is also optional.

To populate the inodes with the appropriate FIDs, the Lustre administrator must set the dirdata attribute on each MDT and then run lfsck with the -t namespace option. The lfsck process runs in the background; the rate at which it updates inodes can be tunable parameter under the control of the system administrator. After the dirdata attribute is set, the Lustre file system cannot be downgraded to work with 1.8.x servers.

5.18.4 Quota Support

Lustre 2.4 addresses several limitations of the previous quota design. Among the improvements to quotas in 2.4 are:

- Quota limits can be changed while slaves are offline
- OSTs can be added and deleted without corrupting space usage statistics
- Master recovery can be completed without all targets being online
- A full quotacheck is no longer required following e2fsck
- Quota enforcement is enabled/disabled by file system rather than per-target
- Infrastructure is restructured for future growth, better performance, and improved functionality

To support these improvements, Lustre 2.4 has changed both the on-disk format of quota information and the user interface to quota functionality.

Quota specification has three components: space usage accounting, quota limit definition, and enabling enforcement.

Space Usage Accounting: In previous versions of Lustre, the lfs quotacheck must be run to generate the database of space used on each target by each user and group. In Lustre 2.4, the quotacheck command is deprecated. Instead, newly formatted 2.4 file systems have space usage accounting enabled by default, and the statistics are automatically kept up to date. When upgrading from 1.8.x to 2.4, the usage statistics must be initialized for existing files before quota limits can be enforced. The statistics are generated by running tunefs.lustre --quota on each target. This tunefs command also sets the QUOTA attribute of the target, which enables automatic accounting when the target is mounted.

Initializing usage statistics is a one time operation. It can be done as part of the upgrade process or sometime later. Note however that quota enforcement and accounting are disabled until the `tunefs.lustre --quota` command is executed on all targets.

Quota Limit Definition: The definition of user and group quota limits does not change with 2.4. The storage format does change. Prior to Lustre 2.4, the quota limits are stored in a file specific to the back end file system. With 2.4, this information is moved in a Lustre defined index along with other Lustre metadata. The quota limits are converted automatically to the new format and storage location when the MDT is upgraded to 2.4.

Enabling Quota Enforcement: In Lustre 2.4, quota enforcement is independent of the space usage accounting. The accounting information is always maintained, even when enforcement is disabled. Enforcement is enabled/disabled for the entire file system. The command is:

```
lctl <set | conf> _param fsname/quota/ost | mdt=u | g | ug | none
```

The `lfs quotaon|off` command and per-target `quota_type` parameter are no longer used in Lustre 2.4.

5.18.5 Performance Expectations

For optimum long term performance and functionality, all of the disk format changes described above are recommended. However, each of the upgrade processes has a performance cost.

5.18.5.1 Object Index Creation and Repair

OI Scrub is designed to have minimal impact on system performance. It runs in the background while the file system remains online. Clients can continue to access files while it runs. The system administrator can control the overhead of the scrubbing process by tuning the maximum number objects examined per second. If no limit is set, OI Scrub will run as fast as possible. On an unloaded system, with no limit set, experiments have shown OI Scrub to process in excess of 100,000 objects per second.

OI Scrub status can be monitored through the `/proc` file:

```
osd-ldisk/mdt_device/oi_scrub
```

5.18.5.2 Adding FIDs to inodes

Updating all the inode extended attributes to include the related FID and parent FID information is a one time operation. (Note, updates to individual inodes may occur when `lfsck` repairs file system corruption.) The process is similar to an explicitly invoked OI Scrub and has similar performance characteristics.

Progress of the inode update can be monitored with the `/proc` file:

```
mmd/mdt_device/lfsck_namespace
```

5.18.5.3 Space Usage Statistics

When upgrading a 1.8.x formatted file system, a database of the space usage statistics must be created. The usage data is gathered and stored when the quota flag is set on each target. The speed of the data collection in 2.4 is similar to the speed of an `lfs quotacheck` in earlier Lustre versions.

After the initial creation, Lustre updates the space usage statistics automatically as files change. Updating the statistics does impose overhead and has been reported to affect metadata performance by as much as 5%. Cray internal testing has shown that the accounting overhead has no measurable effect on performance.

5.18.6 Upgrade Procedure

This procedure is scripted, and assumes the person performing this update has experience with the Cray Linux Environment (CLE) and Lustre administration.

Procedure 69. Upgrading Lustre 1.8.x to Lustre 2.4

1. If you do not already have an `.fs_defs` file, create one that defines the structure of the 1.8.x file system. See *Managing Lustre for the Cray Linux Environment (CLE)*, Section 2.2.

   a. Use `umount` to unmount Lustre file system on all clients.

   b. Stop Lustre servers.

   c. Install Lustre 2.4 RPMs on all CLFS servers.

   d. Log in to the CLFS node. **Do NOT** start Lustre yet.

   e. If the `.fs_defs` file has not been installed, do so now, **being very careful not to start Lustre**. From the CIMS, enter:

```
esms1# lustre_control install filename.fs_defs
```

⚠ **Caution:** The following upgrade procedures require `e2fsprogs` version 1.42.3.wc1 or later. Check the installed version by running `dumpe2fs` without any parameters. **Do NOT** proceed with these instructions if the version is not at least 1.42.3.wc1.

2. Initial mount: Create Object Index (OI).

a. Regenerate configuration logs on all targets.

> **Note:** If the `write_conf` operation reports that a disk device was not available, repeat the `write_conf` operation.

```
esms1# lustre_control write_conf -f fsname
esms1# lustre_control start -p -f fsname
```

b. Mount clients.

```
esms1# lustre_control mount_clients -f fsname
esms1# lustre_control mount_clients -c -f fsname
```

c. Verify file system can be accessed from clients. Use `ls`, `touch`, `cat`, etc. of Lustre files or another procedure for verifying that a Lustre file system is operational.

3. `lfsck`: Add FIDs to inode attributes.

Caution: After the `dirdata` attribute is set on the MDT, 1.8.x servers will no longer be able to mount the file system. Cray strongly recommends that you set the `dirdata` attribute to get the best performance and complete functionality from the Lustre 2.4 file system.

a. Shutdown Lustre

```
esms1# lustre_control umount_clients -c -f fsname
esms1# lustre_control umount_clients -f fsname
esms1# lustre_control stop -f fsname
```

b. Set `dirdata` attribute on the MDT.

```
esms1# ssh MDS_node
mds# tune2fs -O dirdata MDS_node
mds# exit
esms1#
```

> **Note:** The state of the `dirdata` attribute can be checked before and after the `tune2fs` command by dumping the superblock of the MDT.

```
mds# dumpe2fs -h MDS_node | grep 'Filesystem features'
```

An example of attributes before the `tune2fs` command:

```
dumpe2fs 1.42.7.wc1 (12-Apr-2013)
[Filesystem features: has_journal ext_attr resize_inode
dir_index filetype sparse_super large_file uninit_bg quota]
```

c. Start Lustre servers.

```
esms1# lustre_control start -f fsname
```

d. Update inode attributes.

Note: The `lfsck` process performs periodic checkpoints so it can resume from where it left off if it is stopped or interrupted. `lfsck` progress can be monitored by watching the `lfsck_namespace /proc` file:

```
esms1# ssh MDS_node
mds# lctl lfsck_start -M fsname-MDT0000 -t namespace
mds# lctl get_param mdd/fsname-MDT0000/lfsck_namespace
mds# exit
esms1#
```

Before doing `lfsck -t namespace` command, the output looks like this:

```
mdd.fsname-MDT0000.lfsck_namespace=
name: lfsck_namespace
magic: 0xa0629d03
version: 2
status: init
flags:
param:
time_since_last_completed: N/A
time_since_latest_start: N/A
time_since_last_checkpoint: N/A
latest_start_position: N/A, N/A, N/A
last_checkpoint_position: N/A, N/A, N/A
first_failure_position: N/A, N/A, N/A
checked_phase1: 0
checked_phase2: 0
updated_phase1: 0
updated_phase2: 0
failed_phase1: 0
failed_phase2: 0
dirs: 0
M-linked: 0
nlinks_repaired: 0
lost_found: 0
success_count: 0
run_time_phase1: 0 seconds
run_time_phase2: 0 seconds
average_speed_phase1: 0 items/sec
average_speed_phase2: 0 objs/sec
real-time_speed_phase1: N/A
real-time_speed_phase2: N/A
current_position: N/A
```

These values will be updated while `lfsck` is running. Once it has completed, the `success_count` value will go up by 1.

4. (Optional) Enable Quotas.

⚠ **Caution:** Some small regressions in metadata performance have been attributed to the automatic usage accounting. If quota enforcement is not needed, step 4 can be skipped. Be aware however that the default configuration for Lustre 2.4 enables automatic accounting. Disabling automatic accounting, although possible, is not a documented feature.

a. Stop the Lustre servers.

```
esms1# lustre_control stop -f fsname
```

b. Enable accounting and create space usage database.

Note: The `lustre_control set_quota_flag` operation executes `tunefs.lustre --quota` on each Lustre target in the specified file system. The `tunefs.lustre` command sets the QUOTA feature flag in the superblock of the target and runs `e2fsck` to build the per-UID/GID disk usage database.

```
esms1# lustre_control set_quota_flag -f fsname
```

5. (Optional) OI Scrub.

Note: The upgrade process performs an OI Scrub to create the FID to inode mappings automatically. The following commands to start and stop an OI Scrub are not needed to complete the upgrade, but are included here for reference. These commands are run on the MDS node.

a. Start OI Scrub.

```
mds# lctl lfsck_start -M fsname-MDT0000
```

b. Stop OI Scrub.

```
mds# lctl lfsck_stop -M fsname-MDT0000
```

c. Tune OI Scrub speed.

```
mds# lctl lfsck_start -M fsname-MDT0000 -s Max_Objects_Persecond
```

d. Monitor OI Scrub status.

```
mds# lctl get_param osd-ldiskfs/fsname-MDT0000/oi_scrub
```

Example of output from a small test system after the scrub has completed:

```
name: OI_scrub
magic: 0x4c5fd252
oi_files: 64
status: completed
flags:
param:
time_since_last_completed: 711866 seconds
time_since_latest_start: 711916 seconds
time_since_last_checkpoint: 711866 seconds
latest_start_position: 12
last_checkpoint_position: 268435457
first_failure_position: N/A
checked: 628157
updated: 504
failed: 0
prior_updated: 0
noscrub: 0
igif: 0
success_count: 1
run_time: 49 seconds
average_speed: 12819 objects/sec
real-time_speed: N/A
current_position: N/A
```

5.19 SCSI RDAC Driver Kernel Parameters for Fibre Channel Storage

OSS and MDS slave nodes implementing Fibre Channel (FC) host bus adapters (HBAs) should use a different boot image than the OSS and MDS using SAS or IB HBAs. When booting an OSS or MDS with the CLFS software image, the `scsi_dh_rdac` driver is not loaded at the correct time. This causes nodes that are attached to storage via FC HBAs to encounter I/O errors, which (if enough LUNs are present) can significantly slow boot times. This condition can be corrected by pre-loading the RDAC module using a kernel parameter before the system starts the `qla2`*xxx* FC module. To create the FC software image, clone the exiting ESF software image an add the kernel parameter. The CLFS software image can be modified using the **Settings** tab from the `cmgui`. Enter `rdloaddriver=scsi_dh_rdac` in the **Kernel Parameters** field. Cray recommends this kernel parameter for servers with Fibre Channel attached storage.

Procedure 70. Adding SCSI RDAC kernel parameter to ESF software image

1. Log in to the CIMS as `root`.
2. From a UNIX® shell, copy the functional ESF image (ESF-XX-2.1.0-201309252230), and wait for the copy operation to complete.

```
esms1 # cd /cm/images
esms1 # cp -pr ESF-XX-2.1.0-201309252230 ESF-XX-2.1.0-FC
```

3. Start `cmsh` and clone the functional CLFS software image.

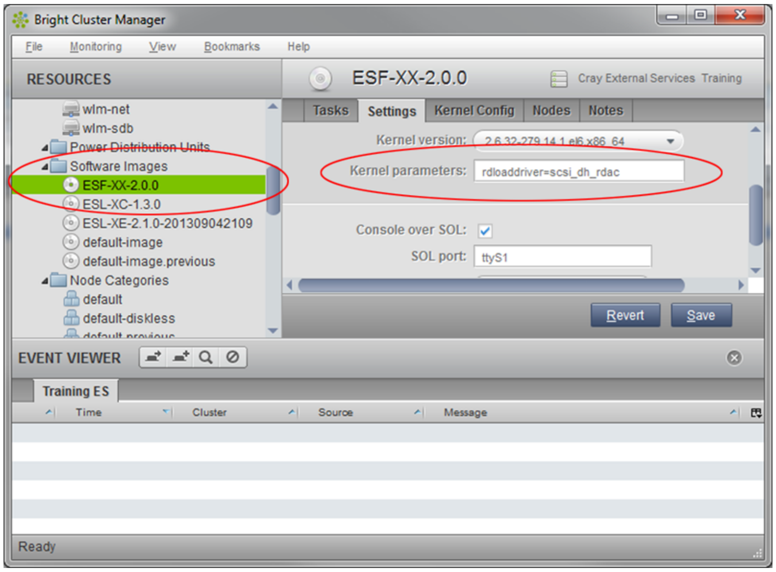
```
esms1 # cmsh
[esms1]% softwareimage
[esms1->softwareimage]% listName (key)                Path
-------------------------- --------------------------------------- -------------------------
ESF-XX-2.1.0-201309252230  /cm/images/ESF-XX-2.1.0-201309252230     2.6.32-279.14.1.el6.x86_64
ESL-XC-1.3.0               /cm/images/ESL-XC-1.3.0                  3.0.74-0.6.8-default
ESL-XE-2.1.0-201309042109  /cm/images/ESL-XE-2.1.0-201309042109     2.6.32.59-0.7-default
default-image              /cm/images/default-image                 3.0.80-0.5-default
default-image.previous     /cm/images/default-image.previous        3.0.80-0.5-default

[esms1->softwareimage]% clone ESF-XX-2.1.0-201309252230 ESF-XX-2.1.0-FC
[esms1->softwareimage*[ESF-XX-2.1.0-FC*]]% commit
[esms1->softwareimage[ESF-XX-2.1.0-FC]]%
```

4. Set kernel parameters to `rdloaddriver=scsi_dh_rdac`.

```
[esms1->softwareimage[ESF-XX-2.1.0-FC]]%  set kernelparameters rdloaddriver=scsi_dh_rdac
[esms1->softwareimage*[ESF-XX-2.1.0-FC*]]% commit
```

The `cmgui` can also be used to set kernel parameters. Select the software image from the Resources tree, then select **Settings**, and enter the kernel parameter `rdloaddriver=scsi_dh_rdac` in the **Kernel Parameters** field as shown in Figure 45.

Figure 45. Setting RDAC Kernel Parameters for Fibre Channel



Kernel version: 2.6.32-279.14.1.el6.x86_64

Kernel parameters: rdloaddriver=scsi_dh_rdac

Console over SOL: ☑

SOL port: ttyS1

5.20 Configuring Lustre® Monitoring Tool (LMT) and Cerebro on the CIMS

Note: Refer to the man pages for `lmtinit`(8), `lmtsh`(8), `lmtop`(1), and `lmt.conf`(1) for more information.

5.20.1 Configuring Cerebro

This configuration is explained in terms of the LMT server (CIMS node) and the LMT agents (CLFS nodes). The `lmt-server` package is installed on the CIMS node. The `lmt-server-agent` package is installed in CLFS nodes.

