

Dell OpenManage™  
Baseboard Management  
Controller Utilities  
**User's Guide**

# Notes and Notices



**NOTE:** A NOTE indicates important information that helps you make better use of your computer.



**NOTICE:** A NOTICE indicates either potential damage to hardware or loss of data and tells you how to avoid the problem.

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# Introduction

The Dell™ PowerEdge™ systems' baseboard management controller (BMC) monitors the system for critical events by communicating with various sensors on the system board and sends alerts and logs events when certain parameters exceed their preset thresholds. The BMC supports the industry-standard Intelligent Platform Management Interface (IPMI) specification, enabling you to configure, monitor, and recover systems remotely. The BMC provides the following features:

- Access through the system's serial port and integrated NIC
- Fault logging and SNMP alerting
- Access to the system event log (SEL) and sensor status
- Control of system functions including power on and power off
- Support that is independent of the system's power or operating state
- Text console redirection for system setup, text-based utilities, and operating system consoles
- Access to Linux Enterprise server serial console interfaces by using Serial over LAN (SOL).

Dell provides several distinct utilities and programs for accessing the BMC to perform management activities. The following BMC interfaces allow you to configure and manage your system through the BMC:

- The BMC Management Utility allows remote, out-of-band LAN and/or serial port power control, event log access, and console redirection.
- The Remote Access Configuration Utility enables configuring BMC in a pre-operating system environment.
- The Dell OpenManage™ Deployment Toolkit Version 2.1 SYSCFG.EXE utility provides a powerful command line configuration tool.
- Dell OpenManage Server Administrator allows remote, in-band access to event logs, power control, and sensor status information and provides the ability to configure the BMC.
- Command Line Interface (CLI) tools provide a command line tool for sensor status information, System Event Log (SEL) access, and power control.

Additionally, the BMC can be accessed by standard, off-the-shelf terminal or terminal emulator utilities that allow access to sensor status information and power control.

## What's New in BMC Management Utility 2.0

The BMC Management Utility (BMU) 2.0 has the following new features:

- Interactive mode for the IPMI Shell.
- New commands for IPMI Shell and SOL Proxy to connect to remote BMC and display sensor status.
- Choice of menu and command mode in SOL Proxy.
- Support for the following baud rate for BMC serial communication and SOL:
  - 19200 for PowerEdge 1425SC and other PowerEdge x8xx systems.
  - 57600 for PowerEdge x9xx systems without Dell Remote Access Controller (DRAC) 5.
  - 57600 and 115200 for PowerEdge x9xx systems with DRAC 5.
- SOL activation through IPMI Shell interactive mode.
- Configuration of each SOL proxy server for up to 20 simultaneous SOL sessions.
- Support for SUSE® Linux Enterprise Server.

## Supported Systems

The BMC management features documented in this guide are supported on the following Dell PowerEdge systems:

- 800
- 830
- 850
- 1425SC
- 1800
- 1850
- 1855
- 1900
- 1950
- 1955
- 2800
- 2850
- 2900
- 2950
- 6800
- 6850



# BMC Configuration and Management Tasks

The following sections document the basic tasks needed to set up and configure the BMC on a managed system in preparation for using the BMC Management Utility. These basic tasks are:

- Configuring the BMC
- Managing the BMC

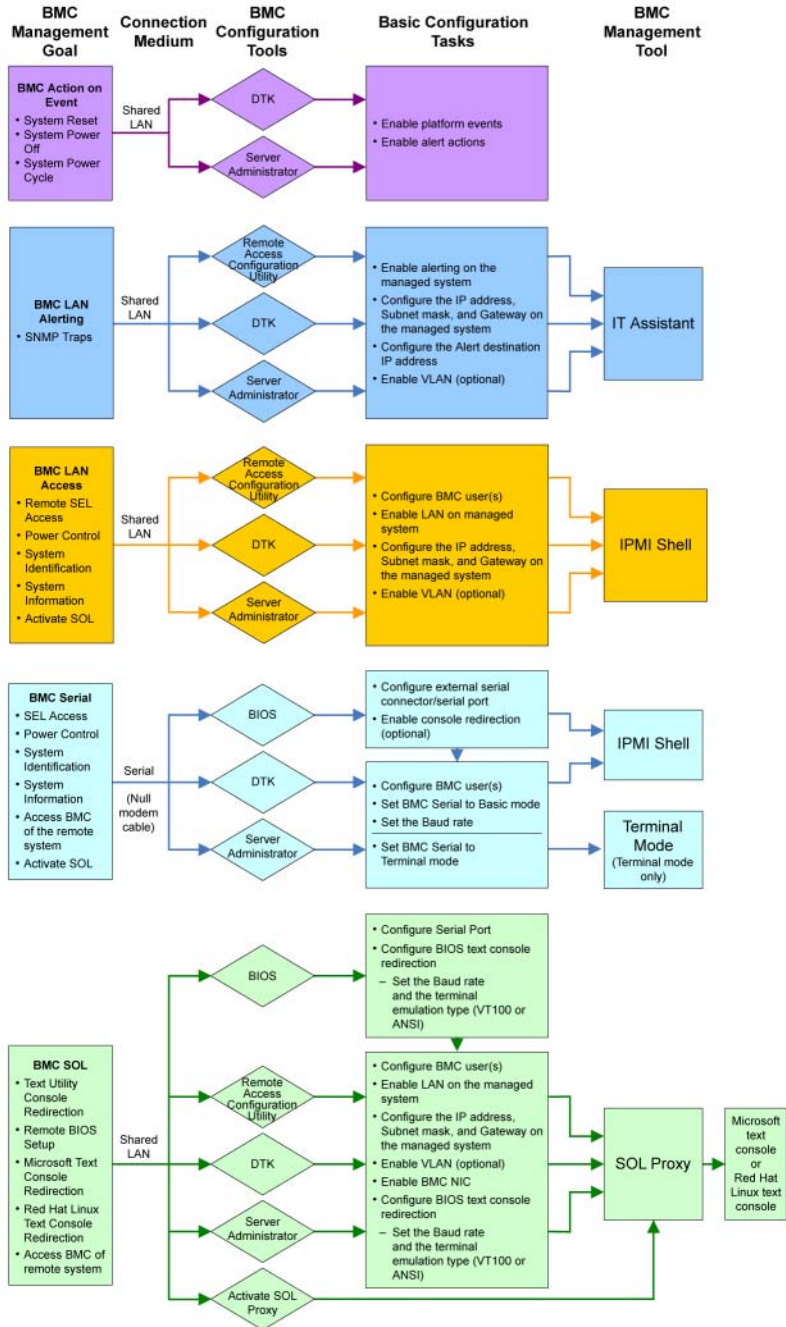
## Configuring the BMC

To configure the BMC in a pre-boot environment, you can use the Remote Access Configuration Utility, the Dell Remote Access Controller (DRAC) 5 Graphical User Interface (GUI), or the command line interface (CLI) depending on the scope of your required configuration tasks. Alternately, you can configure the BMC on a managed system with a running operating system using the Server Administrator home page GUI or CLI. See "Baseboard Management Controller Configuration" for more information.

## Managing the System Using BMC

To manage the BMC in a pre-boot environment, or to access the BMC of a system, you can use the BMC Management Utility. See "Using the BMC Management Utility." To configure the BMC on a system with a running operating system or to perform everyday BMC management tasks, you can use the GUI on the Server Administrator home page. See the *Server Administrator User's Guide* for more information about using Server Administrator to manage your system's BMC functions. Figure 1-1 shows the configuration matrix for BMC.

**Figure 1-1. BMC Configuration Matrix**



## BMC Action on Event


If you plan to use your system's BMC to perform actions when events occur, you must follow the BMC Action on Event configuration guidelines listed in Table 1-1.


**Table 1-1. BMC Action on Event Configuration Guidelines**

Features	Connection Medium	BMC Configuration Tools	Basic Configuration Tasks	Management Tools
<ul style="list-style-type: none"> <li>• System Reset</li> <li>• System Power Off</li> <li>• System Power Cycle</li> </ul>	LAN	<ul style="list-style-type: none"> <li>• Deployment Toolkit (pre-operating system environment)</li> <li>• Server Administrator</li> </ul>	<ul style="list-style-type: none"> <li>• Enable platform events</li> <li>• Enable alert actions</li> </ul>	NA

## Basic BMC Alerting Over a LAN

If you plan to use your system's BMC to send alerts (Platform Event Traps), you must follow the BMC configuration guidelines listed in Table 1-2.

 **NOTE:** The LAN-sharing depends on the NIC selection configuration option. The available options are Shared and Failover, and if a RAC card is present, the additional option available is Dedicated. See the NIC Selection option in the table in "Remote Access Configuration Utility Options" section for more information on Shared, Failover, and Dedicated.

 **NOTE:** The Dedicated NIC selection option is available only if you are using Dell Remote Access Controller (DRAC) 5.

**Table 1-2. BMC LAN Alerting Configuration Guidelines**

Features	Connection Medium	BMC Configuration Tools	Basic Configuration Tasks	Management Tools
Platform Event Alerts (SNMP Traps)	LAN	<ul style="list-style-type: none"> <li>• Remote Access Configuration Utility (pre-operating system environment)</li> <li>• Deployment Toolkit (pre-operating system environment)</li> <li>• Server Administrator</li> </ul>	<ol style="list-style-type: none"> <li>1 Configure NIC Selection to select Shared, Failover, or Dedicated</li> </ol> <p><b>NOTE:</b> This option is available only on Dell PowerEdge x9xx systems.</p> <ol style="list-style-type: none"> <li>2 Configure the IP address, Subnet mask, and Gateway on the managed system</li> <li>3 Configure the VLAN (optional)</li> <li>4 Enable alerting</li> <li>5 Configure the Alert destination IP address</li> <li>6 Configure the Host Name (optional)</li> </ol>	IT Assistant

## IPMI Shell Over a LAN

Table 1-3 lists the actions you can perform, if you plan to use the BMC Management Utility’s IPMI Shell or other IPMI tools to access your system’s BMC over a LAN.

**Table 1-3. BMC LAN Access Configuration Guidelines**

Features	Connection Medium	BMC Configuration Tools	Basic Configuration Tasks	Management Tools
<ul style="list-style-type: none"> <li>• Remote SEL access</li> <li>• Power control</li> <li>• System identification</li> <li>• Sensor information</li> </ul>	LAN	<ul style="list-style-type: none"> <li>• Remote Access Configuration Utility (pre-operating system environment)</li> <li>• Deployment Toolkit (pre-operating system environment)</li> <li>• Server Administrator</li> </ul>	<ol style="list-style-type: none"> <li>1 Enable IPMI over LAN on the managed system</li> <li>2 Configure NIC selection to select Shared, Failover, or Dedicated</li> </ol> <p><b>NOTE:</b> This option is available only on Dell PowerEdge x9xx systems.</p> <ol style="list-style-type: none"> <li>3 Configure the IP address, Subnet mask, and Gateway on the managed system</li> <li>4 Configure IPMI encryption key (optional)</li> </ol> <p><b>NOTE:</b> This option is available only on Dell PowerEdge x9xx systems.</p> <ol style="list-style-type: none"> <li>5 Configure VLAN (optional)</li> <li>6 Configure BMC users</li> </ol>	IPMI Shell

## IPMI Shell Over the Serial Cable

If you plan to use the BMC Management Utility’s IPMI Shell to access your system’s BMC over a serial cable, you must follow the BMC configuration guidelines listed in Table 1-4.



**NOTE:** Console redirection does not apply to BMC when using the serial interface.

**Table 1-4. BMC Serial Configuration Guidelines**

Features	Connection Medium	BMC Configuration Tools	Basic Configuration Tasks	Management Tools
<ul style="list-style-type: none"> <li>• Interactive mode</li> <li>• Remote SEL access</li> <li>• Power control</li> <li>• System identification</li> <li>• System information</li> <li>• Access the BMC of the remote system.</li> </ul>	<p>Accessed through the serial channel by using a null modem cable</p>	<ul style="list-style-type: none"> <li>• BIOS (pre-operating system environment)</li> <li>• Deployment Toolkit (pre-operating system environment)</li> <li>• Server Administrator (to enable BMC serial only)</li> </ul>	<p><b>1</b> Configure Serial Port 1 to BMC Serial</p> <p><b>NOTE:</b> This option is available only on Dell PowerEdge x8xx systems.</p> <p><b>2</b> Configure External Serial Connector to Remote Access</p> <p><b>NOTE:</b> This option is available only on Dell PowerEdge x9xx systems.</p> <p><b>3</b> Set Serial baud rate to match the rate to be used by the management tool</p> <p><b>4</b> Set BMC Serial Connection Mode to Basic for IPMI Shell or Terminal for Terminal emulation</p> <p><b>5</b> Configure BMC users</p>	<ul style="list-style-type: none"> <li>• IPMI Shell (Basic mode)</li> <li>• Terminal emulation (Terminal mode only)</li> </ul>

## SOL Proxy Over a LAN

If you plan to use the BMC Management Utility's SOL Proxy to access your system's console over a LAN, you must follow the BMC configuration guidelines listed in Table 1-5.