The Cerebro configuration file, `/etc/cerebro.conf`, contains comments describing the settings and their defaults. You can also view this information by viewing the man page for `cerebro.conf`. On CIMS node, set up the configuration file as follows:

```
LMT_SERVER_IP=$(hostname -i)
echo "cerebrod_speak off
cerebrod_listen on
cerebrod_listen_message_config $LMT_SERVER_IP" > /etc/cerebro.conf
```

This configuration makes the CIMS node listen for Cerebro messages on its IP address without sending any of its own. On the CLFS nodes, assuming `LMT_SERVER_IP` contains the IP address of the CIMS node, set up the configuration file as follows:

```
echo "cerebrod_speak on
cerebrod_speak_message_config $LMT_SERVER_IP
cerebrod_listen off" > /etc/cerebro.conf
```

This causes the CLFS nodes to send Cerebro messages to the IP address of the CIMS node without listening for messages. The Cerebro daemon (`cerebrod`) can be set up to start automatically on the CIMS node and on the Lustre servers using `chkconfig`. To do so, run the following command on the CIMS node and on all Lustre servers.

```
esms1# chkconfig --level 235 cerebrod on
```

This causes `cerebrod` to start whenever `init` is run in run levels 2, 3, and 5. These are the run levels for multi-user mode, multi-user mode with networking, and multi-user mode with networking and X11, respectively. Turning on `cerebrod` with `chkconfig` will not start `cerebrod` immediately, but it will configure it to start whenever the system is booted (in run levels 2, 3, and 5). After the `chkconfig` command, you can start `cerebrod` manually as described below in Starting Cerebro and LMT on page 230.

5.20.2 Starting Cerebro and LMT

The Cerebro daemon (`cerebrod`) can be started manually, if `chkconfig` has not been used to configure `cerebrod` to start on boot or if the system has not been restarted since the `chkconfig` was issued. To begin sending data into LMT, start the `cerebrod` on all CLFS nodes and the CIMS node as follows:

```
esms1# pdsh -w NodeList "/sbin/service cerebrod start" /sbin/service cerebrod start
```

Example 15. Starting cerebrod manually

```
esms1# pdsh -w esfs-mds[1,2],esfs-oss[1,2,3,4] "/sbin/service cerebrod start"
esms1# /sbin/service cerebrod start
```

5.20.3 Configuring the MySQL Database for Cerebro and LMT

After LMT and Cerebro have been installed, the MySQL database must be configured and the `cerebrod` on the CIMS node must be restarted before data will be added to the database. Bright Cluster Manager® (Bright) uses a MySQL database on the CIMS node.

Procedure 71. Configuring the MySQL database for Cerebro and LMT

1. Log in to the CIMS as `root`.
2. Edit the `mkusers.sql` file to change the password from `mypass` to the site password.

```
esms1# chmod 600 /usr/share/lmt/mkusers.sql
esms1# vi /usr/share/lmt/mkusers.sql
```

- Edit the GRANT statements to grant privileges on only `filesystem_`*FileSystemName*`.*` where *FileSystemName* is the name of your file system. This will only grant permissions on the database for the file system being monitored.
- Edit the password for `lwatchadmin` by changing `mypass` to the desired password. Also add a password for the `lwatchclient` user.

Here is an example `mkusers.sql` script where the file system is named `scratch`, and the desired passwords for `lwatchclient` and `lwatchadmin` are `foo` and `bar`.

```
CREATE USER 'lwatchclient'@'localhost' IDENTIFIED BY 'foo';
GRANT SELECT ON filesystem_scratch.* TO 'lwatchclient'@'localhost';

CREATE USER 'lwatchadmin'@'localhost' IDENTIFIED BY 'bar';
GRANT SELECT,INSERT,DELETE  ON filesystem_scratch.* TO 'lwatchadmin'@'localhost';
GRANT CREATE,DROP           ON filesystem_scratch.* TO 'lwatchadmin'@'localhost';

FLUSH PRIVILEGES;
```

3. Enter the following command and type `root` password when prompted to verify that there are no errors in the`mkusers.sql` script.

```
esms1# mysql -u root -p < /usr/share/lmt/mkusers.sql
```

4. Change the permissions of `/etc/lmt/lmt.conf` so that only root has read access, then edit the file.

```
esms1# chmod 600 /etc/lmt/lmt.conf
esms1# vi /etc/lmt/lmt.conf
```

5. Edit the LMT configuration file (`/etc/lmt/lmt.conf`) to add the passwords

for the users `lwatchclient` and `lwatchadmin`. Replace `nil` in the following line with the `lwatchclient` password in double quotation marks (`foo` in the example):

```
esms1# lmt_db_ropasswd = "foo"
```

6. Create the `/etc/lmt/rwpasswd` file, type the `lwatchadmin` password in the file (`lmt.conf` reads the password from this file), and save the file. It should be accessible only by the `root` user.

```
esms1# touch /etc/lmt/rwpasswd
esms1# chmod 600 /etc/lmt/rwpasswd
esms1# vi /etc/lmt/rwpasswd
```

7. (Optional) Note that a similar password file scheme can be used for the `lwatchclient` user if desired. To do so, replace the `lmt_db_ropasswd` line with the following:

```
f = io.open("/etc/lmt/ropasswd")
if (f) then
  lmt_db_ropasswd = f:read("*l")
  f:close()
else
  lmt_db_ropasswd = nil
end
```

8. Create the `/etc/lmt/ropasswd` file, type the `lwatchclient` password in the file, and save the file. It should be accessible only by the root user.

```
esms1# touch /etc/lmt/ropasswd
esms1# chmod 600 /etc/lmt/ropasswd
esms1# vi /etc/lmt/ropasswd
```

Note: Creating separate files for both passwords enables `/etc/lmt/lmt.conf` to be readable by anybody, while protecting the passwords for `lwatchadmin` and `lwatchclient`.

9. Create the database for the file system being monitored.

```
esms1# lminit -a FileSystemName
```

10. Restart `cerebrod` on the CIMS.

```
esms1# /sbin/service cerebrod restart
```

11. Verify that LMT is adding data to its MySQL database by using `lmtsh` to bring up the LMT shell. Then enter **`t`** to list tables. If the row count increases when you enter **`t`** again, LMT is configured properly.

```
esms1# lmtsh -f FileSystemName
```

12. Use the `ltop` command to display real time information about a Lustre file system.

```
esms1# ltop -f FileSystemName
```

13. The `cerebrod` service will continue to gather data for LMT until the CIMS and CLFS nodes are rebooted. Reboot the CIMS and CLFS nodes, and repeat steps step 13.a through step 13.b to gather fresh data.

    Note: Use the `cmsh reboot -c` *category* command from `cmsh device` mode to reboot the CLFS nodes.

    a. Restart the `cerebrod` daemon on each Lustre server. Substitute the node names of your MDS and OSS nodes in the following command.

```
esms1# pdsh -w esfs-mds00[1,2],esfs-oss00[1,2,3,4] "/sbin/service cerebrod restart"
```

    b. Restart the `cerebrod` on the CIMS.

```
esms1# /sbin/service cerebrod restart
```

5.20.4 Managing the Data

There are two ways to view data provided by LMT. You can view live data with `ltop`, or you can view historical data from the MySQL database with `lmtsh`. Refer to the man pages for each command using the `--help` option for more information.

Note: You can also access the MySQL database directly to view the data if you need more control over how the data is presented.

LMT provides scripts which aggregate data into the aggregate tables in the MySQL database. To run the aggregation scripts, enter the following:

```
esms1# /usr/share/lmt/cron/lmt_agg.cron
```

This command may take some time to complete, but subsequent executions will be much faster. To see the tables which were populated by the aggregation scripts, use `lmtsh`. The aggregation script can be set up to run as a cron job if you would like the aggregated tables to be populated on a regular basis. Use the following commands to set up a cron job:

```
esms1# crontab -e
0 * * * * /usr/share/lmt/cron/lmt_agg.cron
```

LMT does not provide an automated utility for clearing old data from the MySQL database; this must be done manually using MySQL commands. For example, to clear all data from the `MDS_OPS_DATA` table which is older than October 4th at 15:00:00, run the following `mysql` command:

```
esms1# mysql -p -e "use filesystem_FileSystemName;
delete MDS_OPS_DATA from
MDS_OPS_DATA inner join TIMESTAMP_INFO
on MDS_OPS_DATA.TS_ID=TIMESTAMP_INFO.TS_ID
where TIMESTAMP < '2013-10-04 15:00:00';"
```

5.20.5 Stopping the Cerebro Service

To stop Cerebro from sending data to LMT, stop the Cerebro daemon from running on all Lustre servers and the LMT server. *NodeList* in the following command can be `esfs-mds[1,2],esfs-oss[1,2,3,4]`.

```
esms1# pdsh -w NodeList "/sbin/service cerebrod stop"
esms1# /sbin/service cerebrod stop
```

If `cerebrod` has been turned on with `chkconfig`, it can also be turned off with `chkconfig` so that it does not start every time the system is booted. To turn off `cerebrod`, use:

```
esms1# chkconfig --level 235 cerebrod off
```

5.20.6 Deleting the LMT MySQL Database

To delete the LMT MySQL database, enter the following command where *FileSystemName* is the name of the file system you would like to remove.

```
esms1# lmtinit -d FileSystemName
```

To remove the MySQL users added by LMT, run the following MySQL command:

```
esms1# mysql -u root -p -e "drop user 'lwatchclient'@'localhost'; drop
user 'lwatchadmin'@'localhost';"
```

5.20.7 Managing Cerebro with Bright

The `cerebrod` service can be started, stopped, and monitoring using Bright. The following procedures adds the Cerebro service to the `esfs-mds1` slave node. This same procedure can be used to monitor the `cerebrod` service on the CIMS.

Procedure 72. Managing Cerebro on a slave node with Bright

1. Log in to the CIMS as `root` and start `cmsh`.

```
esms1# cmsh
[esms1]%
```

2. Switch to `device services` mode and select the `esfs-mds1` slave node.

```
[esms1]% device services esfs-mds1
[esms1->device[esfs-mds1]->services]%
```

3. Add and configure the `cerebrod` service.

```
[esms1->device[esfs-mds1]->services]% add cerebrod
[esms1->device*[esfs-mds1*]->services*[cerebrod*]]% show
Parameter                      Value
------------------------------ --------------------------
Autostart                      no
Belongs to role                no
Monitored                      no
Revision
Run if                         ALWAYS
Service                        cerebrod

[esms1->device*[esfs-mds1*]->services*[cerebrod*]]% set monitored on
[esms1->device*[esfs-mds1*]->services*[cerebrod*]]% set autostart on
[esms1->device*[esfs-mds1*]->services*[cerebrod*]]% commit
[esms1->device[esfs-mds1]->services[cerebrod]]%
```

4. To monitor the status of `cerebrod`, enter:

```
[esms1->device[esfs-mds1]->services[cerebrod]]% status
cerebrod                  [DOWN]
```

Procedure 73. Managing Cerebro for a category

1. Log in to the CIMS as `root` and start `cmsh`.

```
esms1# cmsh
[esms1]%
```

2. Switch to `category services` mode and select the `esFS-MDS` category.

```
[esms1]% category services esFS-MDS
[esms1->category[esFS-MDS]->services]%
```

3. Configure the `cerebrod` services for the `esFS-MDS` category.

```
[esms1->category[esFS-MDS]->services]% add cerebrod
[esms1->category*[esFS-MDS*]->services*]% set autostart yes
[esms1->category*[esFS-MDS*]->services*]% set monitored yes
[esms1->category*[esFS-MDS*]->services*]% commit
esms1->category[esFS-MDS]->services]%
```

Refer to the *Bright Cluster Manager 6.0 Administrator Manual* for more information about configuring services in Bright.

Monitoring and Troubleshooting [6]

Bright Cluster Manager® (Bright) software enables administrators to monitor health check information and metrics. Health checks run periodically from the cluster management daemon (`cmd` or CMDaemon) and may run on either the CIMS or slave node or both. Health checks return a `PASS`, `FAIL` or `UNKNOWN` condition, and actions can be taken based on the return value. Metrics also run periodically from CMDaemon (`cmd`) and may run on either the CIMS, slave node, or both. Metrics return a numeric value, and actions can be taken based on crossing a threshold value.

Refer to Failover Features and Bright Monitoring on page 167 for information about how to install `esfsmon_healthcheck` and `esfsmon_action` to monitor failover conditions.

Refer to the *Bright Cluster Manager 6.0 Administrator Manual* for more information about Cray Data Management Platform (DMP) monitoring capabilities.

The monitoring system:

- Inspects monitoring data at preset levels to preserve resources
- Configures and gathers monitoring data for new resources
- Identifies current and past problems or abnormal behavior
- Analyzes trends that help an administrator predict likely future problems
- Handles problems by triggering alerts
- Taking action, if necessary, to improve the situation or to investigate further

Bright uses the term *Metric* to describe a property of a device that can be monitored and has a numeric value. Examples are 45.2 °C, any number like 1.23, or a value in bytes such as 12322343. Thresholds can be set so that when a the threshold is crossed (ion either direction), *Actions* are taken. *Actions* are stand-alone shell scripts that run when a monitoring condition is met.

Health checks are device states, that are returned when a health check script is periodically run on a node. Return values for the example are, `PASS`, `FAIL`, or `UNKNOWN`. An example of health the `healthcheck` feature follows:

- Determine if a hard drive has enough space available and returning a `PASS` status if it does
- Determine if an NFS® mount is accessible, and returning `FAIL` if it is not

- Determine if `CPUUser` is below 50%, and returning `PASS` if it is
- Determine if the `cmsh` binary is found, and returning `UNKNOWN` if it is not

Refer to Table 7 for alter level descriptions.

The `cmsh` monitoring mode is separated into 4 sections: `actions`, `healthchecks`, `metrics`, and `setup`. The `monitoring actions` mode enables control over the actions you have defined in shell scripts, or the built in actions such as `power off`.

Example 16. `cmsh monitoring actions` Mode

```
esms1# cmsh
[esms1]% monitoring actions
[esms1->monitoring->actions]% list
Name (key) Command
------------------------ ------------------------------------------------
Drain node             <built in>
Power off               <built in>
Power on               <built in>
Power reset             <built in>
Reboot                  <built in>
SendEmail               <built in>
Shutdown                <built in>
Undrain node            <built in>
killprocess             /cm/local/apps/cmd/scripts/actions/killprocess.pl
remount                 /cm/local/apps/cmd/scripts/actions/remount
testaction              /cm/local/apps/cmd/scripts/actions/testaction
```

Example 17. cmsh monitoring healthchecks mode

```
esms1# cmsh
[esms1->monitoring->healthchecks]% list
name (key)         command
------------------ -------------------------------------------------------
DeviceIsUp         <built-in>
ManagedServicesOk  <built-in>
chrootprocess      /cm/local/apps/cmd/scripts/healthchecks/chrootprocess
cmsh               /cm/local/apps/cmd/scripts/healthchecks/cmsh
diskspace          /cm/local/apps/cmd/scripts/healthchecks/diskspace
exports            /cm/local/apps/cmd/scripts/healthchecks/exports
failedprejob       /cm/local/apps/cmd/scripts/healthchecks/failedprejob
failover           /cm/local/apps/cmd/scripts/healthchecks/failover
hardware-profile   /cm/local/apps/cmd/scripts/healthchecks/node-hardware-+
hpraid             /cm/local/apps/cmd/scripts/healthchecks/hpraid
interfaces         /cm/local/apps/cmd/scripts/healthchecks/interfaces
ipmihealth         /cm/local/apps/cmd/scripts/metrics/sample_ipmi
ldap               /cm/local/apps/cmd/scripts/healthchecks/ldap
lustre             /cm/local/apps/cmd/scripts/healthchecks/lustre
mounts             /cm/local/apps/cmd/scripts/healthchecks/mounts
mysql              /cm/local/apps/cmd/scripts/healthchecks/mysql
ntp                /cm/local/apps/cmd/scripts/healthchecks/ntp
oomkiller          /cm/local/apps/cmd/scripts/healthchecks/oomkiller
portchecker        /cm/local/apps/cmd/scripts/healthchecks/portchecker
rogueprocess       /cm/local/apps/cmd/scripts/healthchecks/rogueprocess
schedulers         /cm/local/apps/cmd/scripts/healthchecks/schedulers
smart              /cm/local/apps/cmd/scripts/healthchecks/smart
ssh2node           /cm/local/apps/cmd/scripts/healthchecks/ssh2node
swraid             /cm/local/apps/cmd/scripts/healthchecks/swraid
testhealthcheck    /cm/local/apps/cmd/scripts/healthchecks/testhealthcheck
```

Refer to the *Bright Cluster Manager 6.0 Administrator Manual* for more information about each metric and descriptions for each.