**Table 1-5. BMC SOL Configuration Guidelines**

Features	Connection Medium	BMC Configuration Tools	Basic Configuration Tasks	Management Tools
<ul style="list-style-type: none"> <li>• Text Utility console redirection</li> <li>• Remote BIOS setup</li> <li>• Microsoft text console redirection</li> <li>• Linux text console redirection</li> <li>• Force a reboot on a remote system and activate console redirection</li> <li>• Access BMC of the remote system</li> </ul>	LAN	<ul style="list-style-type: none"> <li>• BIOS (pre-operating system environment)</li> <li>• Remote Access Configuration Utility (pre-operating system environment)</li> <li>• Deployment Toolkit (pre-operating system environment)</li> <li>• Server Administrator</li> </ul>	<p><b>1</b> Configure Serial Port 1 to BMC NIC</p> <p><b>NOTE:</b> This option is available only on Dell PowerEdge x8xx systems.</p> <p><b>2</b> Configure BIOS console redirection to Serial Port 1</p> <p><b>NOTE:</b> This option is available only on Dell PowerEdge x8xx systems.</p> <p><b>3</b> Configure Console Redirection to On with Console Redirection via COM2</p> <p><b>NOTE:</b> This option is available only on Dell PowerEdge x9xx systems.</p> <p><b>4</b> Configure other Console Redirection parameters, such as baud rate, emulation type, etc.</p> <p><b>5</b> Enable IPMI over LAN on the managed system</p> <p><b>6</b> Configure the IP address, Subnet mask, and Gateway on the managed system</p> <p><b>7</b> Configure IPMI encryption key/IPMI encryption key (optional)</p> <p><b>NOTE:</b> This option is available only on Dell PowerEdge x9xx systems.</p> <p><b>8</b> Configure VLAN (optional)</p> <p><b>9</b> Configure BMC users</p>	<ul style="list-style-type: none"> <li>• SOL Proxy</li> <li>• IPMI Shell</li> </ul>

# BMC Configuration and Management Tools

## Using the Remote Access Configuration Utility

The Remote Access Configuration Utility provides basic BMC setup and configuration functions that can be accessed during system boot. Use the Remote Access Configuration Utility for initial BMC setup and configuration only. For advanced configuration tasks, you must use the Deployment Toolkit Version 2.1 SYSCFG.EXE utility or Server Administrator Version 2.0 or later.



**NOTE:** The Remote Access Configuration Utility is called the BMC Setup Module in the Dell PowerEdge x8xx systems.

## Using Deployment Toolkit

The Deployment Toolkit Version 2.1 SYSCFG.EXE utility provides a powerful Microsoft Windows Preinstallation Environment (PE) and Linux command-line interface for locally configuring your system's BMC as part of an initial deployment. Use the SYSCFG.EXE utility to set all supported BMC features. Additionally, you can use the Deployment Toolkit utilities as part of a scripted deployment to multiple similar systems. To use the SYSCFG.EXE utility, you must perform the following tasks:

- Download the Deployment Toolkit ISO image from the Dell support website at [support.dell.com](http://support.dell.com) and save the utilities to your hard drive.
- Burn the Deployment Toolkit ISO image containing the SYSCFG.EXE utility on a CD.
- Use the SYSCFG.EXE utility to configure BMC on the managed system.

See the *Deployment Toolkit Version 2.1 User's Guide* and *Command Line Interface Reference Guide* for more information about using the SYSCFG.EXE utility to configure and manage your system's BMC.

## Using the BMC Management Utility

The BMC Management Utility provides a command-line interface to your remote management station to manage BMC-supported functions. Use the BMC Management Utility to manage your BMC from a remote management station and as your managed system's emergency management console. The utility gives you the option of using either a command line interface (IPMI Shell) or a SOL Proxy to access and manage the BMC. To use the BMC Management Utility, you must perform the following tasks:

- Configure BMC using the Remote Access Configuration Utility, the Deployment Toolkit SYSCFG.EXE utility, or Server Administrator.
- Install the BMC Management Utility on a management station.

See "Configuring Your Managed System" for instructions on configuring the BMC on a managed system in preparation for using the BMC Management Utility.

## Using Server Administrator

The Server Administrator provides a convenient and easy-to-use graphical user interface for remotely configuring or managing your system's BMC on a system running a supported operating system. You can use the Server Administrator to configure the most relevant BMC features, such as Platform Event Filter

(PEF) parameters and alert destinations. Additionally, Server Administrator can be used as a command line interface. Server Administrator requires that the system has an operating system installed and functioning. As a result, Server Administrator is best suited for everyday BMC management tasks, and is not an option for performing pre-boot setup or accessing the BMC as an emergency management console. To use Server Administrator, you must perform the following tasks:

- Install Server Administrator on the managed system.
- Access the Server Administrator home page remotely or locally from a supported browser on a management station.
- Configure BMC remotely or locally on the managed system.

See the *Dell OpenManage™ Server Administrator Version 5.0 User's Guide* and *Command Line Interface User's Guide* for more information about using Server Administrator to configure and manage your system BMC.

## Other Dell Documents You May Need

In addition to this *User's Guide*, you can find the following guides either on the Dell Support website at [support.dell.com](http://support.dell.com) or on the documentation CD:

- The *Dell OpenManage Quick Installation Guide* provides additional information about installing the BMC Management Utility on a management station.
- The *Dell OpenManage Server Administrator User's Guide* provides additional information about using Server Administrator to manage your system's BMC.
- The *Dell OpenManage Deployment Toolkit User's Guide* provides additional information about installing and using the Deployment Toolkit utilities.
- The *Dell OpenManage Deployment Toolkit Command Line Interface Reference Guide* provides a complete list of all valid BMC-related command-line options, suboptions, and arguments.
- The *Dell OpenManage IT Assistant User's Guide* provides information about how to monitor and manage a large number of client and server systems on a local area network (LAN) or wide area network (WAN).
- The Dell system User's Guide provides supplemental information about configuring your BIOS settings with the System Setup Program, as well as instructions for configuring your system to use console redirection.

Additionally, the Dell OpenManage **readme.txt** file provides the latest available information for the installation and operation of the programs and utilities used to manage your system through the BMC. The readme is available on the *Dell OpenManage Systems Management Consoles* CD and on the Dell Support website at [support.dell.com](http://support.dell.com).



## Obtaining Technical Assistance


If at any time you do not understand a procedure described in this guide or if your product does not perform as expected, help tools are available to assist you. For more information about these help tools, see "Getting Help" in your system's *Installation and Troubleshooting Guide* or the Hardware Owner's Manual.

Additionally, Dell Enterprise Training and Certification is available; see [www.dell.com/training](http://www.dell.com/training) for more information. This service may not be offered in all locations.



# Configuring Your Managed System

Before using the BMC Management Utility, configure certain items, such as the necessary system BIOS, network, Intelligent Platform Management Interface (IPMI) encryption key, and serial connection settings, depending on the functionality to be performed, to enable access to the BMC.

 **NOTE:** The IPMI encryption key is a public key that is used to generate an encryption key for use between the firmware and the application.


In addition, to utilize the BMC Management Utility IPMI serial functions, you must have a working connection between the management station and the correct serial I/O port of the target BMC, using a null modem cable.

This section describes the basic procedures you must perform to prepare your BMC to be accessed and managed using the BMC Management Utility. The following procedures are described:

- BIOS Configuration
- Baseboard Management Controller Configuration
- Configuring Your BMC with the Deployment ToolKit SYSCFG.EXE utility.
- Configuring Your BMC with Dell™ OpenManage™ Server Administrator

## BIOS Configuration

For most configurations, you must configure the serial port settings and the console redirection settings in your system BIOS before you can use the BMC Management Utility. To configure the necessary system BIOS setting, you must enter the System Setup Program. The BIOS settings can also be configured using the Deployment Toolkit or the Server Administrator.


 **NOTE:** For more information about configuring BIOS settings, see your system *User's Guide*.

### Configuring System BIOS in Dell PowerEdge™ x8xx Systems

- 1 Turn on or restart your system.
- 2 Press <F2> immediately after you see the following message:

<F2> = Setup

The **System Setup** screen appears.

 **NOTE:** If your operating system begins to load before you press <F2>, allow the system to finish booting, and then restart your system and try again.

- 3 Use the up- and down-arrow keys to navigate to the **Integrated Devices** field and press <Enter>.

4 Use the up- and down-arrow keys to navigate to the **Serial Port 1** field and press <Enter>.

5 Use the space bar to select the serial port option.

The options are **COM1**, **COM3**, **BMC Serial**, **BMC NIC**, **Off**, and **RAC** (if an optional RAC is installed in the system).

To use BMC, serial port 1 uses the **COM1** address and communication can be through the serial port or the integrated shared NIC. RAC control uses only the **COM1** address. **Off** and **COM3** are not available options when Console Redirection is set to use serial port 1.

a Select **BMC Serial** if you are planning to access the BMC through the serial cable connection.

b Select **BMC NIC** if you are using SOL proxy and are planning to access the BMC over a shared LAN.

6 Press <Enter> to return to the **System Setup** screen.

7 Use the up- and down-arrow keys to navigate to the **Console Redirection** field and press <Enter>.

8 Use the up- and down-arrow keys to navigate to the **Console Redirection** option and then use the space bar to set the console redirection feature to **Serial Port 1**. Optionally, you can also enable **Redirection after Boot**.

9 Use the up- and down- arrow keys to navigate to the **Failsafe Baud Rate** option and then use the space bar to set the console failsafe baud rate, if applicable.

10 Use the up- and down-arrow keys to navigate to the **Remote Terminal Type** option and then use the space bar to select either **VT 100/VT 200** or **ANSI**, if applicable.

11 Press <Enter> to return to the **System Setup** screen.

12 Press <Esc> to exit the System Setup program. The **Exit** screen displays the following options:

- Save Changes and Exit
- Discard Changes and Exit
- Return to Setup

13 Choose the appropriate option and exit the system setup.


## Configuring System BIOS in Dell PowerEdge x9xx Systems

1 Turn on and restart your system.

2 Press <F2> immediately after you see the following message:

<F2> = Setup

The **System Setup** screen appears.

 **NOTE:** If your operating system begins to load before you press <F2>, allow the system to finish booting, and then restart your system and try again.

3 Use the up- and down- arrow keys to navigate to the **Serial Communication** field and press <Enter>.

4 Use the spacebar to select the appropriate serial communication option.


5 Select the appropriate option for Console Redirection. The following options are available:

**On without Console Redirection:** COM1 and COM2 are enabled and available for use by the operating system or applications. Console redirection is disabled. This is the default option.

**On with Console Redirection via COM1:** COM1 and COM2 are enabled and available for use by the operating system and applications. BIOS Console redirection is through COM1.

**On with Console Redirection via COM2:** COM1 and COM2 are enabled and available for use by the operating system or applications. BIOS Console redirection is through COM2.

**Off:** COM1 and COM2 are both disabled and not available for use by the operating system or applications. BIOS Console redirection is disabled.


 **NOTE:** Select **On with Console Redirection via COM2** to use Console Redirection with SOL.

6 Press <Enter> to select and return to the previous screen.

7 Use the up- and down- arrow keys to navigate to the **External Serial Communication** field and press <Enter>.

8 Use the spacebar to select the appropriate external serial communication option.

The available options are COM1, COM2, and **Remote Access**. The default option is COM1.

 **NOTE:** Select **Remote Access** to access the BMC through the serial cable connection. This option can be set to any value for using SOL and accessing the BMC over LAN.

9 Press <Enter> to select and return to the previous screen.

10 If required, use the spacebar to navigate to and change the settings for **Redirection after Boot**.


11 Use the up- and down- arrow keys to navigate to the **Failsafe Baud Rate** option and then use the space bar to set the console failsafe baud rate, if applicable.


12 Use the up- and down- arrow keys navigate to the Remote Terminal Type option and then use the space bar to select either **VT 100/VT 200** or **ANSI**, if applicable.

13 Press <Enter> to return to the **System Setup** screen.

14 Press <Esc> to exit the System Setup program. The **Exit** screen displays the following options:

- Save Changes and Exit
- Discard Changes and Exit
- Return to Setup

 **NOTE:** For most options, any changes that you make are recorded but do not take effect until you restart the system.

 **NOTE:** Press <F1> to display the help file for the System Setup program.

## Using BIOS Console Redirection With SOL Proxy

Console redirection allows maintenance of a system from a remote location by redirecting keyboard input and output through the serial port. Any console-based feature or operating system can then be used to access the server. DR DOS<sup>®</sup>, Linux (init 3) and Windows<sup>®</sup> Special Administrative Console (SAC) are examples of operating systems and consoles that can be used to access the server.

By default, some operating systems, such as Windows Server<sup>™</sup> 2003, are automatically configured to send text console output to the BIOS. Manual configuration of the **Redirection after Boot** feature through the system BIOS may not be visible to the operating system. This results in both, the operating system feature and the BIOS redirection feature, being enabled. Depending on the operating system and its setup, the results may vary. Dell recommends the following steps as good practice:

**DR DOS:** Do not configure DOS for serial console output. Enable console redirection after reboot in system BIOS.

**Windows Special Administrative Console (SAC):** Do not configure Windows SAC for serial console redirection. Enable console redirection after reboot in system BIOS.

**Linux:** Do not configure console redirection after rebooting the system BIOS. Do the tasks listed in the "Installation and Setup for Linux Operating Systems" section, to configure Linux for console redirection.

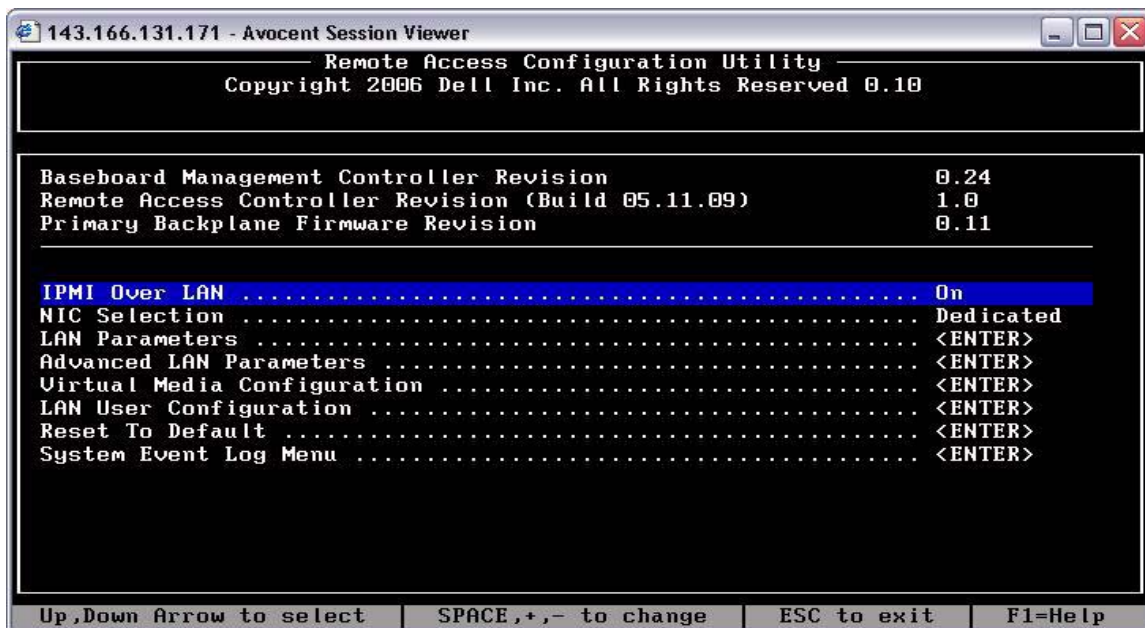


**NOTE:** See "Escape key sequences" for a list of keystrokes to be used for BIOS Setup operations from a serial terminal.

## Baseboard Management Controller Configuration

You can perform basic BMC configuration using the Remote Access Configuration Utility during system startup. See Figure 2-1. For more advanced configuration options, see the instructions for the SYSCFG.EXE utility in the *Deployment Toolkit 2.1 User's Guide*.

**Figure 2-1. Remote Access Configuration Utility**



### Entering the Remote Access Configuration Utility

- 1 Turn on or restart your system.
- 2 Press <Ctrl-E> when prompted after POST.  
If your operating system begins to load before you press <Ctrl-E>, allow the system to finish booting, and then restart your system and try again.

### Remote Access Configuration Utility Options

Table 2-1 lists the Remote Access Configuration Utility options and shows how to configure the BMC on a managed system.


**Table 2-1. Remote Access Configuration Utility**

Option	Description
IPMI Over LAN	Enables or disables the out-of-band LAN channel access to the shared network controller.
NIC Selection <b>NOTE:</b> This option is available only on Dell PowerEdge x9xx systems.	<p>Displays the configuration option.</p> <ul style="list-style-type: none"><li>• Shared</li></ul> <p>Select this option to share the network interface with the host operating system. The remote access device network interface is fully functional when the host operating system is configured for NIC teaming.</p> <p>The remote access device receives data through NIC 1 and NIC 2, but transmits data only through NIC 1.</p> <p><b>NOTE:</b> If NIC 1 fails, the remote access device will not be accessible.</p> <p><b>NOTE:</b> The NIC 2 is not available on the PowerEdge 1900 system.</p> <ul style="list-style-type: none"><li>• Failover</li></ul> <p>Select this option to share the network interface with the host operating system. The remote access device network interface is fully functional when the host operating system is configured for NIC teaming.</p> <p>The remote access device receives data through NIC 1 and NIC 2, but transmits data only through NIC 1. If NIC 1 fails, the remote access device fails over to NIC 2 for all data transmission.</p> <p>The remote access device continues to use NIC 2 for data transmission. If NIC 2 fails, the remote access device fails over all data transmission back to NIC 1.</p> <p><b>NOTE:</b> This option cannot be selected on the PowerEdge 1900 system.</p> <ul style="list-style-type: none"><li>• Dedicated</li></ul> <p>Select this option to enable the remote access device to utilize the dedicated network interface available on the Remote Access Controller (RAC). This interface is not shared with the host operating system and routes the management traffic to a separate physical network, enabling it to be separated from the application traffic.</p> <p><b>NOTE:</b> This option is available only if a DRAC card is installed in the system.</p>
Encryption Key <b>NOTE:</b> This option is available only on PowerEdge x9xx systems.	<p>Is used to encrypt the IPMI sessions.</p> <p><b>NOTE:</b> The encryption key must be an even number of hexadecimal characters, with a maximum of 40 characters.</p>
Static IP vs. DHCP Source	Displays whether the network controller will be assigned a static IP address or a DHCP address.



**Table 2-1. Remote Access Configuration Utility (continued)**

Option	Description
BMC IP Address	The static IP address of the BMC. This field is limited to a maximum value of 255.255.255.255. <b>NOTE:</b> IP address 169.254.0.2 is returned when the BMC is unable to contact the DHCP server. <b>NOTE:</b> Two rules apply to the IP address when it is being entered: <ul style="list-style-type: none"><li>• It cannot be 127.xxx.xxx.xxx.</li><li>• 1st octet must be between 001-223.</li></ul>
MAC Address	Displays the network controller's BMC MAC address.
Subnet Mask	The subnet mask for the static IP address.
Default Gateway	The IP gateway for the static IP address.
VLAN Enable	Enables or disables the virtual LAN ID.
VLAN ID	A valid value for the virtual LAN ID must be a number from 1 to 4094. <b>NOTE:</b> If you enter a value outside the specified range, an error message displays when changes are applied.
VLAN	Specifies the priority of the VLAN. The valid values range from 0-7.
Alerting	Enables or disables BMC alerting.
Alert IP Address	Displays the address of the first alert destination.
Alert Destinations	Enables or disables BMC alerting destinations.
Hostname	Specifies the managed system hostname used to correlate Platform Event Traps to the system on which they originate.
Advanced LAN Parameters	Enables setting the LAN speed and configuring the Domain Name (DN) and Servers options, such as setting the IP address for the DN servers, registering the RAC name, and setting the domain name from DHCP. <b>NOTE:</b> This option is available only on systems installed with a DRAC card.
Virtual Media Configuration	Enables setting the virtual media and virtual flash. <b>NOTE:</b> This option is available only on systems installed with a DRAC card.
LAN User Configuration	Enables setting the user name, user password, user privilege, and enables user access for user ID=2.
Reset To Default	Clears the BMC settings and resets the BMC setting to the defaults.
System Event Log	Enables viewing and clearing the system event log.

 **NOTE:** If the first integrated network interface controller (NIC 1) is used in an Ether Channel team or link aggregation team, the BMC management traffic will not function on PowerEdge x8xx systems. The NIC teaming option is supported only on PowerEdge x9xx systems. For more information about network teaming, see the documentation for the network interface controller.


## Configuring Your BMC Using the Deployment Toolkit Version 2.1 SYSCFG.EXE Utility

The Dell OpenManage Deployment Toolkit includes a set of Microsoft® Windows PE and Linux-based utilities for configuring and deploying PowerEdge systems. The Deployment Toolkit (DTK) SYSCFG.EXE utility is specifically designed to address all necessary BMC configuration tasks using a powerful and comprehensive command-line interface. This utility runs on PowerEdge 1425SC and all supported PowerEdge x7xx, x8xx, and x9xx systems.

To use the BMC Management Utility, configure your managed system with the SYSCFG.EXE utility by perform the following tasks:

- Install the Deployment Toolkit Version 2.1.
- Create either a BMC configuration diskette or CD containing a bootable image, the appropriate CD drivers (for a CD only), and the SYSCFG.EXE utility.
- Configure BMC Users.
- Configure BMC SOL access.
- Configure BMC IPMI serial access.

### Installation and Setup for Microsoft Windows PE Operating Systems

 **NOTE:** See the *Deployment Toolkit Version 2.1 User's Guide* for additional information about installing and using the utilities, and the *Deployment Toolkit Version 2.1 Command Line Interface Reference Guide* for a complete list of valid options, suboptions, and arguments for using the SYSCFG.EXE to configure and manage your BMC.

The Deployment Toolkit components are provided as a self-extracting zip file on the Dell Support website at [support.dell.com](http://support.dell.com). The self-extracting file can be opened on any system running a Microsoft Windows operating system, or it can be extracted in DOS using the **PKUNZIP.EXE** utility (not supplied with the Deployment Toolkit). By default, the **dtk-2.X-dos-XXX.exe** files are extracted to the root directory of your local hard drive, for example, C:\. This location can be changed by giving a different path when extracting the file. Perform the following steps to extract the Deployment Toolkit components to a workstation running Windows:

- 1 Download the Deployment Toolkit file **dtk-2.X-winpe-XXX.exe** from the Dell Support website at [support.dell.com](http://support.dell.com) and save it anywhere on a system running a supported Windows operating system.
- 2 After the zip file downloads, double-click the file.
- 3 Click **OK**.
- 4 Click **Unzip**.

By default, the Deployment Toolkit files are unzipped to C:\. The SYSCFG.EXE utility is located in the C:\Dell\Toolkit\Tools directory.

## Creating a CD

Use the following steps to create bootable media that can be used to configure the BMC on a managed system:

- 1 Create a directory, **WinPE\_OPKTools**, on your hard drive.
- 1 Insert the Windows OEM Preinstallation Kit (OPK) CD into your CD drive.
- 2 Copy all CD files from the Windows PE directory to the **WinPE\_OPKTools** directory.
- 3 Copy **factory.exe** and **netcfg.exe** from the *CD drive* \tools\x86 directory to the **WinPE\_OPKTools** directory.
- 4 Remove the CD from the CD drive.
- 5 Create and name a directory on your development system hard drive. This is where the ISO file is stored.
- 6 Navigate to the **WinPE\_OPKTools** directory through a command prompt.
- 7 Run the following command:

```
OSCDIMG -bETFSBOOT.COM -n <DELLWINPEBUILD>
```

ETFSBOOT.COM is part of the OPK tools and makes the Windows PE CD bootable. The following command line creates a bootable ISO image called Dellx86winpe.iso:

```
C:\WINPE_OPKTOOLS\OSCDIMG -bETFSBOOT.com -n c:\DELLWINPEBUILD  
C:\FINALBUILD\Dellx86winpe.iso
```

- 8 Copy the SYSCFG.EXE utility to the root of the directory.
- 9 Start your CD burning software and generate a bootable CD using the bootable diskette you created as the boot image.

You are now ready to use your bootable CD to configure the BMC on a managed system. For more information, see "Configuring the BMC."

## Installation and Setup for Linux Operating Systems





**NOTE:** See the *Deployment Toolkit Version 2.1 User's Guide* for additional information about installing and using the utilities, and the *Deployment Toolkit Version 2.1 Command Line Interface Reference Guide* for a complete list of all valid options, suboptions, and arguments for using the SYSCFG.EXE to configure and manage your BMC.

- 1 Obtain the ISO image of embedded Linux available on the Dell support website at [support.dell.com](http://support.dell.com).
- 2 Burn the ISO image using any commonly available CD burning software.




**NOTE:** When you create a bootable CD, this image is supplied to the CD burning software along with the complete deployment directory structure, which includes all necessary supporting files to perform the deployment.

- 3 The CD burning software creates an image of the self-bootable ISO image and the deployment files on the CD.
- 4 Extract the contents of the ISO image to a folder on your hard drive.
- 5 Copy your custom scripts into the folder you created in step 4.
  -  **NOTE:** Your scripts should also take care of copying miscellaneous items to unlock the CD, so that the CD can be mounted and ejected as required by the operating system's installation process.
- 6 In `/mnt/cdrom/isolinux.cfg`, the `cd install` section points to your customized start-up script.
  -  **NOTE:** The scripts that you copy into the CD will be copied to and run from the RAM disk. This task is done to ensure the CD is not locked. Ensure that your sample scripts have valid path names.
- 7 Copy the directory structure created in your work station, into the root folder that you created in "step 4".
- 8 This folder contains the Deployment Toolkit CD files necessary for operating system installation, and files required for replication.
- 9 Use the `isolinux` utility to burn the contents of the folder you created in "step 7" to a CD and make it bootable.
- 10 Your ISO image is ready for booting.