Example 18. cmsh monitoring metrics Mode

```
esms1# cmsh
[esms1->monitoring]% metrics
[esms1->monitoring->metrics]% list
Name (key)                   Command
---------------------------- ------------------------------------------------
AlertLevel                   <bulit-in>
Ambient_Temp                 /cm/local/apps/cmd/scripts/metrics/sample_ipmi
.
.
.
```

6.1 Check Device Status

Use the following cmsh commands to check node and other device status in Bright.

```
esms1# cmsh
[esms1]% device status
KVM ................. [ UP ]
esms ................ [ UP ]
eth-01 .............. [ UP ]
ib-01 ............... [ UP ]
ib-02 ............... [ UP ]
mds01 ............... [ UP ]
mds02 ............... [ UP ]
oss01 ............... [ UP ]
oss02 ............... [ UP ]
oss03 ............... [ UP ]
oss04 ............... [ UP ]
[esms]%
```

6.2 Check Power Status

Use the following cmsh commands to check node power status, and the power status of other devices in Bright.

```
esms# cmsh
[esms]% device power status
No power control .... [ UNKNOWN ] KVM
No power control .... [ UNKNOWN ] esms
No power control .... [ UNKNOWN ] eth-01
No power control .... [ UNKNOWN ] ib-01
No power control .... [ UNKNOWN ] ib-02
ipmi0 ............... [ ON ] mds01
ipmi0 ............... [ ON ] mds02
ipmi0 ............... [ ON ] oss01
ipmi0 ............... [ ON ] oss02
ipmi0 ............... [ ON ] oss03
ipmi0 ............... [ ON ] oss04
[esms]%
```

6.3 Check Node Health Status

Use the following cmsh commands to check node health status, and the health status of other devices in Bright.

```
esms1# cmsh
[esms1]% device
[esms1->device]% showhealth
Device      AlertLevel Failed               Thresholds    Unknown
------------------- ---------- -------------------- -------------- ---------------
esmaint-net-switch  0
esms1               30         ManagedServicesOk
ib-switch-1         0
ipmi-net-switch     0
lake-esl            0
mds001              10         mounts, rogueprocess
```

```
mds002              40          DeviceIsUp
node001             no data
oss001              10          mounts, rogueprocess
oss002              10          mounts, rogueprocess
eslogin1            0
```

The AltertLevel entries are defined in Table 7:

Table 7. healthcheck Alert Levels

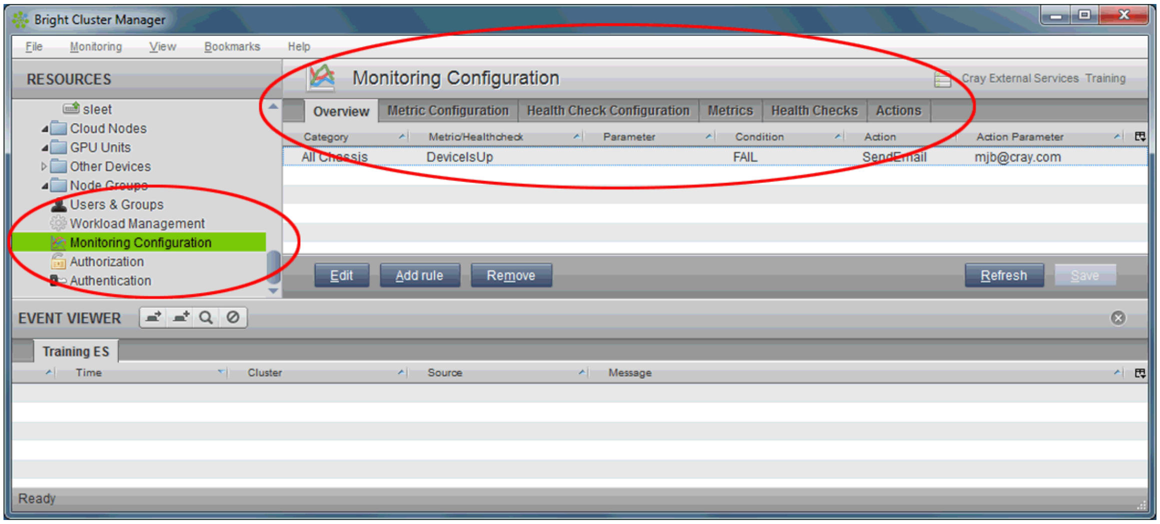
Value	Name	Description
0	Info	Informational Message
10	Notice	Normal, but significant condition
20	Warning	Warning conditions
30	Error	Error conditions
40	alert	take immediate action

```
esms1# cmsh
[esms1]% device
[esms1->device]% latesthealthdata mds001
Health Check           Severity   Value      Age (sec.) Info Message
---------------------- --------   -------    ---------  -------------------------
DeviceIsUp              0          PASS       45
ManagedServicesOk       0          PASS       165
mounts                  10         FAIL       645       defined mountpoint /proc has different+
rogueprocess            10         FAIL       645       /usr/sbin/sendmail.sendmail (smmsp) /*6+
ssh2node                0          PASS       645
[esms1->device]%
```

6.4 Monitoring Configuration with cmgui

The monitoring configuration for health checks, metrics, and triggered actions is configured in the **Monitoring Configuration** section under resources section of cmgui.

Figure 46. Bright Monitoring Configuration



Category	Metric/Healthcheck	Parameter	Condition	Action	Action Parameter
All Chassis	DeviceIsUp		FAIL	SendEmail	mjb@cray.com

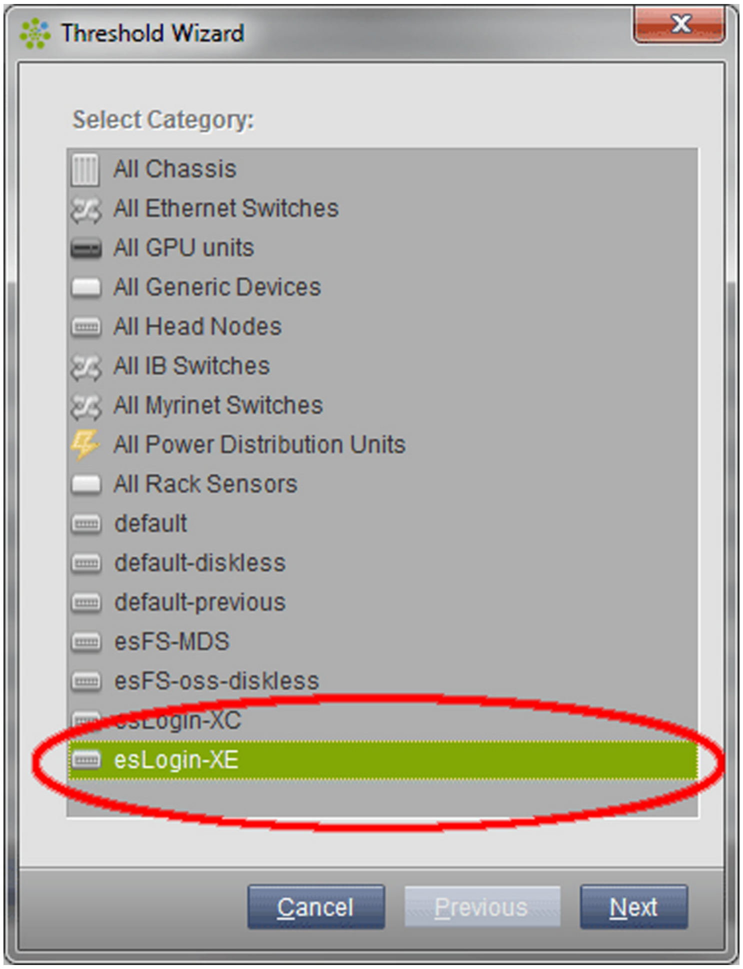
The Monitoring option in the menu bar of `cmgui` starts a visualization tool that enables you to monitor system behavior over periods of time. The monitoring framework enables you to monitor a condition, add an *Action* (an executable shell script), and then set up a threshold level that triggers the action.

Procedure 74. Monitoring configuration setup

This procedures configures a monitoring rule that alerts the administrator if an CDL node goes down for any reason.

1. In `cmgui`, select **Monitoring Configuration** from the resource tree (refer to Figure 46.)
2. From the **Threshold Wizard**, select a device category (this example selects the `esLogin-XE` category).

Figure 47. Monitoring Configuration Category

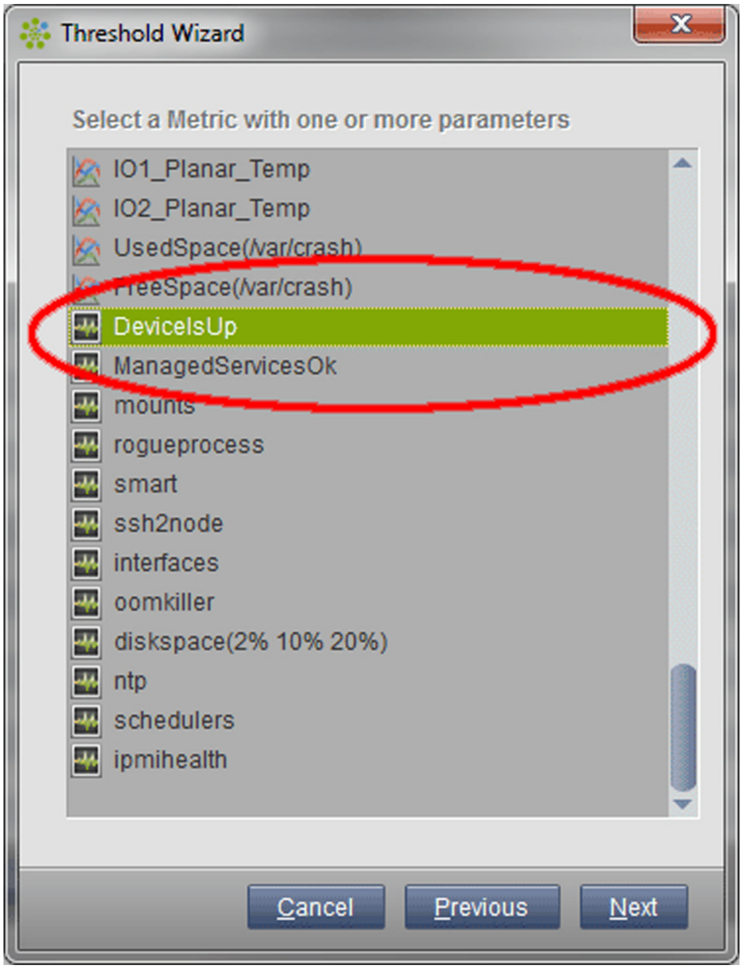

Threshold Wizard

Select Category:

All Chassis
All Ethernet Switches
All GPU units
All Generic Devices
All Head Nodes
All IB Switches
All Myrinet Switches
All Power Distribution Units
All Rack Sensors
default
default-diskless
default-previous
esFS-MDS
esFS-oss-diskless
esLogin-XC
esLogin-XE

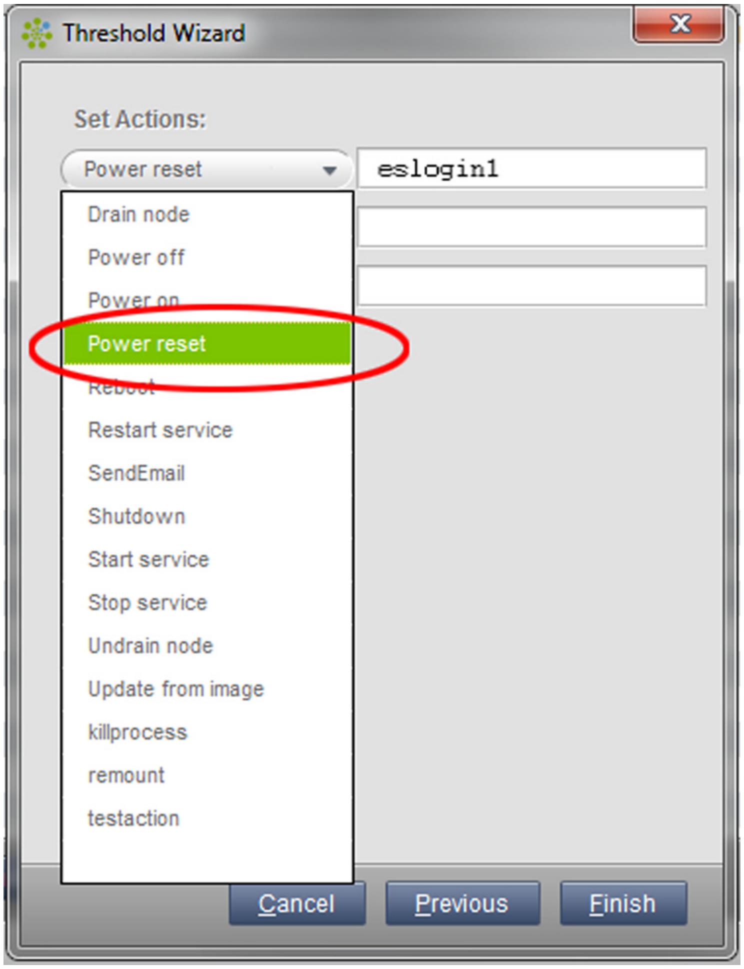
3. Click **Next**, then scroll down and locate the **DeviceIsUp** health check metric from the menu, and click **Next** again.

Figure 48. Monitoring Configuration Metric



4. In the **Set Actions** pulldown menu, select **Power Reset**, and enter the name of the slave node to reset (this example shows `eslogin1`). You can also include a **SendEmail** action, and enter an email address for the administrator.

Figure 49. Monitoring Configuration Action



5. Click **Finish** to save the monitoring rule.

6.5 Check System Status

The CM software enables you to display power and device status. The following states indicate a normal operational status:

- `CLOSED` — The node is not being monitored by Bright Cluster Manager (Bright).
- `OPEN` — The node is being monitored by the Bright and is not in one of the following states.
- `DOWN` — The operating system is down and/or the CIMS cannot communicate

with CMDaemon (`cmd`) running on the node. This can be an expected state if it is intentionally entered by the administrator. If it in not intentionally in a `DOWN` state, expect a failure.

> **Note:** In cases of high load on a CLFS node during normal operation, the CLFS node state may toggle between `UP` and `DOWN` within 2-3 second intervals. This is not a failure, but indicates that the node was busy handling file system traffic during the time the CIMS was requesting its state.

- `INSTALLING` — The Bright node-installer is provisioning the node during the boot process.
- `INSTALLER_CALLINGINIT` — The CM node-installer has handed over control to the local `init` process.
- `UP` — The OS is up and the CIMS is able to manage the node.

The following states indicate a problem has occurred during the boot process:

- `INSTALLER_FAILED` — The Bright node-installer has detected an unrecoverable problem during the boot process or has taken too long to enter the UP state. Possible reasons for this state include:
  - Local hard disk not found.
  - Failure to start a network interface.
  - Previous state was `INSTALLER_REBOOTING` and the reboot took too long. Possible reasons for failure to reach the `UP` state in time include:
    - Failure to hand over control from the Bright node-installer to the local `init` process.
    - The local `init` process failed to start CMDaemon (`cmd`) or the `cmd` took too long to start if the latter, this state will go to `UP` when `cmd` starts.
- `INSTALLER_UNREACHABLE` — The CIMS CMDaemon (`cmd`) can no longer ping the node. The node may have crashed while running the CM node-installer.
- `INSTALLER_REBOOTING` — The Bright node-installer may need to reboot a node to install a new kernel.
- `INSTALLER_FAILED` — The Bright node-installer failed or it took too long to long to enter the UP state.

Use the examples in the following procedures to check status of individual nodes or a group of nodes. You can check the power status of nodes individually, by list, range, category, or node group as shown in Procedure 75.

Procedure 75. Check power status

1. Log in to the CIMS as `root` and run `cmsh`.

```
esms1# cmsh
[esms1]%
```

2. Type **`device`** at the `cmsh` prompt to enter device mode.

```
[esms1]% device
[esms1->device]%
```

   a. To check power status of an individual node such as, `eslogin01`, type:

```
[esms1->device]% power -n eslogin01 status
```

   b. To check power status of a list of nodes, such as `eslogin01` to `eslogin04` plus `eslogin06`, type:

```
[esms1->device]% power -n eslogin01..eslogin04,eslogin06 status
```

   c. To check power status of all nodes in the `eslogin` category, type:

```
[esms1->device]% power -c eslogin status
```

   d. To check power status of all nodes in the `dm` node group, type:

```
[esms1->device]% power -g dm status
```

3. You can check the device status of nodes individually, by list and range, by category or node group.

   a. To check device status of an individual node such as, `eslogin01`, type:

```
[esms1->device]% status -n eslogin01
```

   b. To check device status of a list of nodes, such as `eslogin01` to `eslogin04` plus `eslogin06`, type:

```
[esms1->device]% status -n eslogin01..eslogin04,eslogin06
```

   c. To check device status of all nodes in the `eslogin-XE` category, type:

```
[esms1->device]% status -c eslogin-XE
```

   d. To check device status of all nodes in the `datamover` node group, type:

```
[esms1->device]% status -g datamover
```

6.6 Monitoring Health and Metrics

- Refer to Switches and PDUs on page 34 for information about monitoring switches, RAID controllers, and other devices using Bright.
- Refer to Configuring the LSI® MegaCLI™ RAID Utility on page 69 for information about monitoring CIMS, CDL, or CLFS local RAID systems.

- Refer to Configuring CLFS Failover (`esfsmon`) on page 165 for information about configuring `esfsmon` to monitor file system failover.
- Set Email Alerts when a Node Goes Down on page 250 describes how to configure a healthcheck to send an Email when a node goes down.

Procedure 76. Monitor system health and metrics

1. Log in to the CIMS as `root` and start `cmsh`.

```
esms1# cmsh
```

2. Type **`device`** at the `cmsh` prompt to enter device mode and display the device mode prompt:

```
[esms1]% device
[esms1->device]%
```

3. Type **`latesthealthdata`** ***device*** **`-v`** to monitor system health and metrics:

```
[esms1->device]% latesthealthdata esfs-oss001 -v
Health Check                 Severity Value            Age (sec.) Info Message
---------------------------- -------- ---------------- ---------- ----------------------------------------
DeviceIsUp                   0        PASS             111
ManagedServicesOk            0        PASS             111
mounts                       0        PASS             1551
rogueprocess                 0        PASS             351
smart                        0        PASS             1551       sda: Smart command failed
                                                                  sdb: Smart command failed
                                                                  sdc: Smart command failed
                                                                  sdd: Smart command failed
                                                                  sde: Smart command failed
                                                                  sdf: Smart command failed
                                                                  sdg: Smart command failed
                                                                  sdh: Smart command failed
ssh2node                     0        PASS             1551
interfaces                   0        PASS             1551
oomkiller                    0        PASS             1551
diskspace:2% 10% 20%         0        PASS             1551
ntp                          0        PASS             351
schedulers                   0        PASS             1551
ipmihealth                   0        PASS             111
```

Procedure 77. Display the metric status

1. Log in to the CIMS as `root` and start `cmsh`.

```
esms1# cmsh
```

2. Type **`device`** at the `cmsh` prompt to enter device mode and display the device mode prompt:

```
[esms1]% device
[esms1->device]%
```

3. Type **`latestmetricdata`** ***device*** **`-v`**:

```
 [esms1->device]% latestmetricdata esfs-oss001 -v
Metric                       Value            Age (sec.) Info Message
---------------------------- ---------------- ---------- ----------------------------------------
AlertLevel:max               0                106
AlertLevel:sum               0                106
BytesRecv:BOOTIF             332.35           166
BytesRecv:eth1               0                166
BytesRecv:eth2               0                166
BytesRecv:eth3               0                166
BytesRecv:ib0                8.4              166
BytesRecv:ib1                0                166
. . .
```

Procedure 78 shows you how to dump the health check data for a node. You can dump the collected health check data for a node for a specified period of time. Most health checks are logging the past 3000 samples. Available health checks for a node are given by the `latesthealthdata` command described above.

Procedure 78. Dump health check data

1. Log in to the CIMS as `root` and start `cmsh`.

```
esms1# cmsh
```

2. Type **`device`** at the `cmsh` prompt to enter device mode and display the device mode prompt:

```
 [esms1]% device
[esms1->device]%
```

3. Type **`dumphealthdata`** ***start-time end-time healthcheck device***. The following example dumps the `deviceisup` data for the past hour:

```
[esms1->device]% dumphealthdata -1h now deviceisup esfs-oss001
# From Wed Sep 11 13:32:10 2013 to Wed Sep 11 14:32:10 2013
Time                        Value            Info Message
--------------------------  ---------------- ------------------------------------------
Wed Sep 11 13:32:10 2013    PASS
Wed Sep 11 14:32:00 2013    PASS
```

Procedure 79 shows you how to dump the metric data for a node. You can dump the collected metric data for a node for a specified period of time. Most metrics are logging the past 3000 samples. Available metrics for a node are given by the `latestmetricdata` command described above.

Procedure 79. Dump metric data

1. Log in to the CIMS as `root` and start `cmsh`.

```
esms1# cmsh
```

2. Type **`device`** at the `cmsh` prompt to enter device mode and display the device mode prompt:

```
[esms1]% device
[esms1->device]%
```

3. Type **`dumpmetricdata`** ***start-time end-time healthcheck device***. The following example dumps the `deviceisup` data for the past hour:

```
 [esms1->device]% dumpmetricdata -1h now FreeSpace:/var/crash eslogin1
# From Wed Sep 11 13:38:58 2013 to Wed Sep 11 14:38:58 2013
Time                       Value            Info Message
-------------------------- ---------------- ------------------------------------------
Wed Sep 11 13:38:58 2013   1.64826e+10
Wed Sep 11 14:38:58 2013   1.64826e+10
```

6.6.1 Set Email Alerts when a Node Goes Down

Procedure 80. Set email alerts when a node goes down

1. Log in to the CIMS as `root` and start `cmsh`.

```
esms1# cmsh
[esms1]%
```

2. Switch to `monitoring` mode.

```
[esms1]% monitoring
[esms1->monitoring]%
```

3. Switch to `setup` mode.

```
[esms1]% setup
[esms1->monitoring->setup]%
```

4. Enter `healthconf` and the node category name for the devices that you want to configure.

```
[esms1]% healthconf esLogin-XC
[esms1->monitoring->setup[esLogin-XC]->healthconf]%
```

5. Enter `add` and press the tab key to see the available command line options.

```
[esms1->monitoring->setup[esLogin-XC]->healthconf]% add
chrootprocess      failedprejob       ipmihealth         mysql              schedulers
cmsh               failover           ldap               ntp                smart
aeviceisup         hardware-profile   lustre             oomkiller          ssh2node
diskspace          hpraid             managedservicesok  portchecker        swraid
exports            interfaces         mounts             rogueprocess       testhealthcheck
```

6. Enter `add deviceisup`.

Note: Pressing the Tab key displays a list of valid options.

```
[esms1->monitoring->setup[esLogin-XC]->healthconf]% add Tab
chrootprocess      failedprejob       ipmihealth         mysql              schedulers
cmsh               failover           ldap               ntp                smart
deviceisup         hardware-profile   lustre             oomkiller          ssh2node
diskspace          hpraid             managedservicesok  portchecker        swraid
exports            interfaces         mounts             rogueprocess       testhealthcheck
```

7. Add the `SendEmail` action to `DeviceIsUp`

```
[esms1->monitoring->setup[esLogin-XC]->healthconf]% set DeviceIsUp failactions SendEmail
```

8. Enter commit to store the changes.

```
[esms1->monitoring->setup[esLogin-XC]->healthconf]% commit
```

6.7 Log Files

All syslog traffic from the DMP slave nodes is forwarded to /var/log/messages on the CIMS.

In addition to syslog, Bright maintains an event log in its database (refer to View the Event Log on page 251.) Ensure that CMDaemon (cmd) is running on the CIMS and on the suspect node if cluster management operations are malfunctioning.

Other log files of interest are:

- /var/log/messages — Slave node syslog messages.
- /var/log/cmdaemon — Bright CMDaemon (cmd) messages. Check this log if there are system management problems.
- /var/log/node-installer — Node Installer messages. Check this log if there are boot problems.
- /var/log/conman/ — Slave node console messages.
- /var/adm/cray/logs — Software installation logs.
- Bright event log. Stored in the Bright database and accessed using events command in cmsh or event viewer when using the cmgui.

6.8 Bright Logs

6.8.1 View the Event Log

Procedure 81 shows you how to view the event log.

Procedure 81. View the event log

1. Log in to the CIMS as root and start cmsh.

```
esms1# cmsh
```

2. Type **`events`** followed by the number of events to display. Use `events details` *eventnum* to display details for a specific event.

```
[esms1]% events 50
Thu Aug 29 16:30:43 2013 [notice] esms1: Starting image directory removal: /cm/images/ESL-XE-1.1.1-kdump
Thu Aug 29 16:31:00 2013 [notice] esms1: Check 'chrootprocess' is in state PASS on esms1
Thu Aug 29 16:31:47 2013 [notice] esms1: Image directory removal succeeded for: /cm/images/ESL-XE-1.1.1-kdump
Fri Aug 30 08:29:14 2013 [notice] esms1: Service named was restarted
Fri Aug 30 08:42:04 2013 [warning] esms1: Service nfs died
Fri Aug 30 08:42:05 2013 [notice] esms1: Service nfs was restarted
Fri Aug 30 09:18:03 2013 [warning] lake-esl: Check 'ntp' is in state FAIL on lake-esl
For details type: events details 3118
Fri Aug 30 09:18:03 2013 [warning] oss001: Check 'ntp' is in state FAIL on oss001
. . .
esms1]% events details 3118
ntpd not synchronized to a time server
```

6.8.2 View the `rsync` Log

Procedure 82 shows you how to view the `rsync` log which records which changes were stored to a particular device during the last image update operation.

Procedure 82. View the `rsync` log

1. Log in to the CIMS as `root` and start `cmsh`.

```
esms1# cmsh
```

2. Type **`device`** at the `cmsh` prompt to enter device mode and display the device mode prompt:

```
[esms1]% device
[esms1->device]%
```

3. Type **`synclog`** ***device***:

```
[esms1->device]% synclog lustre1-oss001
```

Changing BIOS for a DELL™ R720 Managed CDL Node [A]

Before you can configure a managed CDL node with Bright Cluster Manager® (Bright), you must change the BIOS and Dell remote access controller (iDRAC) settings. The following configuration is required for each CDL node.

- A CDL node must be cabled to both the CIMS administration network (`esmaint-net`) and IPMI network (`ipmi-net`).
- A CDL node using a workload manager such as Moab® or TORQUE must be cabled directly to the SDB on the Cray system over the `wlm-net`.
- A CDL node must be configured to provide IPMI Serial Over LAN (SOL) for remote console support.
- A CDL node must be configured to PXE boot from the CIMS (embedded NIC) before attempting to boot from the local disk.

Use the following procedure to change the BIOS and iDRAC settings for a CDL node.

Procedure 83. Changing a R720 slave node's BIOS and iDRAC settings

Note: This procedure shows specific steps for a Dell R720 system. Dell R815 BIOS setup procedures are also in the Appendix.

1. Power up the slave node. When the BIOS power-on self-test (POST) process begins, **quickly press the F2 key** after the following messages appear in the upper-right of the screen.

```
      F2 = System Setup
  F10 = System Services
F11 = BIOS Boot Manager
         F12 = PXE Boot
```

   When the `F2` keypress is recognized, the `F2 = System Setup` line changes to `Entering System Setup`.

After the POST process completes and all disk and network controllers have been initialized, the **Dell System Setup** screen appears. The following submenus are available:

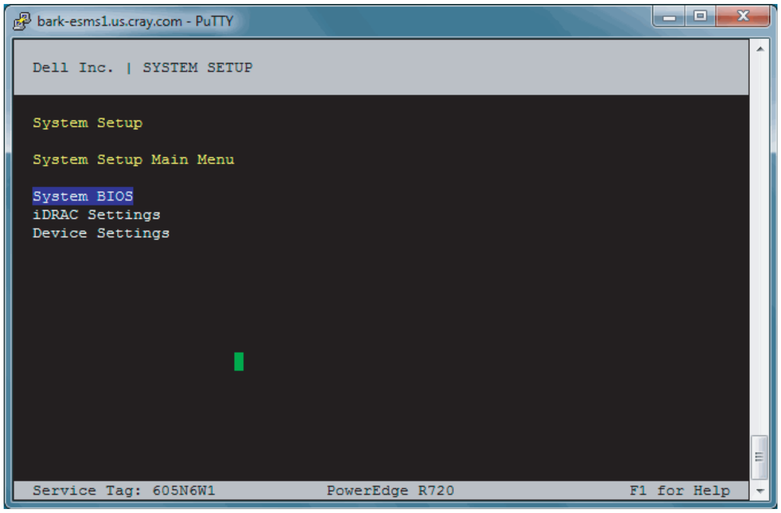
```
System BIOS
iDRAC Settings
Device Settings
```

> **Note:** In this utility, use the `Tab` key to move to different areas on the screen. To select an item, use the `up-arrow` and `down-arrow` keys to highlight the item, then press the `Enter` key. Press the `Escape` key to exit a submenu and return to the previous screen.

2. Change the system BIOS settings.

   a. Select **System BIOS**, then press `Enter`. See Figure 50.

Figure 50. Dell 720 System BIOS Settings



```
Dell Inc. | SYSTEM SETUP

System Setup

System Setup Main Menu

System BIOS
iDRAC Settings
Device Settings

Service Tag: 605N6W1            PowerEdge R720            F1 for Help
```

   b. Select **Boot Settings**, then press `Enter`.

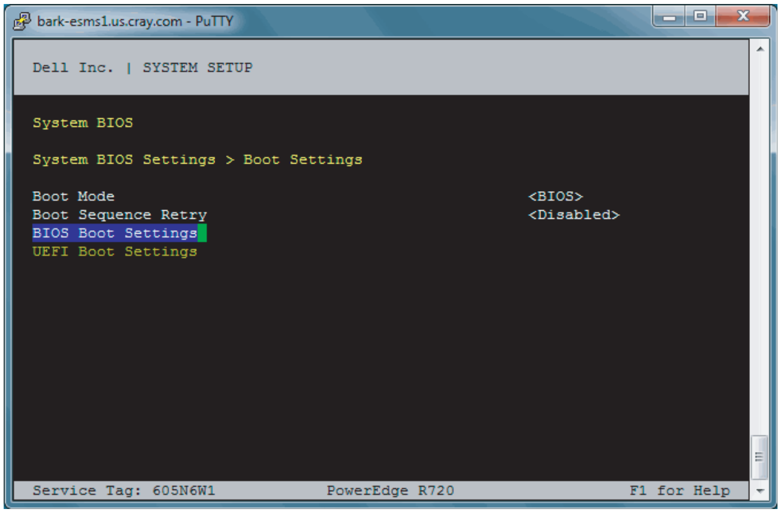
   c. Select **BIOS Boot Settings**, then press `Enter`.

   d. Select **Boot Sequence**, then press `Enter` to view the boot settings.

   e. In the pop-up window, change the boot order so that the integrated NIC appears first, before the optical (DVD) drive. The hard drive should be last on the list. See Figure 51.

   > **Tip:** Use the `up-arrow` or `down-arrow` key to highlight an item, then use the `+` and `-` keys to move the item up or down.

Figure 51. Dell 720 Boot Sequence BIOS Settings



```
Dell Inc. | SYSTEM SETUP

System BIOS

System BIOS Settings > Boot Settings

Boot Mode                                                     <BIOS>
Boot Sequence Retry                                           <Disabled>
BIOS Boot Settings
UEFI Boot Settings

Service Tag: 605N6W1              PowerEdge R720              F1 for Help
```

f. Be sure that **Hard Drive C:** is enabled under the **Boot Option Enable/Disable** section. See Figure 51.

g. Press `Enter` to return to the **BIOS Boot Settings** screen.

h. Press `Escape` to exit **BIOS Boot Settings**.

i. Press `Escape` to exit **Boot Settings** and return to the **System BIOS Settings** screen.