## Configuring the BMC

Before you can use the BMC Management Utility to remotely manage the BMC on a managed system, you must perform some basic configuration tasks. The Deployment Toolkit SYSCFG.EXE utility provides a powerful command-line interface for performing the following configuration tasks:

- Configuring BMC users for the managed system
- Configuring the BMC IP address for IPMI LAN access and SOL access for the managed system
- Configuring the BMC serial channel for IPMI serial access for the managed system

 **NOTE:** See the *Deployment Toolkit Version 2.1 User's Guide* for additional information about installing and using the Deployment Toolkit utilities, and the *Command Line Interface Reference Guide* for a complete list of valid options, suboptions, and arguments for using the SYSCFG.EXE to configure and manage your BMC.

### Configuring New BMC Users

The BMC is configured by default with user ID 2 set to username: `root` and password: `calvin`. It is highly recommended that you change the user name and password when deploying your system.

- 1 Insert the bootable BMC configuration diskette or CD into the appropriate drive of the system to be deployed and reboot the system.
- 2 To create a new user, at the command prompt, type:

```
syscfg username --userid=X --name=name
```

where `X` is a number between 2–10 and `name` is an ASCII string of 16 or fewer characters.

Press <Enter> to execute the command line options.

- 3 To enable the new user ID, at the command prompt, type:


```
syscfg useraction --userid=X --action=enable
```

Press <Enter> to execute the command line options.

- 4 To set the password for a BMC user, at the command prompt, type:

```
syscfg passwordaction --action=setpassword --userid=X --password=  
password
```

where *password* is an ASCII string of 16 or fewer characters for PowerEdge x8xx systems and 20 characters for PowerEdge x9xx systems.

 **NOTICE:** A password must be set for each BMC user. The BMC firmware does not allow access to users with null user names or passwords.

Press <Enter> to execute the command line options.

- 5 To configure BMC user privilege, at the command prompt, type:

```
syscfg lanuseraccess --usrprivlmt=bmcuserprivilege where  
bmcuserprivilege=user, operator, administrator, noaccess
```

Press <Enter> to execute the command line options.

### Configuring the BMC IP Address

- 1 Insert the Deployment Toolkit CD into the appropriate drive of the system to be deployed and reboot the system.

- 2 To configure the BMC IP address source for the LAN channel to DHCP, at the command prompt, type:

```
syscfg lcp --ipaddrsrc=dhcp
```

Press <Enter> to execute the command line options.

For a complete list of valid options, suboptions, and arguments for configuring the BMC LAN channel see the *Deployment Toolkit Version 2.1 Command Line Interface Reference Guide*.

- 3 To configure the BMC IP address source for the LAN channel to a static IP address, at the command prompt, type:

```
syscfg lcp --ipaddrsrc=static --ipaddress=XXX.XXX.XXX.XX  
--subnetmask=XXX.XXX.XXX.X --gateway=XXX.XXX.XXX.X
```

Press <Enter> to execute the command line options.

For a complete list of valid options, suboptions, and arguments for configuring the BMC LAN channel see the *Deployment Toolkit Version 2.1 Command Line Interface Reference Guide*.

## Configuring the BMC Serial Channel Access

- 1 Insert the bootable diskette or CD into the appropriate drive of the system to be deployed, and reboot the system.

- 2 To configure the serial port for BMC, at the command prompt, type:

```
syscfg scp --connectionmode=basic --msgcommbitrate=XXXXXX
```

where XXXXX is the baud rate in bps.

Press <Enter> to execute the command line options.

- 3 To configure the terminal mode for BMC, at the command prompt, type:

```
syscfg scp --connectionmode=terminal --msgcommbitrate=XXXXXX
```

where XXXXX is the baud rate in bps.

Press <Enter> to execute the command line options.

For a complete list of valid options, suboptions, and arguments for configuring the BMC serial channel, see the *Deployment Toolkit Version 2.1 Command Line Interface Reference Guide*.

## Configuring Your BMC Using Server Administrator Version 5.0

You can also configure the BMC options using Server Administrator, which is a one-to-one systems management software program that must be installed on the managed system. Once installed, you can remotely access Server Administrator from a management station with a supported browser to perform BMC configuration tasks. See the *Server Administrator User's Guide* for more information about installing and using Server Administrator.

You can configure the BMC settings from either the Server Administrator home page or from its command line interface. Users must have Administrator privileges to access the BMC settings. Users logged in with User or Power User group privileges can view the BMC information but cannot change the settings.

See the *Server Administrator Version 5.0 Command Line Interface User's Guide* for information about configuring the BMC from the command line.

When using Server Administrator, you can click **Help** on the global navigation bar for more detailed information about the specific window you are viewing. Server Administrator help is available for all windows accessible to the user based on user privilege level and the specific hardware and software groups that Server Administrator discovers on the managed system.

### Configuring the BMC

The Server Administrator Instrumentation Service allows you to manage BMC features, such as, general BMC information, configuration of the LAN and serial port, BMC users, and BIOS setup. To use Server Administrator to configure the BMC on a managed system, perform the following steps:



**NOTE:** You must be logged in with Admin privileges to configure the BMC settings.


- 1 Log in to the Server Administrator home page for the target system.
- 2 Click the **System** object.
- 3 Click the **Main System Chassis** object.
- 4 Click the **Remote Access** object.
- 5 The **BMC Information** window is displayed.

- 6 Click the **Configuration** tab.

Under the **Configuration** tab, you can configure LAN, Serial Port, and Serial Over LAN.

- 7 Click the **Users** tab.

Under the **Users** tab, you can modify the BMC user configuration.

 **NOTICE:** A password must be set for each BMC user. The BMC firmware does not allow access to users with null user names or passwords.

### Configuring BIOS in Server Administrator

To configure BIOS in Server Administrator, complete the following steps:

- 1 Click the **System** object.
- 2 Click the **Main System Chassis** object.
- 3 Click the **BIOS** object.
- 4 Click the **Setup** tab.


Under the **Setup** tab, you can configure **Console Redirection** and **Serial Port communication** parameters.


## Configuring Your BMC Using Dell Remote Access Controller 5

The Dell Remote Access Controller (DRAC) 5 provides a Web-based interface and RACADM (a command-line interface) that enables you to configure the DRAC 5 properties and users, perform remote management tasks, and troubleshoot a remote (managed) system for problems.

### Configuring the Network and IPMI LAN Settings

 **NOTE:** You must have Configure DRAC 5 permission to do the following steps.

 **NOTE:** Most DHCP servers require a server to store a client identifier token in its reservations table. The client (DRAC 5, for example) must provide this token during DHCP negotiation. For RACs, the DRAC 5 supplies the client identifier option using a one-byte interface number (0) followed by a six-byte MAC address.

 **NOTE:** If your managed system DRAC is configured in Shared or Shared with Failover mode and the DRAC is connected to a switch with Spanning Tree Protocol (STP) enabled, network clients will experience a 20-30 second delay in connectivity when the management station's LOM link state changes during the STP convergence.

- 1 Access the DRAC 5 Web-based interface. See the *Dell Remote Access Controller 5 User's Guide* for more information.
- 2 Click Remote Access in the System tree.
- 3 Click the Configuration tab and then click Network.
- 4 Configure the DRAC 5 NIC settings in the **Network Configuration** page. Table 2-1 describes the Network Settings and IPMI Settings on the **Network Configuration** page.
- 5 Click **Apply Changes** when completed.
- 6 Click the appropriate **Network Configuration** page button to continue.

### **Adding and Configuring DRAC 5 Users**

Create unique users with specific administrative permissions (or role-based authority) to manage your system with the DRAC 5 and maintain system security. For additional security, you can also configure alerts that are e-mailed to specific users when a specific system event occurs.



**NOTE:** You must have Configure DRAC 5 permission to do the following steps.

- 1 Expand the System tree and click **Remote Access**.
- 2 Click the **Configuration** tab and then click **Users**. The **Users** page appears, which includes each user's State, RAC Privilege, IPMI LAN Privilege, and IPMI Serial Privilege.
- 3 Click a user ID number in the User ID column.
- 4 Configure the user's properties and privileges in the **User Configuration** page.
- 5 Click **Apply Changes** when completed.
- 6 Click the appropriate **User Configuration** page button to continue.

See the *Dell Remote Access Controller 5 User's Guide* for more information on the IPMI user privileges, DRAC group permissions, and the DRAC user privilege settings.



## Using the BMC Management Utility

The BMC Management Utility is a collection of software applications that enable remote management and configuration of systems equipped with a BMC. The BMC Management Utility includes the following components:

- Command Line Interface (IPMI Shell)

The IPMI Shell is a scriptable console application program used for the control and management of remote systems using the IPMI 1.5 protocol or later. The IPMI Shell supports both serial access and LAN access to the BMC. It can be used either in the generic CLI mode or the interactive mode. The interactive mode allows for a dedicated connection to a server and availability of all commands from the operating system CLI. Using the IPMI Shell in this mode improves usability and reduces time and traffic required for connecting and authenticating.

The IPMI Shell allows administration of one or more managed systems from a command line shell, rather than a graphical user interface (GUI). Use the IPMI Shell to perform the following tasks:

- System power management
- System identifier control
- Access to the event log
- Access to the system sensors
- Enable Serial-over-LAN for a remote managed system

- Serial-Over-LAN Proxy (SOL Proxy)

The SOL Proxy is a telnet daemon that allows LAN-based administration of remote systems using the Serial Over LAN (SOL) and IPMI protocols. Any standard telnet client application, such as HyperTerminal on Microsoft® Windows® or telnet on Linux, can be used to access the daemon's features. SOL can be used either in the menu mode or command mode. The SOL protocol coupled with the remote system's BIOS console redirection allows administrators to remotely view and change a managed system's BIOS settings over a LAN. The Linux serial console and Microsoft's EMS/SAC interfaces can also be accessed over a LAN using SOL.



**NOTICE:** All versions of the Microsoft Windows operating system include Hilgraeve's HyperTerminal terminal emulation software. However, the included version does not provide many functions required during console redirection. Instead, you can use any terminal emulation software that supports VT100 or ANSI emulation mode. One example of a full VT100 or ANSI terminal emulator that supports console redirection on your system is Hilgraeve's HyperTerminal Private Edition 6.1 or later.



**NOTE:** See your system's *User's Guide* for more information about console redirection, including hardware and software requirements and instructions for configuring host and client systems to use console redirection.

**NOTE:** HyperTerminal and telnet settings must be consistent with the settings on the managed system. For example, the baud rates and terminal modes should match.

**NOTE:** The Windows "telnet" command that is run from a MS-DOS<sup>®</sup> prompt supports ANSI terminal emulation, and the BIOS needs to be set for ANSI emulation to display all the screens correctly.

## Installing the BMC Management Utility

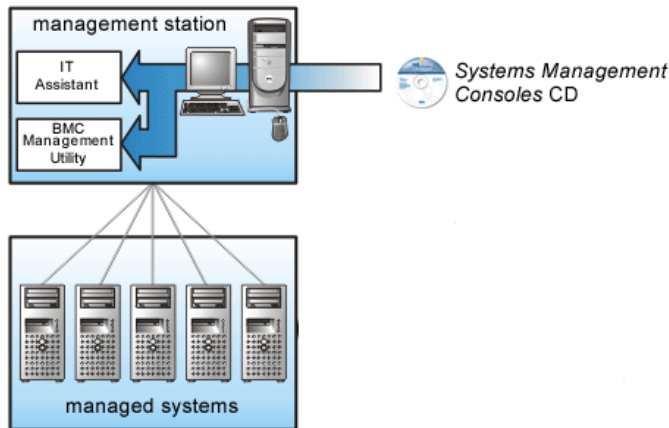
The BMC Management Utility is installed on a management station to remotely connect to the managed system's BMC. See Figure 3-1.

### Installation Prerequisites

Before using the BMC Management Utility, you must perform at least the basic BIOS and BMC configuration tasks described in "Configuring Your Managed System."

In addition, to access the BMC using the IPMI serial feature, you must have a working connection between the management station and the correct serial I/O port of the managed system's BMC using a null modem cable.

**Figure 3-1. Installing on a Management Station**



### Supported Operating Systems

The management station must be running one of the following supported operating systems:

- Red Hat Enterprise Linux AS, ES, WS (version 4)
- Microsoft Windows 2000
- Microsoft Windows XP
- Microsoft Windows Server™ 2003 Web, Standard, and Enterprise Editions
- SUSE<sup>®</sup> Linux Enterprise Server

# Installation Procedures

The following installation procedures provide step-by-step instructions for installing and uninstalling the BMC Management Utility for each supported operating system:

- Installing/uninstalling on systems running supported Windows operating systems
- Installing/uninstalling on systems running supported Linux operating systems

## Installing on Systems Running Supported Windows Operating Systems

To install the BMC Management Utility on a management station running the Windows operating system, perform the following steps:

- 1 Log in with administrator privileges to the system where you want to install the systems management software components.
- 2 Exit any open application programs and disable any virus-scanning software.
- 3 Insert the *Dell OpenManage™ Systems Management Consoles* CD into your system's CD drive.  
If the CD does not automatically start the setup program, click the **Start** button, click **Run**, and then type `x:\windows\setup.exe` (where *x* is the drive letter of your CD drive).