3. Change the serial communication settings.

a. On the **System BIOS Settings** screen, select **Serial Communication**.

b. On the **Serial Communication** screen, select **Serial Communication**. A pop-up window displays the available options.

c. Select **On with Console Redirection via COM2**, then press `Enter`.

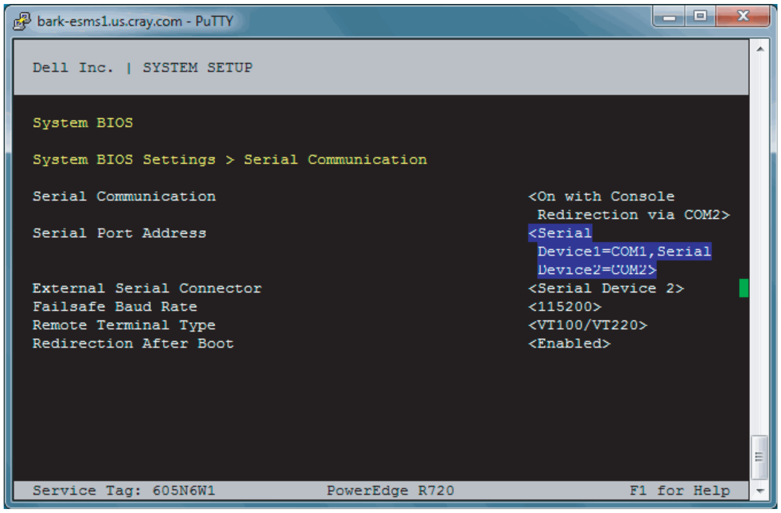
d. Verify that **Serial Port Address** is set to **Serial Device1=COM1, Serial Device2=COM2**.

Note: This setting enables the remote console. If this setting is incorrect, you cannot use a remote console to access the CDL node.

1) If necessary, press `Enter` to display the available options.

2) Change the setting to **Serial Device1=COM1, Serial Device2=COM2**. See Figure 52.

Figure 52. Dell 720 Serial Device BIOS Settings



```
Dell Inc. | SYSTEM SETUP

System BIOS

System BIOS Settings > Serial Communication

Serial Communication                                  <On with Console
                                                       Redirection via COM2>
Serial Port Address                                   <Serial
                                                       Device1=COM1,Serial
                                                       Device2=COM2>
External Serial Connector                             <Serial Device 2>
Failsafe Baud Rate                                    <115200>
Remote Terminal Type                                  <VT100/VT220>
Redirection After Boot                                <Enabled>

Service Tag: 605N6W1              PowerEdge R720               F1 for Help
```

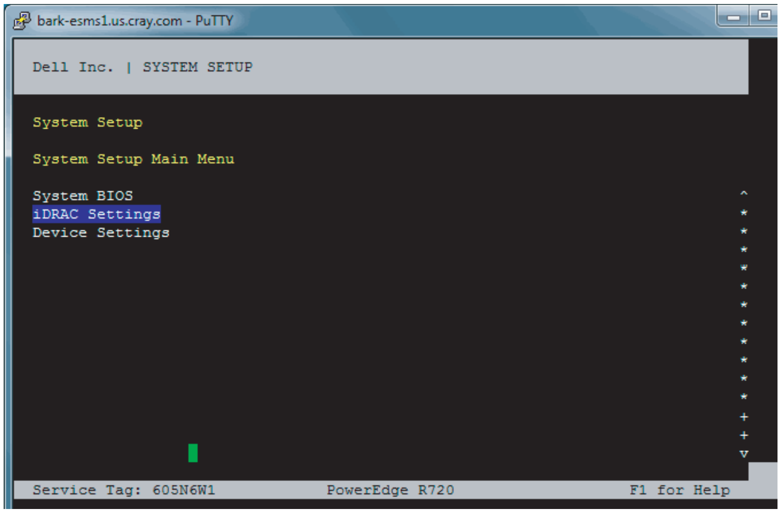
3) Press `Enter` to return to the **Serial Communication** screen.

e. Select **External Serial Connector**. A pop-up window displays the available options.

f. In the pop-up window, select **Remote Access Device**, then press `Enter` to return to the previous screen.

g. Select **Failsafe Baud Rate**. A pop-up window displays the available options.

Figure 53. Dell 720 Serial Communication BIOS Settings



```
Dell Inc. | SYSTEM SETUP

System Setup

System Setup Main Menu

System BIOS
iDRAC Settings
Device Settings

Service Tag: 605N6W1              PowerEdge R720               F1 for Help
```

h. In the pop-up window, select **115200**, then press `Enter` to return to the previous screen.

i. Press the `Escape` key to exit the **Serial Communication** screen.

j. Press the `Escape` key to exit the **System BIOS Settings** screen.

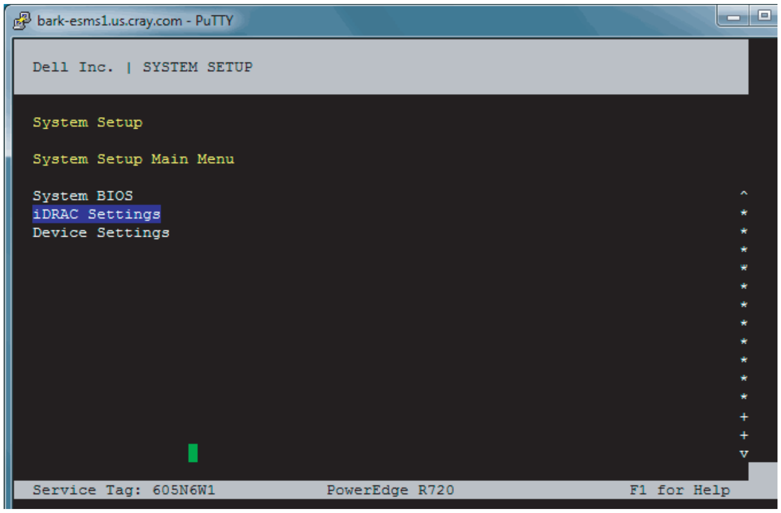
k. Press the `Escape` key to exit the **BIOS Settings** screen.

l. A "Settings have changed" message appears. Select **Yes** to save your changes.

m. A "Settings saved successfully" message appears. Select **OK**.

4. On the System Setup Main Menu, select **iDRAC Settings**, then press `Enter`. See Figure 54.

Figure 54. Dell 720 iDRAC BIOS Settings



```
Dell Inc. | SYSTEM SETUP

System Setup

System Setup Main Menu

System BIOS
iDRAC Settings
Device Settings

Service Tag: 605N6W1          PowerEdge R720          F1 for Help
```

5. Select **Network**, then press `Enter`. A long list of network settings is displayed.

6. Change the IPMI settings to enable the Serial Over LAN (SOL) console.

   a. Use the `down-arrow` key to scroll to the **IPMI SETTINGS** list.

   b. Ensure that **IPMI over LAN** (or **Enable IPMI over LAN**) is enabled.

      1) If necessary, select **IPMI over LAN**, then press `Enter`.

      2) In the pop-up window, select **<Enabled>**.

      3) Press `Enter` to return to the previous screen.

   c. Press the `Escape` key to exit the Network screen and return to the **iDRAC Settings** menu.

7. Change the LCD configuration to show the host name in the LCD display.

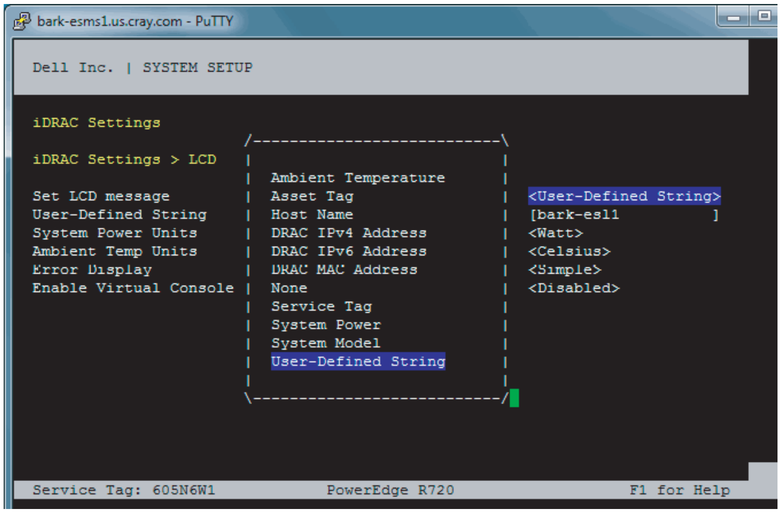
   a. On the **iDRAC Settings** screen, use the `down-arrow` key to scroll down and highlight **LCD** (or **Front Panel Security**), then press `Enter`.

b. Select **Set LCD message**. A pop-up window opens.

c. In the pop-up window, select **User-Defined String**, then press `Enter`.

d. Select **User-Defined String** (again), then press `Enter`. A text pop-up window opens for entering the new string. See Figure 55.

Figure 55. Dell 720 iDRAC BIOS LCD Settings



```
Dell Inc. | SYSTEM SETUP

iDRAC Settings
                           /---------------------------\
iDRAC Settings > LCD       |                           |
                           |  Ambient Temperature      |
Set LCD message            |  Asset Tag                |  <User-Defined String>
User-Defined String        |  Host Name                |  [bark-esl1          ]
System Power Units         |  DRAC IPv4 Address        |  <Watt>
Ambient Temp Units         |  DRAC IPv6 Address        |  <Celsius>
Error Display              |  DRAC MAC Address         |  <Simple>
Enable Virtual Console     |  None                     |  <Disabled>
                           |  Service Tag              |
                           |  System Power             |
                           |  System Model             |
                           |  User-Defined String      |
                           |                           |
                           \---------------------------/

Service Tag: 605N6W1             PowerEdge R720                 F1 for Help
```

e. In the text pop-up window, enter the CDL host name (such as `eslogin1`), then press `Enter`.

f. Press the `Escape` key to exit the LCD screen.

g. Press the `Escape` key to exit the Network screen.

h. Press the `Escape` key to exit the **iDRAC Settings** screen.

i. A "Settings have changed" message appears. Select **Yes**, then press `Enter` to save your changes.

j. A "Settings saved successfully" message appears. Select **OK**, then press `Enter`.

8. Change the device settings so that the CDL node can PXE boot on the CIMS administration network (`esmaint-net`).

   a. On the System Setup Main Menu, select **Device Settings**, then press `Enter`.

   b. In the **Device Settings** window, select **Integrated NIC 1 Port *N* ...**, then press `Enter`. The Main Configuration Page opens.

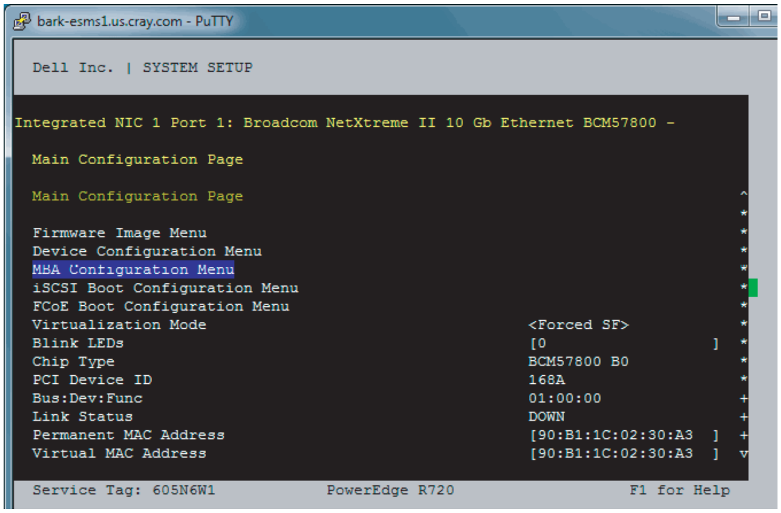
Tip: Choose the NIC port number that corresponds to the Ethernet port for the `esmaint-net` network.

- If `esmaint-net` uses the first Ethernet port (`eth0`), select **Integrated NIC 1 Port 1 ...**
- If `esmaint-net` uses the third Ethernet port (`eth2`), select **Integrated NIC 1 Port 3 ...**

Note: PXE booting must be disabled for the other three Ethernet ports.

c. On the Main Configuration Page screen, select **MBA Configuration Menu**, then press `Enter`. See Figure 56.

Figure 56. Dell 720 MBA Configuration Menu BIOS Settings

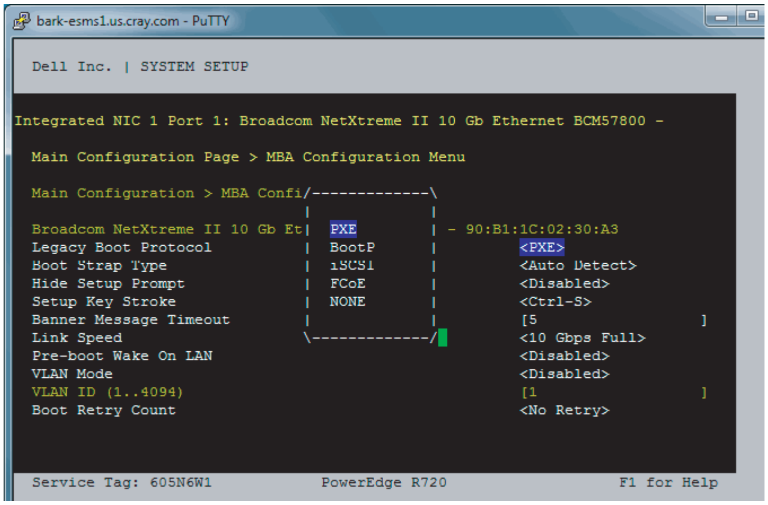


```
 Dell Inc. | SYSTEM SETUP

Integrated NIC 1 Port 1: Broadcom NetXtreme II 10 Gb Ethernet BCM57800 -

 Main Configuration Page

 Main Configuration Page                                                 ^
                                                                         *
 Firmware Image Menu                                                     *
 Device Configuration Menu                                               *
 MBA Configuration Menu                                                  *
 iSCSI Boot Configuration Menu                                           *
 FCoE Boot Configuration Menu                                            *
 Virtualization Mode                              <Forced SF>            *
 Blink LEDs                                       [0                 ]   *
 Chip Type                                        BCM57800 B0            *
 PCI Device ID                                    168A                   *
 Bus:Dev:Func                                     01:00:00               +
 Link Status                                      DOWN                   +
 Permanent MAC Address                            [90:B1:1C:02:30:A3  ]  +
 Virtual MAC Address                              [90:B1:1C:02:30:A3  ]  v

 Service Tag: 605N6W1          PowerEdge R720                 F1 for Help
```

d. On the MBA Configuration Menu screen, select **Legacy Boot Protocol**, then press `Enter`. A pop-up window displays the available options.

e. In the pop-up window, use the `down-arrow` key to highlight **PXE**, then press `Enter`. See Figure 57.

Figure 57. Dell 720 Legacy Boot Protocol BIOS Settings



```
 Dell Inc. | SYSTEM SETUP

Integrated NIC 1 Port 1: Broadcom NetXtreme II 10 Gb Ethernet BCM57800 -

 Main Configuration Page > MBA Configuration Menu

 Main Configuration > MBA Confi/-------------\
                               |             |
 Broadcom NetXtreme II 10 Gb Et|  PXE        | - 90:B1:1C:02:30:A3
 Legacy Boot Protocol          |  BootP      |          <PXE>
 Boot Strap Type               |  iSCSI      |          <Auto Detect>
 Hide Setup Prompt             |  FCoE       |          <Disabled>
 Setup Key Stroke              |  NONE       |          <Ctrl-S>
 Banner Message Timeout        |             |          [5             ]
 Link Speed                    \-------------/          <10 Gbps Full>
 Pre-boot Wake On LAN                                   <Disabled>
 VLAN Mode                                              <Disabled>
 VLAN ID (1..4094)                                      [1             ]
 Boot Retry Count                                       <No Retry>


 Service Tag: 605N6W1         PowerEdge R720                  F1 for Help
```

f. Press the `Escape` key to exit the MBA Configuration Menu screen.

g. Press the `Escape` key to exit the Main Configuration Page screen.

h. Verify that **Legacy Boot Protocol** is set to **None** for the other three Ethernet ports. If necessary, repeat step 8.b through step 8.g to change the setting for these three ports.

i. Press the `Escape` key to exit the **Device Settings** screen.

j. A "Settings have changed" message appears. Select **Yes**, then press `Enter` to save your changes.

k. A "Settings saved successfully" message appears. Select **OK**, then press `Enter`. The main screen (System Setup Main Menu) appears.

9. Save your changes and exit.

   a. Press `Escape` to exit the System Setup Main Menu.

   b. The utility displays the prompt "Are you sure you want to exit and reboot?" Select **Yes**.

Next, you will use Bright on the CIMS to create an CDL node.

Changing BIOS for a DELL™ R815 Managed CDL Node [B]

Before configuring a managed CDL node with Bright Cluster Manager® (Bright), you must change the BIOS and Dell remote access controller (iDRAC) settings. The following configuration is required for each CDL node.

- A CDL node must be cabled to both the CIMS administration network (`esmaint-net`) and IPMI network (`ipmi-net`).
- A CDL node using a workload manager such as TORQUE or Moab®, must be cabled directly to the SDB on the Cray system over the `wlm-net`.
- A CDL node must be configured to provide IPMI Serial Over LAN (SOL) for remote console support.
- A CDL node must be configured to PXE boot from the CIMS (embedded NIC) before attempting to boot from the local disk.

Use the following procedure to change the BIOS and iDRAC settings for a CDL node.

Procedure 84. Changing a R815 slave node's BIOS and iDRAC settings

Note: This procedure shows specific steps for a Dell R815 system. See Procedure 83 for Dell R720 BIOS set up procedure.

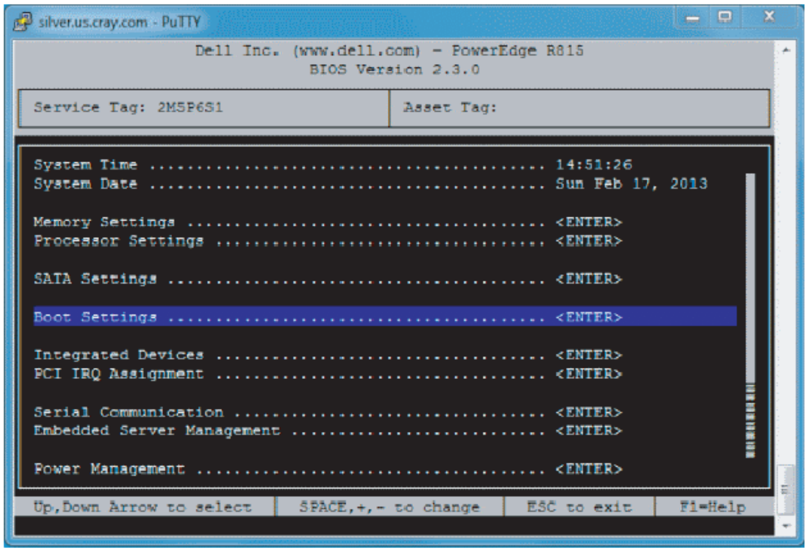
1. Power up the slave node. When the BIOS power-on self-test (POST) process begins, **quickly press the `F2` key** after the following messages appear in the upper-right of the screen.

   ```
         F2 = System Setup
     F10 = System Services
   F11 = BIOS Boot Manager
            F12 = PXE Boot
   ```

   When the `F2` keypress is recognized, the `F2 = System Setup` line changes to `Entering System Setup`.

2. Select **Boot Settings**, then press `Enter`.

Figure 58. Dell 815 Boot Settings Menu

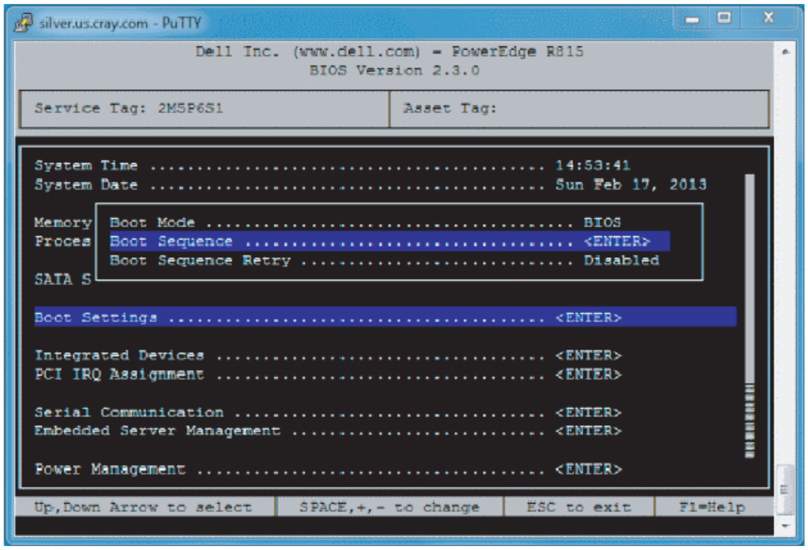


```
                Dell Inc. (www.dell.com) - PowerEdge R815
                         BIOS Version 2.3.0

Service Tag: 2MSP6S1                  Asset Tag:

System Time ........................................ 14:51:26
System Date ........................................ Sun Feb 17, 2013

Memory Settings .................................... <ENTER>
Processor Settings ................................. <ENTER>

SATA Settings ...................................... <ENTER>

Boot Settings ...................................... <ENTER>

Integrated Devices ................................. <ENTER>
PCI IRQ Assignment ................................. <ENTER>

Serial Communication ............................... <ENTER>
Embedded Server Management ......................... <ENTER>

Power Management ................................... <ENTER>
Up,Down Arrow to select | SPACE,+,- to change | ESC to exit | F1=Help
```

a. Select **Boot Sequence**, then press `Enter` to view the boot settings.

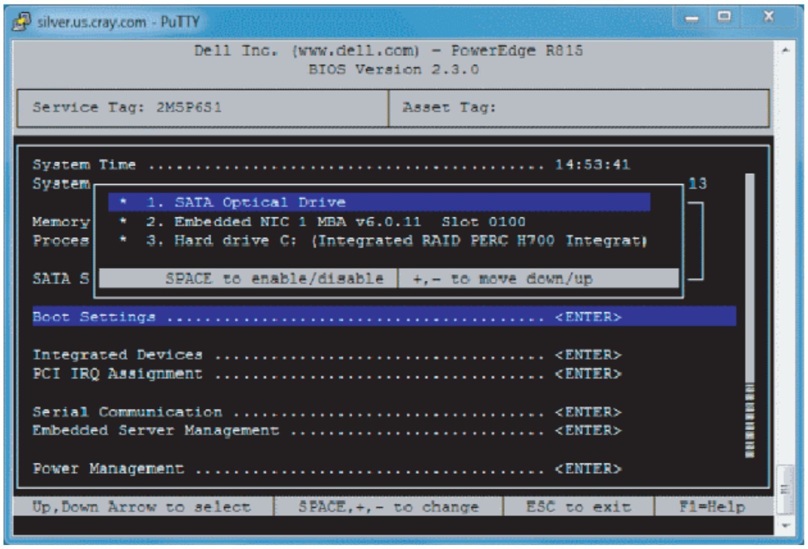
b. In the pop-up window, change the boot order so that the integrated NIC appears first, before the optical (DVD) drive. The hard drive should be last on the list.

Figure 59. Dell 815 Boot Sequence Menu



```
                Dell Inc. (www.dell.com) - PowerEdge R815
                         BIOS Version 2.3.0

Service Tag: 2MSP6S1                  Asset Tag:

System Time ........................................ 14:53:41
System Date ........................................ Sun Feb 17, 2013

Memory| Boot Mode ...................................... BIOS
Proces| Boot Sequence .................................. <ENTER>
      | Boot Sequence Retry ............................ Disabled
SATA S

Boot Settings ...................................... <ENTER>

Integrated Devices ................................. <ENTER>
PCI IRQ Assignment ................................. <ENTER>

Serial Communication ............................... <ENTER>
Embedded Server Management ......................... <ENTER>

Power Management ................................... <ENTER>
Up,Down Arrow to select | SPACE,+,- to change | ESC to exit | F1=Help
```

Figure 60. Dell 815 Boot Sequence Settings

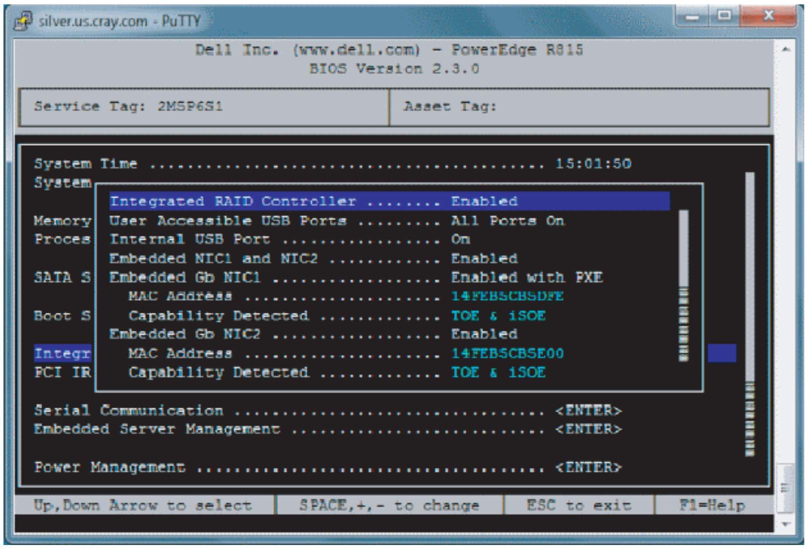


```
                     Dell Inc. (www.dell.com) - PowerEdge R815
                               BIOS Version 2.3.0

 Service Tag: 2MSP6S1                          Asset Tag:

 System Time ......................................... 14:53:41
 System                                                             13
          *  1. SATA Optical Drive
 Memory   *  2. Embedded NIC 1 MBA v6.0.11  Slot 0100
 Proces   *  3. Hard drive C: (Integrated RAID PERC H700 Integrat)

 SATA S      SPACE to enable/disable   +,- to move down/up

 Boot Settings ....................................... <ENTER>

 Integrated Devices .................................. <ENTER>
 PCI IRQ Assignment .................................. <ENTER>

 Serial Communication ................................ <ENTER>
 Embedded Server Management .......................... <ENTER>

 Power Management .................................... <ENTER>
 Up,Down Arrow to select | SPACE,+,- to change | ESC to exit | F1=Help
```

c. Press `Enter` to return to the **BIOS Boot Settings** screen.

3. Press `Esc` to return to the System Setup Menu, scroll down and select **Integrated Devices**.

Figure 61. Dell 815 Integrated Devices (NIC) Settings



```
                     Dell Inc. (www.dell.com) - PowerEdge R815
                               BIOS Version 2.3.0

 Service Tag: 2MSP6S1                          Asset Tag:

 System Time ......................................... 15:01:50
 System
         Integrated RAID Controller ........ Enabled
 Memory  User Accessible USB Ports ......... All Ports On
 Proces  Internal USB Port ................. On
         Embedded NIC1 and NIC2 ............ Enabled
 SATA S  Embedded Gb NIC1 .................. Enabled with PXE
           MAC Address ..................... 14FEB5CB5DFE
 Boot S    Capability Detected ............. TOE & iSOE
         Embedded Gb NIC2 .................. Enabled
 Integr    MAC Address ..................... 14FEB5CB5E00
 PCI IR    Capability Detected ............. TOE & iSOE

 Serial Communication ................................ <ENTER>
 Embedded Server Management .......................... <ENTER>

 Power Management .................................... <ENTER>
 Up,Down Arrow to select | SPACE,+,- to change | ESC to exit | F1=Help
```

a. Set **Embedded NIC 1** to **Enabled with PXE**.

b. Set **Embedded Gb NIC 2** to **Enabled**.

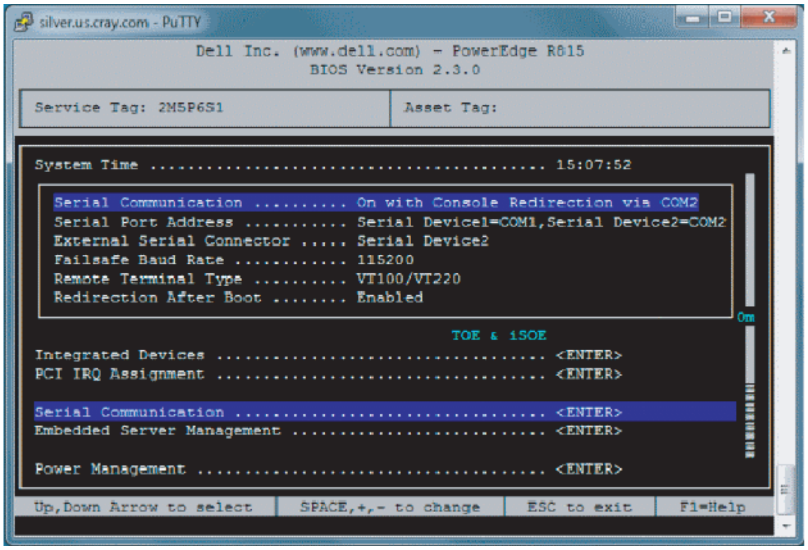
c. Scroll down and set **Embedded NIC 3** to **Enabled**.

d. Set **Embedded Gb NIC 4** to **Enabled**.

e. Press `Esc` to return to the System Settings Menu.

4. Change the serial communication settings.

Figure 62. Dell 815 Serial Communication BIOS Settings



```
                 Dell Inc. (www.dell.com) - PowerEdge R815
                            BIOS Version 2.3.0

 Service Tag: 2M5P6S1                 Asset Tag:

 System Time ....................................... 15:07:52

   Serial Communication .......... On with Console Redirection via COM2
   Serial Port Address ........... Serial Device1=COM1,Serial Device2=COM2
   External Serial Connector ..... Serial Device2
   Failsafe Baud Rate ............ 115200
   Remote Terminal Type .......... VT100/VT220
   Redirection After Boot ........ Enabled

                                      TOE & iSOE
 Integrated Devices ................................ <ENTER>
 PCI IRQ Assignment ................................ <ENTER>

 Serial Communication .............................. <ENTER>
 Embedded Server Management ........................ <ENTER>

 Power Management .................................. <ENTER>
 Up,Down Arrow to select | SPACE,+,- to change | ESC to exit | F1=Help
```

a. Select **Serial Communication**.

b. Select **Serial Communication** and set it to **On** with **Console Redirection via COM2**.

c. Select **Serial Port Address** and set it to **Serial Device=COM1**, **Serial Device2=COM2**.

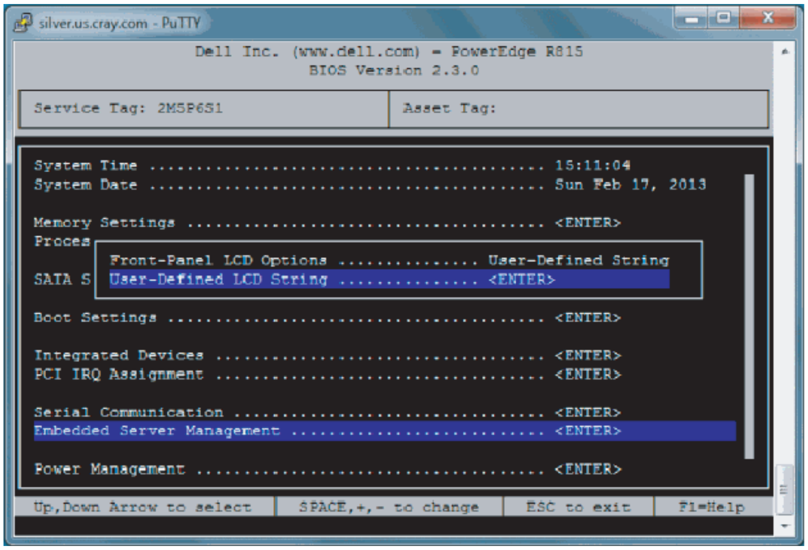
d. Set **External Serial Connector**, and set it to **Remote Access Device**.

e. Set **Failsafe Baud Rate** to **115200**.

f. Press `Esc` to return to the **System Setup Menu**.