The **Dell OpenManage Management Station Installation** screen appears.

- 4 Click **Install, Modify, Repair or Remove Management Station**.

The **Welcome to Install Wizard for Dell OpenManage Management Station** screen appears.

- 5 Click **Next**.

A software license agreement appears.

- 6 Select **I accept the terms in the license agreement**, if you agree.

The **Setup Type** screen appears.

- 7 Select **Custom Setup** and click **Next**.

The **Custom Setup** screen appears.

- 8 From the drop-down, which appears on the left side of BMC Console, select **This feature, and all subfeatures will be installed on the local hard drive**.

To accept the default directory path, click **Next**. Otherwise, click **Browse** and navigate to the directory where you want to install your software, and then click **Next**.

The **Ready to Install the Program** screen appears.

- 9 Ensure that all information is correct and click **Install**.

The **Installing Dell OpenManage Management Station** screen appears and displays the status of the installation.

- 10 When installation is complete, the **Install Wizard Completed** screen appears. Click **Finish**.



**NOTE:** Enable the virus scanning software after installation.

See the *Dell OpenManage Version 5.0 User's Guide* for additional information about installing the BMC Management Utility on a management station.

By default, the installation program copies the files to the following directory:  
**C:\Program Files\Dell\SysMgt\bmc.**

The SOL Proxy service does not auto-start after installation. To start the SOL Proxy service after installation, you can reboot the system (SOL Proxy automatically starts on a reboot). To restart the SOL Proxy service on Windows systems, complete the following steps:

- 1 Right-click **My Computer** and click **Manage**. The **Computer Management** window is displayed.
- 2 Click **Services and Applications** and then click **Services**. Available services are displayed to the right.
- 3 Locate **DSM\_BMU\_SOLProxy** in the list of services and right-click to start the service.

### **Uninstalling on Systems Running Supported Windows Operating Systems**

To uninstall the BMC Management Utility, use the Add/Remove Programs utility in the Control Panel.

### **Installing on Systems Running Supported Linux Enterprise Operating Systems**

To install the BMC Management Utility on a management station running the Linux operating system:

- 1 Log in as root to the system where you want to install the management station components.
- 2 If required, mount the *Systems Management Consoles* CD using the command:  
`mount /mnt/cdrom`
- 3 Install the BMC Management Utility with the following command for SUSE Linux Enterprise server:

```
rpm -ivh /linux/bmc/osabmcutil9g-SUSE*.rpm
```

or for Red Hat Enterprise Linux, use the following command:

```
rpm -ivh /linux/bmc/osabmcutil9g-RHEL*.rpm
```

By default, the installation program copies the files to the following locations:

```
/etc/init.d/SOLPROXY.cfg
```

```
/etc/SOLPROXY.cfg
```

```
/usr/sbin/dsm_bmu_solproxy32d
```

```
/usr/sbin/solconfig
```

```
/usr/sbin/ipmish
```

The SOL Proxy will start automatically during system startup. Alternatively, you can go to directory `/etc/init.d` and use the following commands to manage the SOL Proxy service:

```
solproxy status
```

```
dsm_bmu_solproxy32d start
```

```
dsm_bmu_solproxy32d stop
```

```
solproxy restart
```

## Uninstalling on Systems Running Supported Linux Enterprise Operating Systems

To uninstall the BMC Management Utility, perform the following steps:

- 1 Log in as `root`.
- 2 Enter either of the following command to remove all the installed packages from SUSE Linux Enterprise Server or Red Hat Enterprise Linux.

```
rpm -e osabmcuti19g-SUSE*
```

```
rpm -e osabmcuti19g-RHEL*
```

If the BMC Management Utility has been uninstalled, you will receive a success message.

## IPMI Shell

IPMI Shell is a CLI console application and has no graphical user interface. Its commands and options are specified using command line arguments only.

IPMI Shell supports out-of-band (OOB) access (over a LAN or through the serial port) to a single system at a time, however, multiple IPMI Shell sessions can run simultaneously on the same managed system. See Figure 3-2.

IPMI Shell allows a user with user-level BMC privileges to:

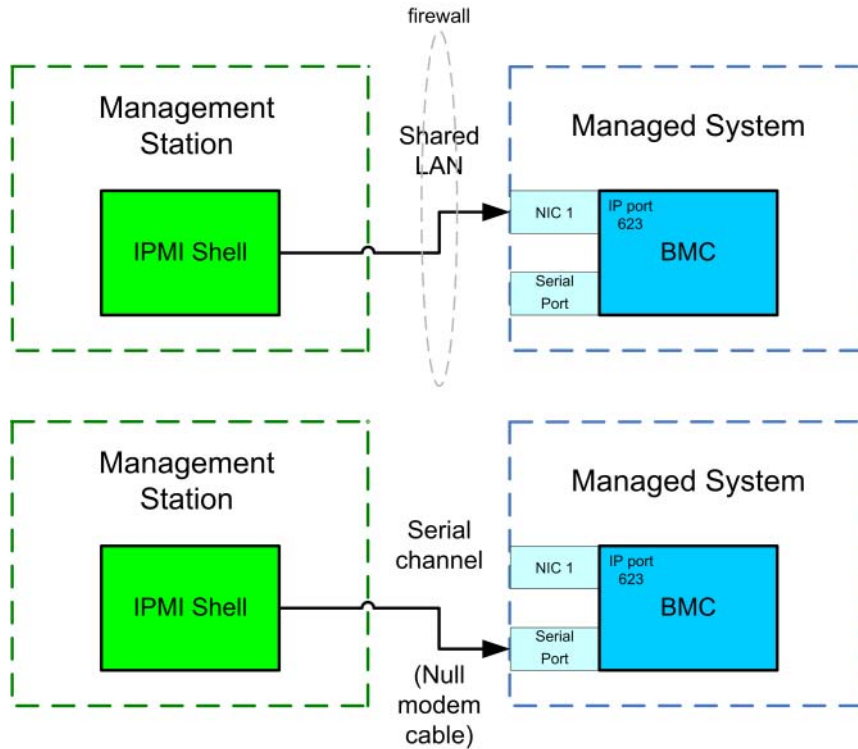
- Display the current power status.
- Display the 16-byte system GUID of the managed system.
- Display information from the system's field replaceable unit (FRU).
- Display the BMC firmware information.
- Display summary information about the event log.
- Display logged events.
- Display current status of platform sensors
- Enable or disable SOL.

In addition to the operations that can be performed by a user with user-level BMC user privileges, IPMI Shell allows a user with operator-level and administrator-level BMC user privileges to:

- Power on, reset, or power cycle a managed system.
- Simulate a hard power off on a managed system (forcing the system to turn off without shutting down the operating system).
- Clear the system event log (SEL).
- Turn the blinking system identification LED on or off.

To facilitate command scripting, upon successful execution, IPMI Shell terminates with an exit code of zero, and will output the execution results in a parsable format. If an error is encountered, the program exits with a non-zero error code and outputs the error in a parsable format. See "BMC Management Utility Error Codes" for a complete list of possible BMC Management Utility error codes.

**Figure 3-2. IPMI Shell Diagram**



### Using IPMI Shell


To use IPMI Shell, perform the following steps:

On systems running a supported Microsoft Windows operating system:

- 1 Start a **Command Prompt** window.
- 2 Locate the `ipmish.exe` file. By default, `ipmish.exe` is located in the directory: `C:\Program Files\Dell\SysMgt\bmc`.
- 3 Enter IPMI Shell commands (see "IPMI Shell Command Syntax") to manage the remote system. See "IPMI Shell Commands" for a complete list of valid options, commands, subcommands, and arguments.

On systems running a supported Linux operating system:

- 1 Start an operating system (OS) shell.
- 2 Enter IPMI Shell commands (see "IPMI Shell Command Syntax") to manage the remote system. See "IPMI Shell Commands" for a complete list of valid options, commands, subcommands, and arguments.

 **NOTE:** The IPMI Shell will be located in `/usr/sbin`.

## IPMI Shell Command Syntax

The general syntax of IPMI Shell CLI commands is as follows:

```
ipmish [global-options] ... command [; command] ...
```

The general usage for a command is:

```
command [subcommand] [command option and argument] ...
```

Both global options and command-specific options are always in the following form:

```
-option argument
```

For example:

```
-help
```

```
-max 20
```

```
-u John
```

Arguments with embedded tabs or spaces must be enclosed in matching double quotation marks (").

For example:

```
-user "John Smith"
```

Every command has one default action. The default action is typically, but not always, the equivalent of reading and displaying the current setting or status for the command.

## IPMI Shell Global Options

IPMI Shell has the following global options:

### Running IPMISH over LAN Option **-ip**


#### *Synopsis*

```
ipmish -ip bmc_ip_address | bmc_hostname -u username -p password
```

```
[-k KG value] <command>
```

### **Description**

This option is used to establish a connection to a remote managed system using the LAN channel. The IP port specified in installation (default value is 623) is used unless another port has been configured.

 **NOTE:** This global option cannot be used independently to connect to the BMC. One or more IPMISH commands must follow the option.

### **Options**

`-ip bmc_ip_address | bmc_hostname`

Specifies the IP address or hostname of the remote managed system.

`-u username`


Specifies the BMC username.


`-p password`

Specifies the BMC user password.

`-k KG value`

Specifies the KG value in Hex format. The IPMI encryption key is a public key used to generate an encryption key for use between firmware and application. It is differentiated from a password, which is not public and is used to access the firmware. The maximum value is 20 ASCII hex pairs with no spaces between the pairs.

 **NOTE:** Even number of hexadecimal characters is valid and odd number of hexadecimal characters is invalid. For example, 123456AB67 is valid, and 123 is invalid. Enter 00, 0000, etc. to disable encryption.


 **NOTE:** The IPMI encryption key is available only on PowerEdge™ x9xx systems.

### **Running IPMISH over Serial - Option -com**

#### **Synopsis**

```
ipmish -com serial_port -baud baud_rate -flow flow_control  
-u username -p password
```

The following attributes should be configured for IPMISH over serial to function correctly.

 **NOTE:** These options can be configured in BIOS Setup, as well as using Dell OpenManage tools. Log on to Server Administrator and navigate to BIOS Setup.

- "External Serial Connector" must be configured and set to "Remote Access" for PowerEdge x9xx systems. This option is available in the "Serial Communication" submenu in BIOS setup.
  - Disable the "RAC serial Console" if you have a DRAC 5 card installed. Log on to the DRAC GUI, navigate to Serial and deselect the "Enable Serial console" checkbox.
- Set "Serial port 1" to "BMC Serial" for PowerEdge x8xx systems. This option is available under the Integrated Devices menu in BIOS Setup.



The Serial communication connection mode for the BMC must be set to "Direct Connect Basic Mode" for all systems. This can be configured using Server Administrator. Log on to Server Administrator and navigate to Serial Port.

### **Description**

This option establishes a connection to a remote managed system using the serial channel.



**NOTE:** This global option cannot be used independently to connect to the BMC. One or more IPMISH commands must follow the option.

### **Options**

`-com serial_port`

Specifies the serial port used when establishing an IPMI session to the managed system. For a system running Windows, the management station port can be 1, 2, 3, and so on. For systems running Linux, the management station port can be ttyS0, ttyS1, ttyS2, and so on.

`-baud baud_rate`

Specifies the communication baud rate over the serial channel. The maximum supported baud rates are:

- 19200 for PowerEdge x8xx systems
- 57600 for PowerEdge x9xx systems without Dell Remote Access Controller (DRAC)5
- 115200 for PowerEdge x9xx systems with DRAC 5



**NOTE:** The baud rate for serial channel should match the baud rate set in the managed system.

`-flow flow_control`

Specifies the data flow control method. There are two flow control options: CTS (hardware flow control) and NONE (no flow control).

`-u username`

Specifies the BMC username.

`-p password`

Specifies the BMC user password.

**IPMI Help Option -help**

### **Synopsis**

`ipmish -help [command]`

## Description

This option displays the following information:

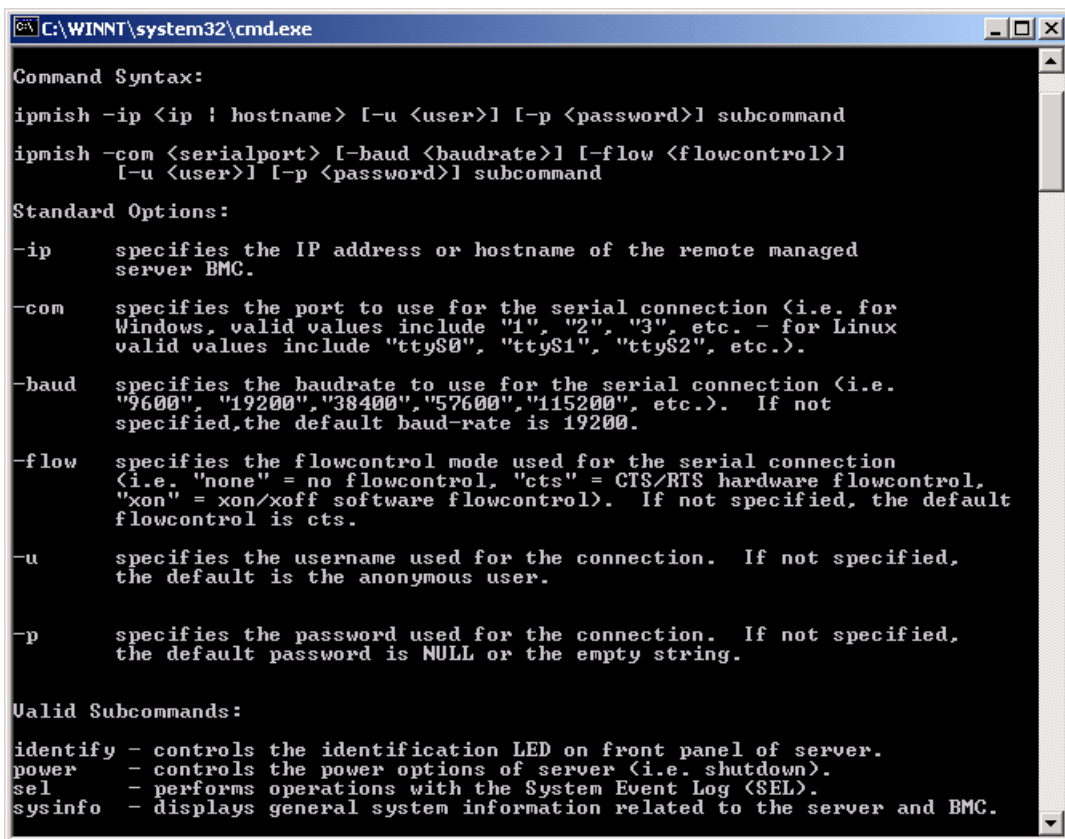
- A summary page for all commands
- A summary of all subcommands for a single command
- A detailed description of a command-subcommand combination

## Options

-help *subcommand*

A command list and a capsule description of options are printed if no argument is given. When there is an argument specifying a valid command, the **help** option displays a detailed description of the command. See Figure 3-3 and Figure 3-4.

**Figure 3-3. IPMI Help Option Example 1**



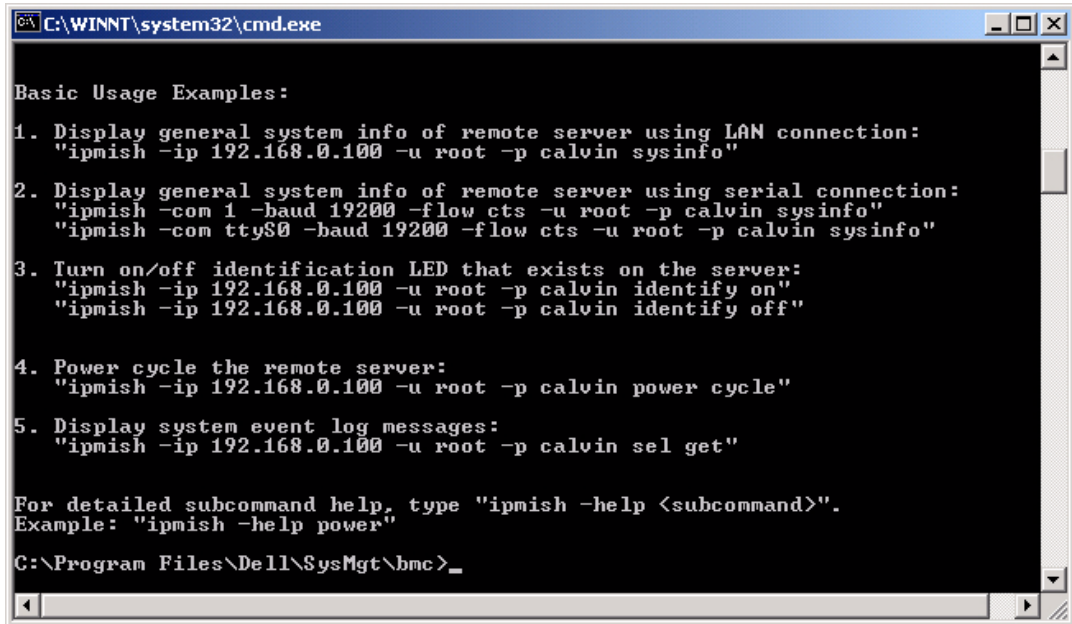
```
C:\WINNT\system32\cmd.exe

Command Syntax:
ipmish -ip <ip | hostname> [-u <user>] [-p <password>] subcommand
ipmish -com <serialport> [-baud <baudrate>] [-flow <flowcontrol>]
      [-u <user>] [-p <password>] subcommand

Standard Options:
-ip      specifies the IP address or hostname of the remote managed
        server BMC.
-com     specifies the port to use for the serial connection (i.e. for
        Windows, valid values include "1", "2", "3", etc. - for Linux
        valid values include "ttyS0", "ttyS1", "ttyS2", etc.).
-baud    specifies the baudrate to use for the serial connection (i.e.
        "9600", "19200", "38400", "57600", "115200", etc.). If not
        specified, the default baud-rate is 19200.
-flow    specifies the flowcontrol mode used for the serial connection
        (i.e. "none" = no flowcontrol, "cts" = CTS/RTS hardware flowcontrol,
        "xon" = xon/xoff software flowcontrol). If not specified, the default
        flowcontrol is cts.
-u       specifies the username used for the connection. If not specified,
        the default is the anonymous user.
-p       specifies the password used for the connection. If not specified,
        the default password is NULL or the empty string.

Valid Subcommands:
identify - controls the identification LED on front panel of server.
power    - controls the power options of server (i.e. shutdown).
sel      - performs operations with the System Event Log (SEL).
sysinfo  - displays general system information related to the server and BMC.
```

Figure 3-4. IPMISH Help option Example 2



```
C:\WINNT\system32\cmd.exe

Basic Usage Examples:

1. Display general system info of remote server using LAN connection:
   "ipmish -ip 192.168.0.100 -u root -p calvin sysinfo"

2. Display general system info of remote server using serial connection:
   "ipmish -com 1 -baud 19200 -flow cts -u root -p calvin sysinfo"
   "ipmish -com ttyS0 -baud 19200 -flow cts -u root -p calvin sysinfo"

3. Turn on/off identification LED that exists on the server:
   "ipmish -ip 192.168.0.100 -u root -p calvin identify on"
   "ipmish -ip 192.168.0.100 -u root -p calvin identify off"

4. Power cycle the remote server:
   "ipmish -ip 192.168.0.100 -u root -p calvin power cycle"

5. Display system event log messages:
   "ipmish -ip 192.168.0.100 -u root -p calvin sel get"

For detailed subcommand help, type "ipmish -help <subcommand>".
Example: "ipmish -help power"

C:\Program Files\Dell\SysMgt\bmc>_
```

### IPMI Session Option -interactive

#### Synopsis

```
ipmish -interactive [-cfg <config-file>]
```

#### Description

This option invokes the interactive CLI mode. An IPMISH prompt appears when entering interactive CLI mode. Type "quit" to exit the IPMISH prompt and return to the MS-DOS prompt.

**NOTE:** The command prompt responds with an error message in the interactive mode, if a command is used before establishing an IPMI session with `connect`.

#### Options

`-interactive`

Invokes the interactive CLI mode.

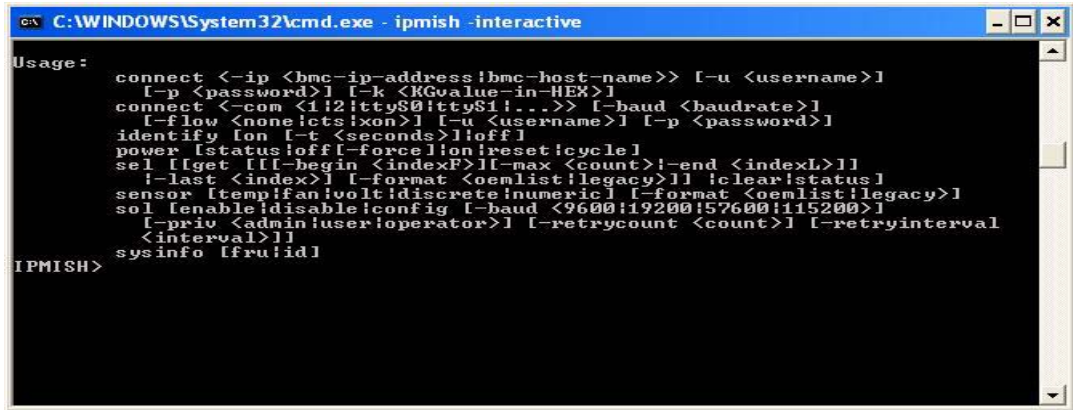
`-cfg <config-file>`

Specifies the configuration file for BMU to start the CLI mode with. If a configuration file is not specified, BMU operates with default configuration settings.

**NOTE:** `-interactive` must be followed by `connect` for ipmish to work.

See "Configuring the SOL Proxy Configuration File" for more information on configuration files.

**Figure 3-5. IPMISH interactive option**



The following line edit functions are supported during the interactive session:

- 1 Up and Down arrow keys to browse command history.
- 2 Left and Right arrow keys to move the input cursor.
- 3 Home and End keys to move the input cursor to the beginning or end of the line.
- 4 Backspace key to move the input cursor back by one space.

The following line edit functions are supported for the SOL proxy menu mode:

- 1 Left and Right arrow key to move the input cursor.
- 2 Home and End keys to move the input cursor to the beginning or end of the line.
- 3 Backspace key to move the input cursor back by one space.

## IPMI Shell Commands

Table 3-1 lists IPMI Shell commands with a brief description.



**NOTE:** The `sol`, `sensor`, and `connect` commands can be used in the IPMI Shell interactive and non-interactive modes and the `quit` command can be used only in the interactive mode.

**Table 3-1. IPMI Shell Commands**

Command	Description
identify	Controls the identification LED on the front panel.
sysinfo	Retrieves and displays managed system information.
power	Controls the power state of the managed system.

**Table 3-1. IPMI Shell Commands (continued)**

Command	Description
sel	Displays or deletes information from the SEL.
sol	Enables Serial-over-LAN for the remote managed system.
sensor	Displays current status of platform sensors.
connect	Connects to the BMC of the remote managed system.
help	displays a command list with descriptions and syntax of options.
quit	exits the command prompt.

## **identify**

### **Synopsis**

```
identify [on [-t seconds] | off]
```

### **Description**

This command controls the identification LED on the front panel. See Figure 3-6.

### **Subcommands**

on

off

Turns the managed system's front panel LED on or off. If the BMC supports the IPMI extension **Chassis Identify On** command, then the **identify on** command turns the LED on indefinitely until the **identify off** command is used to turn the LED off.



**NOTE:** Acknowledgement or status check of the command is not displayed on the command prompt. You should manually check the status on the system.

### **Options**

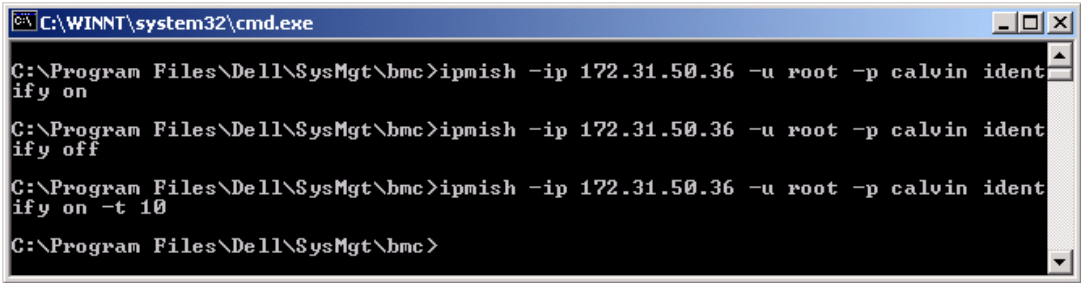
-t *seconds*

Specifies how long the LED is on. It should be no longer than 255 seconds.

### **Default Subcommand**

If a subcommand is not specified, this command acts the same as the **identify on** command.

**Figure 3-6. identify Option Example**



```
C:\WINNT\system32\cmd.exe
C:\Program Files\Dell\SysMgt\bmc>ipmish -ip 172.31.50.36 -u root -p calvin identify on
C:\Program Files\Dell\SysMgt\bmc>ipmish -ip 172.31.50.36 -u root -p calvin identify off
C:\Program Files\Dell\SysMgt\bmc>ipmish -ip 172.31.50.36 -u root -p calvin identify on -t 10
C:\Program Files\Dell\SysMgt\bmc>
```

**sysinfo**

**Synopsis**

`sysinfo [fru | id]`

**Description**

This command retrieves and displays the system information, including field replaceable unit (FRU) and BMC information for the managed system. See Figure 3-7 and Figure 3-8.