5. Select **Embedded Server Management**.

Figure 63. Dell 815 Embedded Server Management Settings

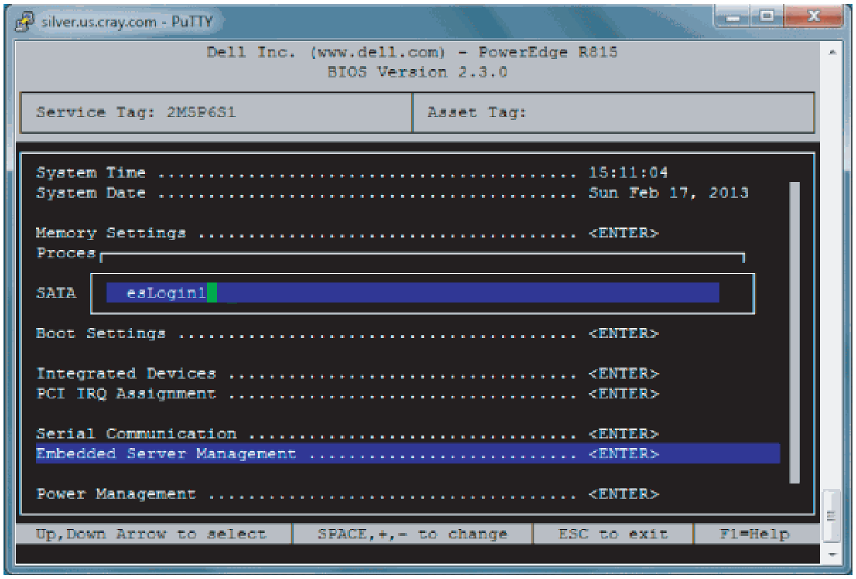


```
                  Dell Inc. (www.dell.com) - PowerEdge R815
                            BIOS Version 2.3.0

 Service Tag: 2M5P6S1                     Asset Tag:

 System Time ..................................... 15:11:04
 System Date ..................................... Sun Feb 17, 2013

 Memory Settings ................................. <ENTER>
 Proces
         Front-Panel LCD Options .............. User-Defined String
 SATA S  User-Defined LCD String .............. <ENTER>

 Boot Settings ................................... <ENTER>

 Integrated Devices .............................. <ENTER>
 PCI IRQ Assignment .............................. <ENTER>

 Serial Communication ............................ <ENTER>
 Embedded Server Management ...................... <ENTER>

 Power Management ................................ <ENTER>
 Up,Down Arrow to select | SPACE,+,- to change | ESC to exit | F1=Help
```

a. Set **Front-Panel LCD Options** to **User-Defined LCD String**.

b. Set **User-Defined LCD String** to your login host name, such as `eslogin1`.

Figure 64. Dell 815 User-defined LCD String Settings



```
                  Dell Inc. (www.dell.com) - PowerEdge R815
                            BIOS Version 2.3.0

 Service Tag: 2M5P6S1                     Asset Tag:

 System Time ..................................... 15:11:04
 System Date ..................................... Sun Feb 17, 2013

 Memory Settings ................................. <ENTER>
 Proces

 SATA      esLogin1

 Boot Settings ................................... <ENTER>

 Integrated Devices .............................. <ENTER>
 PCI IRQ Assignment .............................. <ENTER>

 Serial Communication ............................ <ENTER>
 Embedded Server Management ...................... <ENTER>

 Power Management ................................ <ENTER>
 Up,Down Arrow to select | SPACE,+,- to change | ESC to exit | F1=Help
```

6. Save your changes and exit.

   a. Press `Escape` to exit the System Setup Main Menu.

   b. The utility displays the prompt "Are you sure you want to exit and reboot?" Select **Yes**.

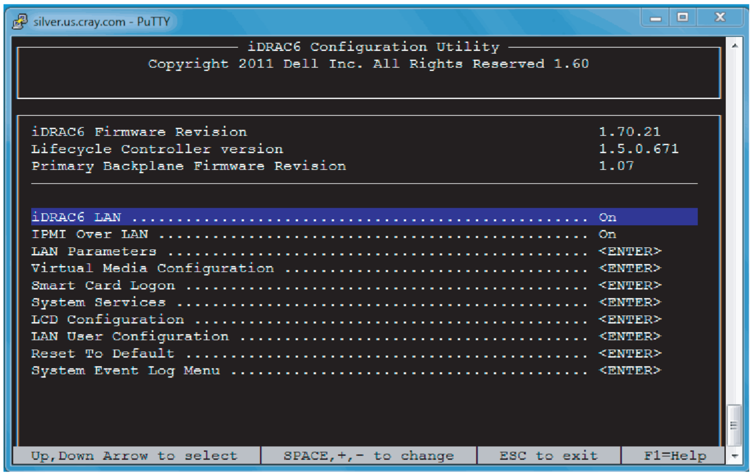
7. When the system reboots, press `Ctrl-E` to configure the iDRAC port settings.

```
www.dell.com

iDRAC6 Configuration Utility 1.60
Copyright 2011 Dell Inc. All Rights Reserved
Four 2.10 GHz Twelve-core Processors, L2/L3 Cache: 6 MB/10 MB
iDRAC6 FirmwareaRevisionHversion: 1.70.21
.
.
.'
 IPv4 Stack      : Enabled
 IP Address      :  10.148. 0 . 2
 Subnet mask     : 255.255. 0 . 0
 Default Gateway :  0 . 0 . 0 . 0
Press <Ctrl-E> for Remote Access Setup within 5 sec......
```

   a. Set the **iDRAC6 LAN** to **ON**.

   b. Set **IPMI Over LAN** to **ON**.

Figure 65. Dell 815 DRAC LAN Parameters Settings

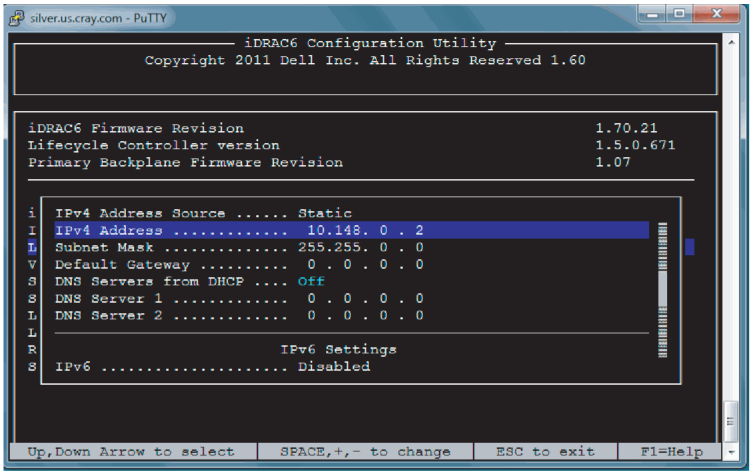


```
iDRAC6 Configuration Utility
Copyright 2011 Dell Inc. All Rights Reserved 1.60

iDRAC6 Firmware Revision                                 1.70.21
Lifecycle Controller version                             1.5.0.671
Primary Backplane Firmware Revision                      1.07

iDRAC6 LAN ............................................. On
IPMI Over LAN .......................................... On
LAN Parameters ......................................... <ENTER>
Virtual Media Configuration ............................ <ENTER>
Smart Card Logon ....................................... <ENTER>
System Services ........................................ <ENTER>
LCD Configuration ...................................... <ENTER>
LAN User Configuration ................................. <ENTER>
Reset To Default ....................................... <ENTER>
System Event Log Menu .................................. <ENTER>

Up,Down Arrow to select | SPACE,+,- to change | ESC to exit | F1=Help
```

   c. Select **LAN Parameters** and press `Enter`. Set the IPv4 address to next available IP address on the `esmaint-net` network (10.148.0.x).

   d. Press `Esc` to return to the iDRAC6 menu, and `Esc` to exit and save.

Figure 66. Dell 815 DRAC IPv4 Parameter Settings



```
                    iDRAC6 Configuration Utility
          Copyright 2011 Dell Inc. All Rights Reserved 1.60

iDRAC6 Firmware Revision                                  1.70.21
Lifecycle Controller version                              1.5.0.671
Primary Backplane Firmware Revision                       1.07

i  IPv4 Address Source ...... Static
I  IPv4 Address .............  10.148. 0 . 2
L  Subnet Mask .............. 255.255. 0 . 0
V  Default Gateway ..........  0 . 0 . 0 . 0
S  DNS Servers from DHCP .... Off
S  DNS Server 1 .............  0 . 0 . 0 . 0
L  DNS Server 2 .............  0 . 0 . 0 . 0
L
R                           IPv6 Settings
S  IPv6 ..................... Disabled

Up,Down Arrow to select | SPACE,+,- to change | ESC to exit | F1=Help
```

Changing BIOS for a DELL™ R720 Managed CLFS Node [C]

Before you can configure a managed CLFS node with Bright Cluster Manager® (Bright), you must change the BIOS and Dell remote access controller (iDRAC) settings. The following configuration is required for each CLFS node.

- A CLFS node must be cabled to both the CIMS administration network (`esmaint-net`) and IPMI network (`ipmi-net`).
- A CLFS node using a workload manager such as TORQUE or Moab®, must be cabled directly to the SDB on the Cray system over the `wlm-net`.
- A CLFS node must be configured to provide IPMI Serial Over LAN (SOL) for remote console support.
- Processor hyper-threading (the "Logical Processor" setting) must be disabled on CLFS nodes.

Use the following procedure to change the BIOS and iDRAC settings for a CLFS node.

Procedure 85. Changing a R720 CLFS node's BIOS and iDRAC settings

Note: This procedure shows specific steps for a Dell 720 system.

1. Power up the slave node. When the BIOS power-on self-test (POST) process begins, **quickly press the `F2` key** after the following messages appear in the upper-right of the screen.

```
        F2 = System Setup
    F10 = System Services
  F11 = BIOS Boot Manager
           F12 = PXE Boot
```

   When the `F2` keypress is recognized, the `F2 = System Setup` line changes to `Entering System Setup`.

After the POST process completes and all disk and network controllers have been initialized, the **Dell System Setup** screen appears. The following submenus are available:

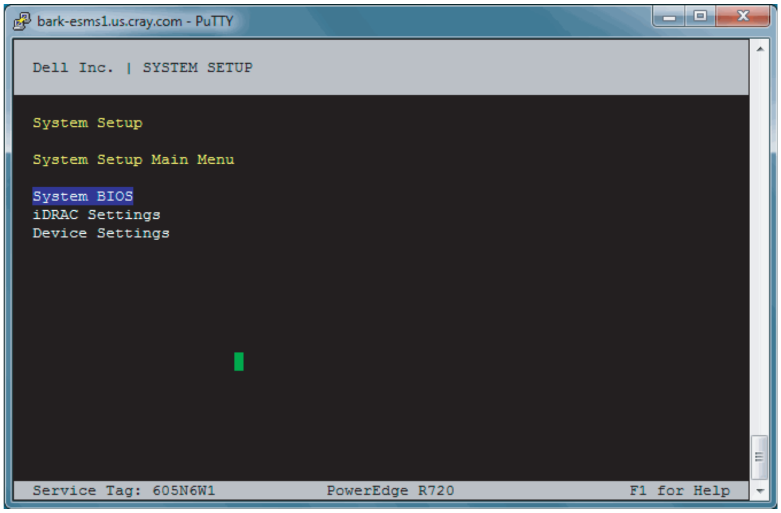
```
System BIOS
iDRAC Settings
Device Settings
```

> **Note:** In this utility, use the `Tab` key to move to different areas on the screen. To select an item, use the `up-arrow` and `down-arrow` keys to highlight the item, then press the `Enter` key. Press the `Escape` key to exit a submenu and return to the previous screen.

2. Change the system BIOS settings.

   a. Select **System BIOS**, then press `Enter`. See Figure 67.

   Figure 67. Dell 720 System BIOS Settings



bark-esms1.us.cray.com - PuTTY

```
Dell Inc. | SYSTEM SETUP

System Setup

System Setup Main Menu

System BIOS
iDRAC Settings
Device Settings

Service Tag: 605N6W1            PowerEdge R720            F1 for Help
```

   b. Select **Boot Settings**, then press `Enter`.

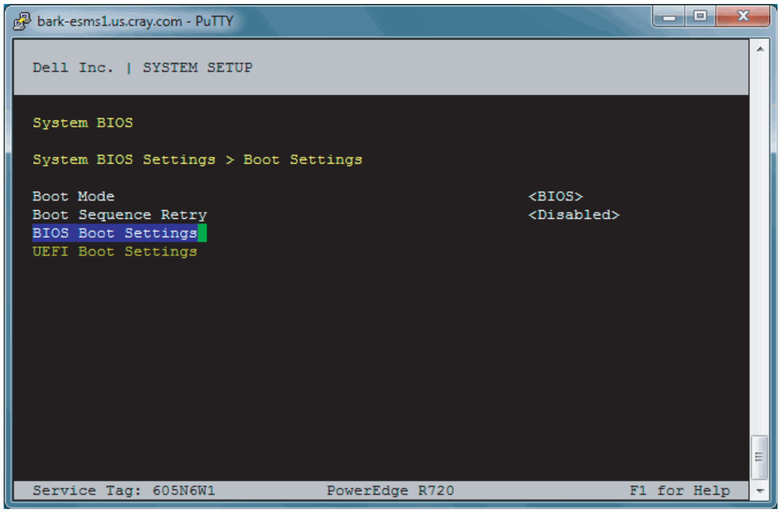
   c. Select **BIOS Boot Settings**, then press `Enter`.

   d. Select **Boot Sequence**, then press `Enter` to view the boot settings.

   e. In the pop-up window, change the boot order so that the integrated NIC appears first, before the optical (DVD) drive. The hard drive should be last on the list. See Figure 68.

   > **Tip:** Use the `up-arrow` or `down-arrow` key to highlight an item, then use the `+` and `-` keys to move the item up or down.

Figure 68. Dell 720 Boot Sequence BIOS Settings



```
Dell Inc. | SYSTEM SETUP

System BIOS

System BIOS Settings > Boot Settings

Boot Mode                                                    <BIOS>
Boot Sequence Retry                                          <Disabled>
BIOS Boot Settings
UEFI Boot Settings

Service Tag: 605N6W1          PowerEdge R720                 F1 for Help
```

f. Be sure that **Hard Drive C:** is enabled under the **Boot Option Enable/Disable** section.

g. Press `Enter` to return to the **BIOS Boot Settings** screen.

h. Press `Escape` to exit **BIOS Boot Settings**.

i. Press `Escape` to exit **Boot Settings** and return to the **System BIOS Settings** screen.

3. On the **System BIOS Settings** screen, select **Processor Settings** and press `Enter`.

   a. Select **Logical Processor**, and press enter. Verify that **Logical Processor** is set to **Disabled**.

   b. Press `Escape` to exit **Processor Settings**.

4. Change the serial communication settings.

   a. On the **System BIOS Settings** screen, select **Serial Communication**.

   b. On the **Serial Communication** screen, select **Serial Communication**. A pop-up window displays the available options.

   c. Select **On with Console Redirection via COM2**, then press `Enter`.