**Subcommands**

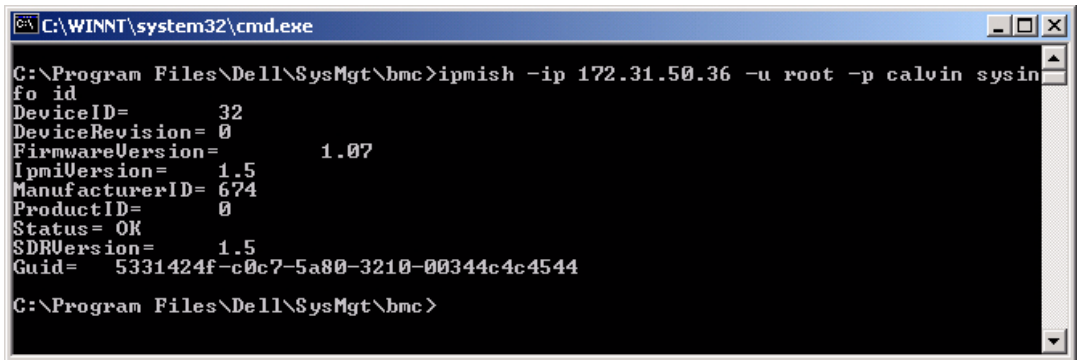
`fru` — Returns FRU related information

`id` — Returns BMC related information

**Default Subcommand**

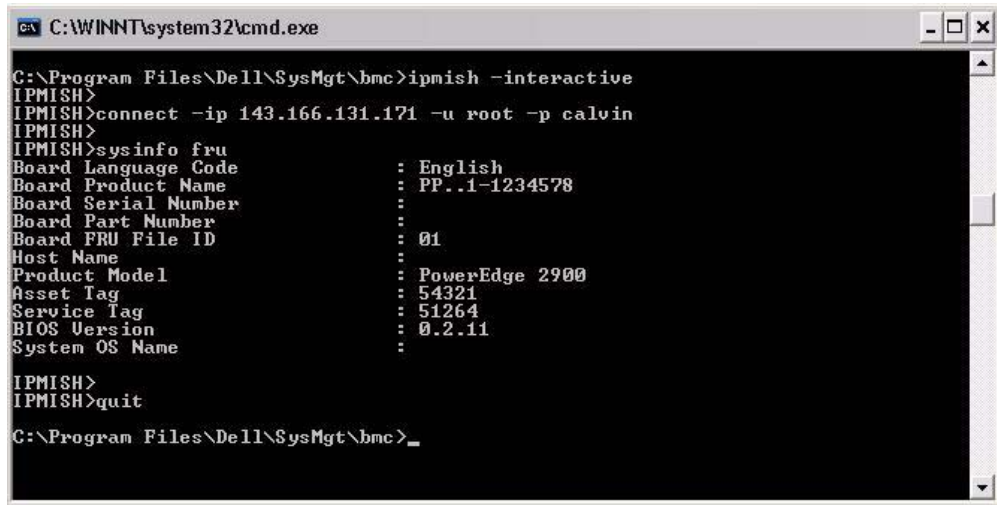
If a subcommand is not specified, this command acts the same as `sysinfo id`. See Figure 3-7.

**Figure 3-7. sysinfo Option Example**



```
C:\WINNT\system32\cmd.exe
C:\Program Files\Dell\SysMgt\bmc>ipmish -ip 172.31.50.36 -u root -p calvin sysinfo id
DeviceID= 32
DeviceRevision= 0
FirmwareVersion= 1.07
IpmiVersion= 1.5
ManufacturerID= 674
ProductID= 0
Status= OK
SDRVersion= 1.5
Guid= 5331424f-c0c7-5a80-3210-00344c4c4544
C:\Program Files\Dell\SysMgt\bmc>
```

Figure 3-8. sysinfo FRU Example



```
C:\WINNT\system32\cmd.exe
C:\Program Files\Dell\SysMgt\bmc>ipmish -interactive
IPMISH>
IPMISH>connect -ip 143.166.131.171 -u root -p calvin
IPMISH>
IPMISH>sysinfo fru
Board Language Code      : English
Board Product Name      : PP..1-1234578
Board Serial Number     :
Board Part Number       :
Board FRU File ID       : 01
Host Name                :
Product Model           : PowerEdge 2900
Asset Tag                : 54321
Service Tag              : 51264
BIOS Version             : 0.2.11
System OS Name           :
IPMISH>
IPMISH>quit
C:\Program Files\Dell\SysMgt\bmc>_
```

## power

### Synopsis

power status

power off [-force] | on | cycle | reset

### Description

This command displays the current power status of the managed system, turns the system on or off, or resets the system. See Figure 3-9.

### Subcommands

status — Displays the current power status of the system, the returned value is “on” or “off”.

on — Turns on the managed system.

off — Issues a “graceful shutdown” IPMI command.



**NOTE:** A graceful shutdown of the server operating system may not be possible when the server software is locked up, or if you are not logged in to the server operating system in Windows. In these cases it may be necessary to use the -force option to reboot or power control the system.

cycle — Turns off the system, pauses, then turns the system back on.

reset — Pulses the system reset signal, regardless of the power state.

### Options

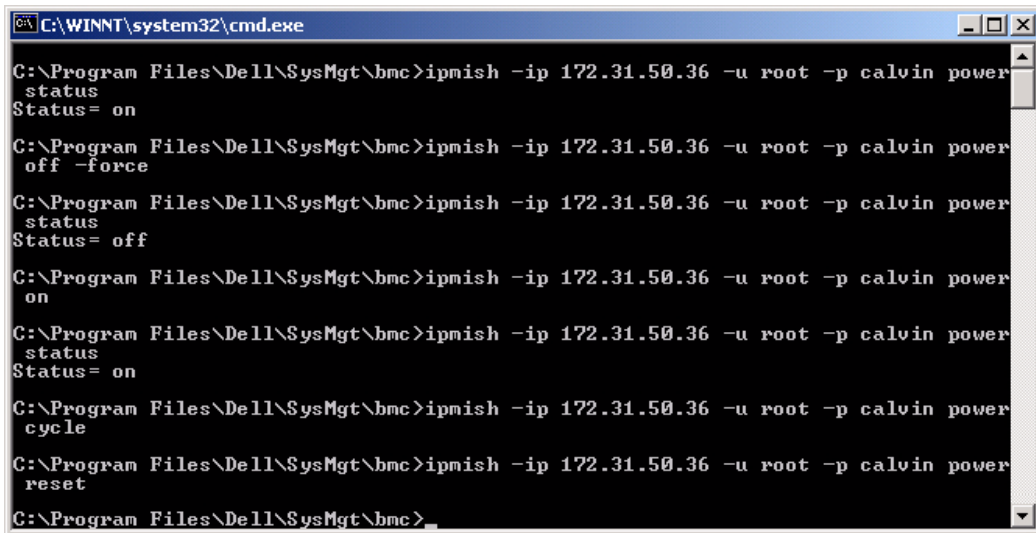
-force

This option simulates pressing and holding the power button for four or more seconds.

### Default Subcommand

If a subcommand is not specified, this command functions the same as `power status`.

**Figure 3-9. power Option Example**



```
C:\WINNT\system32\cmd.exe
C:\Program Files\Dell\SysMgt\bmc>ipmish -ip 172.31.50.36 -u root -p calvin power
status
Status= on
C:\Program Files\Dell\SysMgt\bmc>ipmish -ip 172.31.50.36 -u root -p calvin power
off -force
C:\Program Files\Dell\SysMgt\bmc>ipmish -ip 172.31.50.36 -u root -p calvin power
status
Status= off
C:\Program Files\Dell\SysMgt\bmc>ipmish -ip 172.31.50.36 -u root -p calvin power
on
C:\Program Files\Dell\SysMgt\bmc>ipmish -ip 172.31.50.36 -u root -p calvin power
status
Status= on
C:\Program Files\Dell\SysMgt\bmc>ipmish -ip 172.31.50.36 -u root -p calvin power
cycle
C:\Program Files\Dell\SysMgt\bmc>ipmish -ip 172.31.50.36 -u root -p calvin power
reset
C:\Program Files\Dell\SysMgt\bmc>
```

`sel`

### Synopsis

`sel status`

`sel get [ [-begin index1 ] [-end index2 | -max count] ] | [-last n]  
[-format <oemlist/legacy>]`

`sel clear`

### Description

This command displays the system event log information, displays the contents of the event log, and deletes all the event log records. See Figure 3-10.



### ***Subcommands***

**status** — Displays the total number of system event log records.

**get** — Prints all or part of the event log.

**clear** — Deletes all the records in the event log.

### ***Options***

**-begin** *index1*

Specifies the first record to display.

**-end** *index2*

Specifies the last record to display.

**-max** *count*

Specifies the maximum number of records to display.

If the value of the argument **count** is bigger than the total number of the records, the last record displayed will be the last one in the event log.

**-last** *n*

Specifies the number of records to be displayed, starting from the last record and counting backwards.

### ***Default Subcommand***

If a subcommand is not specified, this command acts the same as **sel status**.

### ***Display Format***

System event log records are displayed using either a tabular format (legacy) or a vertical format (oemlist) consistent with the SEL log output found in other Dell OpenManage products. The default is the oemlist format. The column headers for the legacy format are: **Ordinal Number, Date, Time, Sensor Number, Sensor Type, and Brief Description**. See Figure 3-10 for an example of oemlist and legacy formatted SEL display.

Figure 3-10. sel Option Example

```
C:\WINNT\system32\cmd.exe
C:\Program Files\Dell\SysMgt\bmc>ipmish -interactive
IPMISH>
IPMISH>connect -ip 143.166.131.171 -u root -p calvin
IPMISH>
IPMISH>sel get -format oemlist
Severity      : normal
Date and Time : Mon Feb 13 19:04:35 2006
Description   : System Board SEL: event log sensor for System Board, log cleared was asserted

Severity      : critical
Date and Time : Mon Feb 13 19:05:20 2006
Description   : System Board CPU Power Fault: voltage sensor for System Board, state asserted

IPMISH>
IPMISH>sel get -format legacy
#001 ! System Boot ! SEL:Event Logging Disabled;Log Area Reset/Cleared
#002 ! System Boot ! CPU Power Fault:Voltage;State Asserted
IPMISH>
IPMISH>quit
C:\Program Files\Dell\SysMgt\bmc>
```

## SOL

### Synopsis

`sol[enable | disable]`

`sol config [-baud baud rate] [-priv privilege level] [-retry count retry_count] [retry interval retry_interval]`

### Description

This command allows you to configure sol session parameters of a remote BMC.



**NOTE:** The command prompt responds with an error message if a command is used before establishing an IPMI session with `connect`.

### Subcommands

`enable`

Allows you to enable SOL of connected server.

`disable`

Allows you to disable SOL of connected server.

`config`

Allows you to configure SOL baud rate and privilege level.

### **Options**

`-baud baud_rate`

Specifies the communication baud rate over the serial channel, such as 9600 or 19200. It should be in conformity with the SOL baud rate of the managed server.

`-priv privilege_level`

Specifies minimum privilege levels required to establish an SOL session. Possible values are User, Operator, and Administrator.

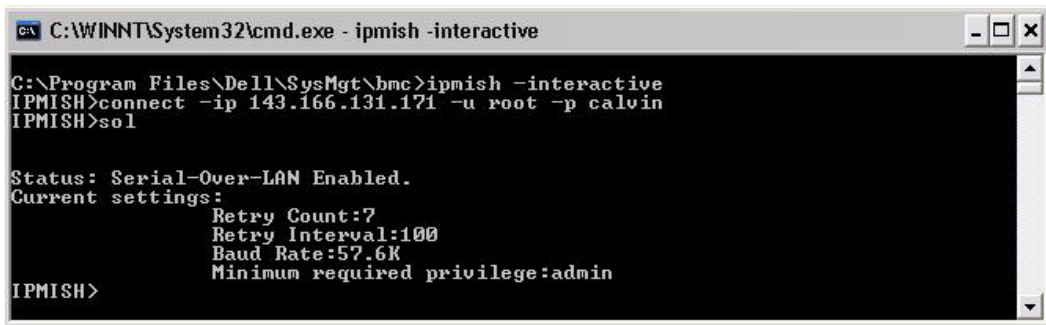
`-retry count retry_count`

Specifies number of times the BMC will retry sending SOL packages if no acknowledgement is received. The maximum and minimum values are 7 and 0, respectively.

`-retry interval retry_interval`

Specifies the retry time interval that the BMC will wait before resending SOL packets to the remote console. It is specified in 10 ms increments. For example, if you set 100 as the value, the BMC will wait 1000 ms before retrying to send SOL packages to the remote console. If you specify zero as the value, the BMC will retry sending instantly, without any time intervals.

**Figure 3-11. IPMISH SOL option**



```
C:\WINNT\System32\cmd.exe - ipmish -interactive
C:\Program Files\Dell\SysMgt\bmc>ipmish -interactive
IPMISH>connect -ip 143.166.131.171 -u root -p calvin
IPMISH>sol
Status: Serial-Over-LAN Enabled.
Current settings:
    Retry Count:7
    Retry Interval:100
    Baud Rate:57.6K
    Minimum required privilege:admin
IPMISH>
```

### **sensor**

#### **Synopsis**

`sensor [temp|fan|volt|discrete|numeric][-format <oemlist|legacy>]`

#### **Description**

This command displays the current status of platform sensors using one of the two possible formats.

#### **OPTIONS**

`[temp|fan|volt|discrete|numeric]`

Specifies the sensor group (temp, volt, fan, discrete, or numeric) for which information is displayed. If you do not specify a sensor group, all sensors for which there is information will be displayed.