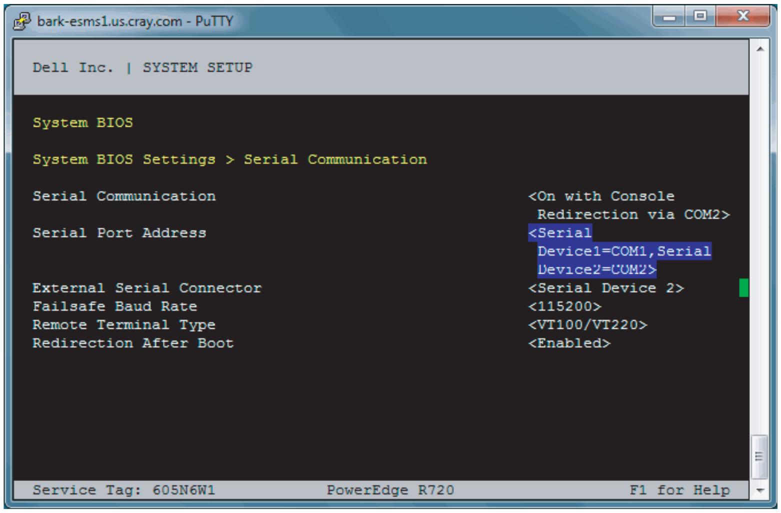
   d. Verify that **Serial Port Address** is set to **Serial Device1=COM1, Serial Device2=COM2**.

   Note: This setting enables the remote console. If this setting is incorrect, you cannot use a remote console to access the CLFS node.

   1) If necessary, press `Enter` to display the available options.

2) Change the setting to **Serial Device1=COM1, Serial Device2=COM2**. See Figure 69.

Figure 69. Dell 720 Serial Device BIOS Settings



```
bark-esms1.us.cray.com - PuTTY

Dell Inc. | SYSTEM SETUP

System BIOS

System BIOS Settings > Serial Communication

Serial Communication                                   <On with Console
                                                        Redirection via COM2>
Serial Port Address                                    <Serial
                                                        Device1=COM1,Serial
                                                        Device2=COM2>
External Serial Connector                              <Serial Device 2>
Failsafe Baud Rate                                     <115200>
Remote Terminal Type                                   <VT100/VT220>
Redirection After Boot                                 <Enabled>

Service Tag: 605N6W1            PowerEdge R720                 F1 for Help
```

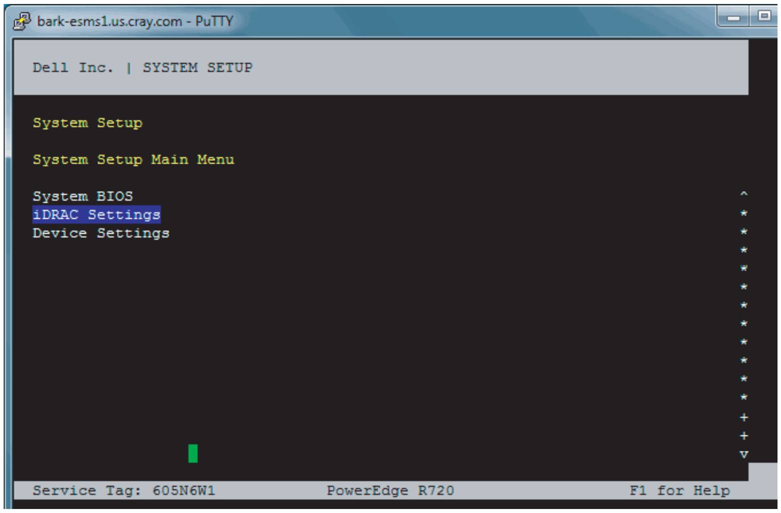
3) Press `Enter` to return to the **Serial Communication** screen.

e. Select **External Serial Connector**. A pop-up window displays the available options.

f. In the pop-up window, select **Remote Access Device**, then press `Enter` to return to the previous screen.

g. Select **Failsafe Baud Rate**. A pop-up window displays the available options.

Figure 70. Dell 720 Serial Communication BIOS Settings



```
bark-esms1.us.cray.com - PuTTY

Dell Inc. | SYSTEM SETUP

System Setup

System Setup Main Menu

System BIOS
iDRAC Settings
Device Settings

Service Tag: 605N6W1            PowerEdge R720                 F1 for Help
```

h. In the pop-up window, select **115200**, then press `Enter` to return to the previous screen.

i. Press the `Escape` key to exit the **Serial Communication** screen.

j. Press the `Escape` key to exit the **System BIOS Settings** screen.

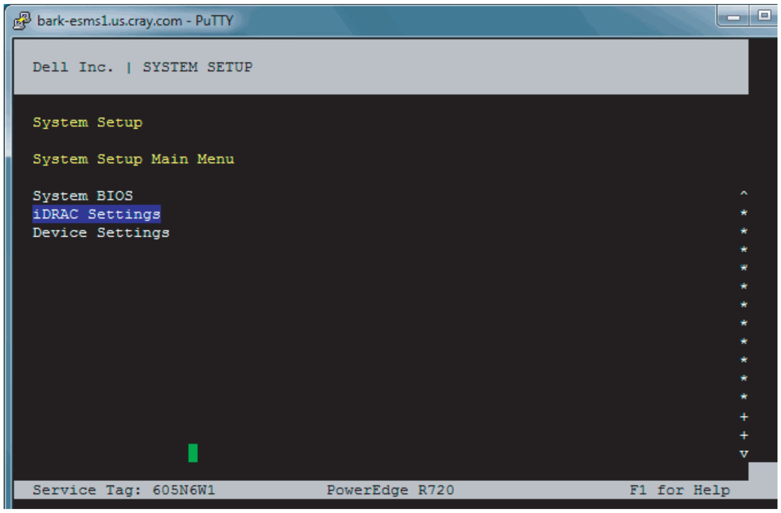
k. Press the `Escape` key to exit the **BIOS Settings** screen.

l. A "Settings have changed" message appears. Select **Yes** to save your changes.

m. A "Settings saved successfully" message appears. Select **OK**.

5. On the System Setup Main Menu, select **iDRAC Settings**, then press `Enter`. See Figure 71.

Figure 71. Dell 720 iDRAC BIOS Settings



```
Dell Inc. | SYSTEM SETUP

System Setup

System Setup Main Menu

System BIOS
iDRAC Settings
Device Settings

Service Tag: 605N6W1          PowerEdge R720          F1 for Help
```

6. Select **Network**, then press `Enter`. A long list of network settings is displayed.

7. Change the IPMI settings to enable the Serial Over LAN (SOL) console.

   a. Use the `down-arrow` key to scroll to the **IPMI SETTINGS** list.

   b. Ensure that **IPMI over LAN** is enabled.

      1) If necessary, select **IPMI over LAN**, then press `Enter`.

      2) In the pop-up window, select **<Enabled>**.

      3) Press `Enter` to return to the previous screen.

   c. Press the `Escape` key to exit the Network screen and return to the **iDRAC Settings** menu.

8. Change the LCD configuration to show the host name in the LCD display.

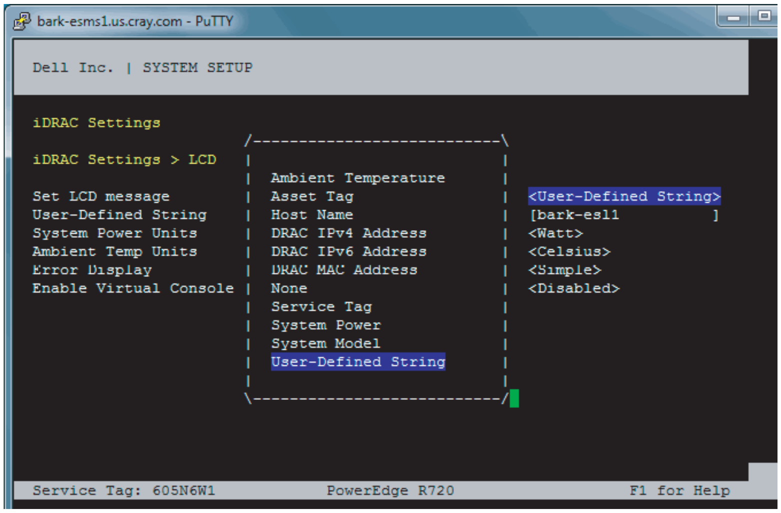
a. On the **iDRAC Settings** screen, use the `down-arrow` key to highlight **LCD**, then press `Enter`.

b. Select **Set LCD message**. A pop-up window opens.

c. In the pop-up window, select **User-Defined String**, then press `Enter`.

d. Select **User-Defined String** (again), then press `Enter`. A text pop-up window opens for entering the new string. See Figure 72.

Figure 72. Dell 720 iDRAC BIOS LCD Settings



```
Dell Inc. | SYSTEM SETUP

iDRAC Settings
                       /---------------------------\
iDRAC Settings > LCD   |                           |
                       |  Ambient Temperature      |
Set LCD message        |  Asset Tag                |  <User-Defined String>
User-Defined String    |  Host Name                |  [bark-esl1           ]
System Power Units     |  DRAC IPv4 Address        |  <Watt>
Ambient Temp Units     |  DRAC IPv6 Address        |  <Celsius>
Error Display          |  DRAC MAC Address         |  <Simple>
Enable Virtual Console |  None                     |  <Disabled>
                       |  Service Tag              |
                       |  System Power             |
                       |  System Model             |
                       |  User-Defined String      |
                       |                           |
                       \---------------------------/


Service Tag: 605N6W1            PowerEdge R720                  F1 for Help
```

e. In the text pop-up window, enter the CLFS host name (such as `esfs-mds001`), then press `Enter`.

f. Press the `Escape` key to exit the LCD screen.

g. Press the `Escape` key to exit the Network screen.

h. Press the `Escape` key to exit the **iDRAC Settings** screen.

i. A "Settings have changed" message appears. Select **Yes**, then press `Enter` to save your changes.

j. A "Settings saved successfully" message appears. Select **OK**, then press `Enter`.

9. Change the device settings so that the CLFS node can PXE boot on the CIMS administration network (`esmaint-net`).

   a. On the System Setup Main Menu, select **Device Settings**, then press `Enter`.

   b. In the **Device Settings** window, select **Integrated NIC 1 Port *N* ...**, then press `Enter`. The Main Configuration Page opens.

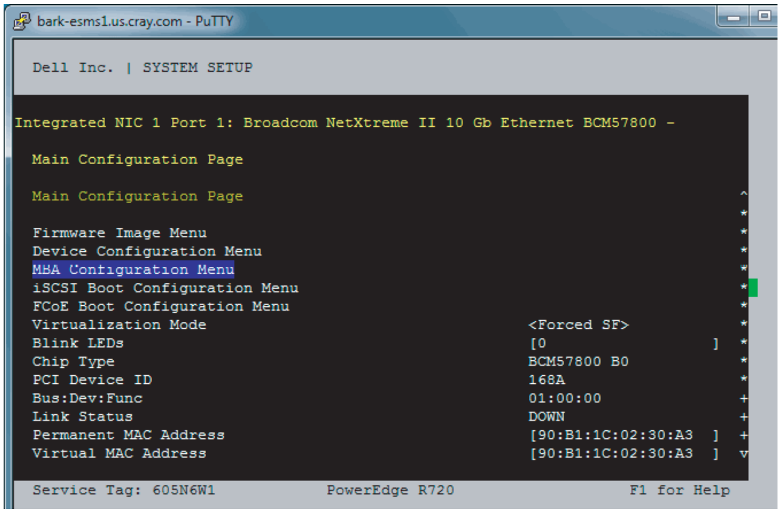
Tip: Choose the NIC port number that corresponds to the Ethernet port for the `esmaint-net` network.

- If `esmaint-net` uses the first Ethernet port (`eth0`), select **Integrated NIC 1 Port 1 ....**
- If `esmaint-net` uses the third Ethernet port (`eth2`), select **Integrated NIC 1 Port 3 ....**

Note: PXE booting must be disabled for the other three Ethernet ports.

c. On the Main Configuration Page screen, select **MBA Configuration Menu**, then press `Enter`. See Figure 73.

Figure 73. Dell 720 MBA Configuration Menu BIOS Settings

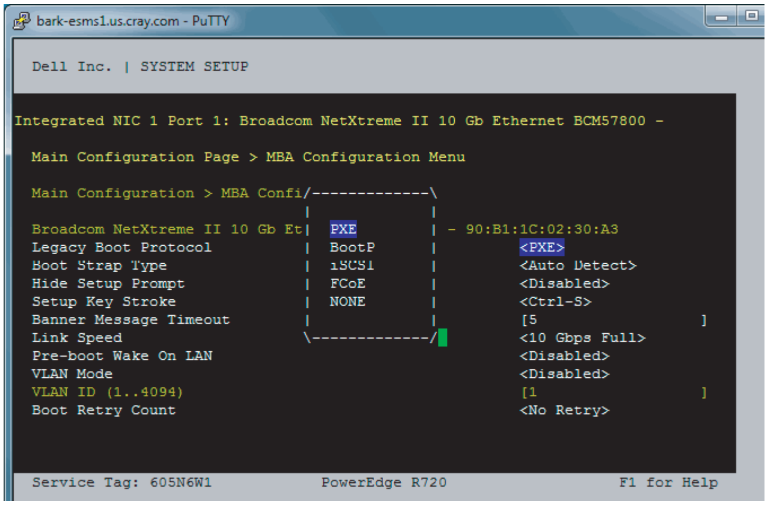


```
  Dell Inc. | SYSTEM SETUP

Integrated NIC 1 Port 1: Broadcom NetXtreme II 10 Gb Ethernet BCM57800 -

  Main Configuration Page

  Main Configuration Page                                                       ^
                                                                                *
  Firmware Image Menu                                                           *
  Device Configuration Menu                                                     *
  MBA Configuration Menu                                                        *
  iSCSI Boot Configuration Menu                                                 *
  FCoE Boot Configuration Menu                                                  *
  Virtualization Mode                                    <Forced SF>            *
  Blink LEDs                                             [0                  ]  *
  Chip Type                                              BCM57800 B0            *
  PCI Device ID                                          168A                   *
  Bus:Dev:Func                                           01:00:00               +
  Link Status                                            DOWN                   +
  Permanent MAC Address                                  [90:B1:1C:02:30:A3  ]  +
  Virtual MAC Address                                    [90:B1:1C:02:30:A3  ]  v

  Service Tag: 605N6W1            PowerEdge R720                    F1 for Help
```

d. On the MBA Configuration Menu screen, select **Legacy Boot Protocol**, then press `Enter`. A pop-up window displays the available options.

e. In the pop-up window, use the `down-arrow` key to highlight **PXE**, then press `Enter`. See Figure 74.

Figure 74. Dell 720 Legacy Boot Protocol BIOS Settings



```
  Dell Inc. | SYSTEM SETUP

Integrated NIC 1 Port 1: Broadcom NetXtreme II 10 Gb Ethernet BCM57800 -

  Main Configuration Page > MBA Configuration Menu

  Main Configuration > MBA Confi/-------------\
                                |             |
  Broadcom NetXtreme II 10 Gb Et|  PXE        | - 90:B1:1C:02:30:A3
  Legacy Boot Protocol          |  BootP      |         <PXE>
  Boot Strap Type               |  iSCSI      |         <Auto Detect>
  Hide Setup Prompt             |  FCoE       |         <Disabled>
  Setup Key Stroke              |  NONE       |         <Ctrl-S>
  Banner Message Timeout        |             |         [5                  ]
  Link Speed                    \-------------/         <10 Gbps Full>
  Pre-boot Wake On LAN                                  <Disabled>
  VLAN Mode                                             <Disabled>
  VLAN ID (1..4094)                                     [1                  ]
  Boot Retry Count                                      <No Retry>


  Service Tag: 605N6W1            PowerEdge R720                   F1 for Help
```

f. Press the `Escape` key to exit the MBA Configuration Menu screen.

g. Press the `Escape` key to exit the Main Configuration Page screen.

h. Verify that **Legacy Boot Protocol** is set to **None** for the other three Ethernet ports. If necessary, repeat step 9.b through step 9.g to change the setting for these three ports.

i. Press the `Escape` key to exit the **Device Settings** screen.

j. A "Settings have changed" message appears. Select **Yes**, then press `Enter` to save your changes.

k. A "Settings saved successfully" message appears. Select **OK**, then press `Enter`. The main screen (System Setup Main Menu) appears.

10. Save your changes and exit.

a. Press `Escape` to exit the System Setup Main Menu.

b. The utility displays the prompt "Are you sure you want to exit and reboot?" Select **Yes**.

Next, you will use Bright on the CIMS to create a CLFS node.