`-format <oemlist|legacy>`

Use different formats to output the sensor data. Default format is oemlist. Legacy format is displayed as below:

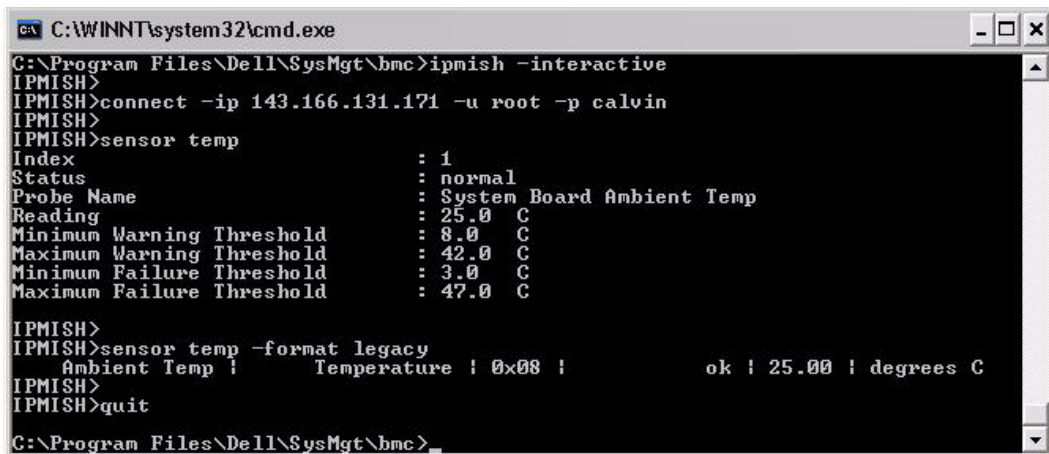
```
Sensor Name | Sensor Type | Sensor # | Status [| Value | Units ]
```

### Subcommands

```
[temp | fan | volt | discrete | numeric]
```

Specifies the sensor group for which information is displayed. If no sensor group is specified, information is displayed for all groups.

**Figure 3-12. Sensor option example**



```
C:\WINNT\system32\cmd.exe
C:\Program Files\Dell\SysMgt\bmc>ipmish -interactive
IPMISH>
IPMISH>connect -ip 143.166.131.171 -u root -p calvin
IPMISH>
IPMISH>sensor temp
Index                : 1
Status               : normal
Probe Name           : System Board Ambient Temp
Reading              : 25.0 C
Minimum Warning Threshold : 8.0 C
Maximum Warning Threshold : 42.0 C
Minimum Failure Threshold : 3.0 C
Maximum Failure Threshold : 47.0 C

IPMISH>
IPMISH>sensor temp -format legacy
Ambient Temp |      Temperature | 0x08 |      ok | 25.00 | degrees C
IPMISH>
IPMISH>quit
C:\Program Files\Dell\SysMgt\bmc>
```

### connect

#### Synopsis

```
connect -ip bmc-ip-address | bmc-host-name [-u username] [-p password]
[-k IPMI encryption key value]
```

```
connect -com bmc_ip_address | bmc_hostname -u username -p password
[-k KG value] <command>
```

#### Description

This command establishes an IPMI connection with the remote server in the interactive mode to enable the user to perform server management activities. The command remains active until the user quits the command prompt or uses the command again to connect to a different server.

### **Options**

`-ip bmc-ip-address/bmc_hostname`

Specifies the out-of-band IP address or hostname of the remote managed system.

`-u username`


Specifies the username to connect to the remote system.

`-p password`

Specifies the password to be used to connect to the remote managed system.

`-k IPMI encryption key value`

Specifies the KG value in Hex format. The IPMI encryption key is a public key used to generate an encryption key for use between firmware and application. It is differentiated from a password, which is not public and is used to access the firmware. The maximum value is 20 ASCII hex pairs with no spaces between the pairs.

 **NOTE:** Even number of hexadecimal characters is valid and odd number of hexadecimal characters is invalid. For example, 123456AB67 is valid, and 123 is invalid. Enter 00, 0000, etc. to disable encryption.

**Figure 3-13. IPMISH connect option**



```
C:\WINNT\System32\cmd.exe - ipmish -interactive
C:\Program Files\Dell\SysMgt\bmc>ipmish -interactive
IPMISH>connect -ip 143.166.131.171 -u root -p calvin
IPMISH>
```

**quit**

### **Synopsis**

`quit`

### **Description**

This command exits the IPMI Shell interactive mode and returns to the command mode.

**help**

### **Synopsis**

`help [command]`

### **Description**

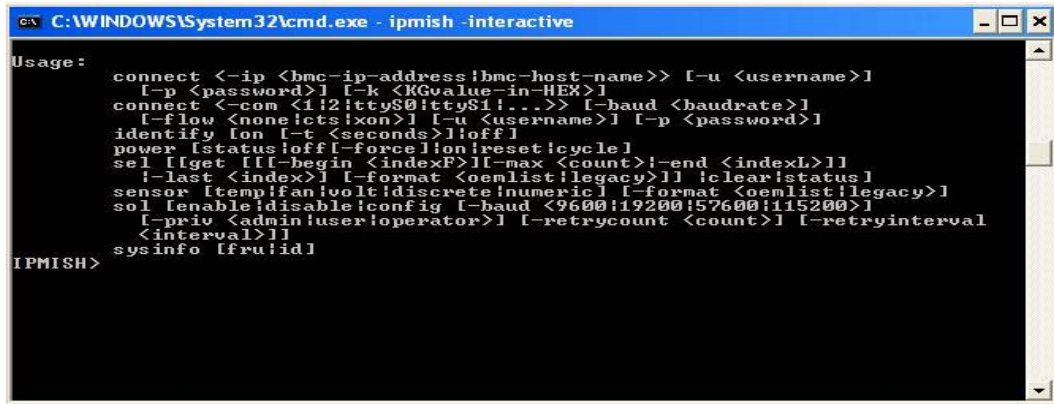
This command lists commands and capsule descriptions with syntax for each command.

## Argument

*command*

Specifies the command for which detailed description is required.

**Figure 3-14.** IPMISH help option



```
C:\WINDOWS\System32\cmd.exe - ipmish -interactive
Usage :
connect <-ip <bmc-ip-address|bmc-host-name>> [-u <username>]
        [-p <password>] [-k <KGvalue-in-HEX>]
connect <-com <{i2ttyS0|ttyS1|...}>> [-baud <baudrate>]
        [-flow <none|cts|xon>] [-u <username>] [-p <password>]
identify [-on [-t <seconds>]] [-off]
power [-status|off|[-force|]on|reset|cycle]
sel [[get [[[-begin <indexF>]][-max <count>]!-end <indexL>]]
        !-last <index>] [-format <oemlist|legacy>]] [-clear|status]
sensor [-temp|fan|volt|discrete|numeric] [-format <oemlist|legacy>]
sol [-enable|disable|config [-baud <9600|19200|57600|115200>]
        [-priv <admin|user|operator>] [-retrycount <count>] [-retryinterval
        <interval>]]
sysinfo [-fru|id]
```

## SOL Proxy

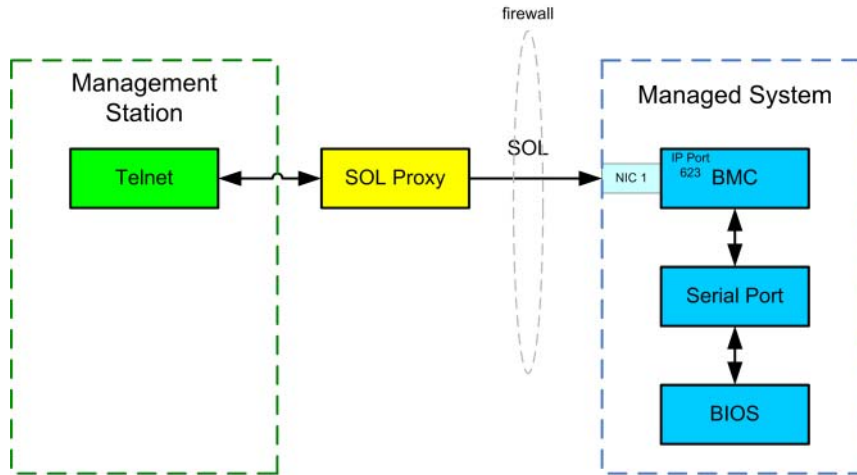
SOL Proxy is a simple telnet server. It allows a telnet client to interact with the hardware-designated serial port of a remote managed system using the LAN communication channel. See Figure 3-15. With SOL Proxy, administrators can view and change the BIOS settings over a shared LAN. In addition, you can also access your managed system's BMC using SOL Proxy using the Linux serial console and Microsoft's EMS/SAC interfaces. SOL Proxy does not support in-band or serial connection to the managed system's BMC.

When BIOS console redirection to serial port is enabled on the remote managed system, any application that uses the BIOS to read from or write to the system console will have its I/O redirected to the designated serial I/O port. When SOL is activated, the BMC firmware reads any data written to the serial port and transmits it to the SOL Proxy as LAN packets. SOL Proxy then forwards the data to the telnet client as TCP/IP packets.

Conversely, any keyboard activity at the telnet client is sent to the BMC by SOL Proxy. BMC then writes the packets to the system serial I/O port.



**NOTE:** See your system's *User's Guide* for more information about console redirection, including hardware and software requirements and instructions for configuring host and client systems to use console redirection.



The SOL Proxy communication scheme enables you to view and configure the BIOS settings of a managed system, as well as to reset the managed system remotely using a telnet client. SOL Proxy is installed as a daemon service and automatically starts each time the system boots. SOL Proxy can accommodate only one telnet session at a time.

You can use a variety of telnet clients to access SOL Proxy features. For example:

- In a Windows environment, you can use a Command Prompt window as your console. However, function keys such as <F1> and <F2> will not operate correctly with this client except on systems running Windows Server 2003.
- In a Windows environment, you can also use any telnet application that supports VT100 or ANSI emulation mode (such as HyperTerminal) as your console.

**NOTICE:** All versions of the Microsoft Windows operating system include Hilgraeve's HyperTerminal terminal emulation software. However, the included version does not provide many functions required during console redirection. Instead, you can use any terminal emulation software that supports VT100 or ANSI emulation mode. One example of a full VT100 or ANSI terminal emulator that supports console redirection on your system is Hilgraeve's HyperTerminal Private Edition 6.1 or later.

**NOTE:** When using HyperTerminal, you must deselect the **Wrap lines that exceed terminal width** check box to avoid console redirected data that may appear to be corrupted or garbled. To deselect this feature, click **File** → **Properties** → **Settings** → **ASCII Setup...** → **Wrap lines that exceed terminal width**.

**NOTE:** See your system's *User's Guide* for more information about console redirection, including hardware and software requirements and instructions for configuring host and client systems to use console redirection.

- In a Linux environment, you can use a shell such as **csh** or **ksh** as your console, or you can use any telnet application supporting VT100 or ANSI emulation mode.

**NOTE:** Telnet settings must be consistent with the settings on the managed system. For example, the baud rates and terminal modes should match.

You can also send the terminal break function while in console redirection. The use of this functionality requires that the specific terminal program in use has the ability to send the break function. For example, you can send the break signal through the Linux telnet modules by typing:

```
Ctrl+]send brk<Enter>
```

The Linux SysRq function is one example of an advanced debugging feature that is enabled by use of the break function. See the "BIOS Configuration" section on how to use this feature. See the "Serial Console redirection with SOL Proxy" section for more information on the SysRq feature.

To enable BIOS console redirection for use with SOLProxy:

- Configure the "Console redirection" attribute to "On with Console Redirection via COM2" for PowerEdge x9xx systems. This option is available under the "Serial Communication" submenu in BIOS setup.
- Configure the "Console Redirection" Attribute to "Serial Port1" for PowerEdge x8xx systems. This option is available under the Console Redirection menu in BIOS Setup. Set "Serial port 1" to "BMC NIC." This option is available under the Integrated Devices menu in BIOS Setup.

## Using SOL Proxy


Depending on the console you use, there are different steps for accessing SOL Proxy. Throughout this section, the management station where the SOL Proxy is running is referred to as the SOL Proxy Server.

### Initiating the SOL Proxy session using the Windows Command Prompt:

To connect and use SOL Proxy:

- 1 Open a Command Prompt window on your management station.
- 2 Enter the **telnet** command in the command-line and provide the IP address of the SOL Proxy server and the port number that you specified in the SOL Proxy installation (the default value is 623).  
For example:

```
telnet 192.168.1.24 623
```

 **NOTE:** The IP address and port number you provide should conform to the ones defined in the SOL Proxy configuration file. For more details, see "Configuring the SOL Proxy Configuration File."

- 3 If you are prompted for a username, provide the operating system login credentials of the system running the SOL Proxy Server service.
- 4 Provide a password when prompted. SOL Proxy will use this combination of operating system username and password to authenticate you on the SOL Proxy Server. The specific authentication scheme will depend on the operating system configuration for the SOL Proxy Server. However, if **localhost** or an IP address of 127.0.0.1 is used, it is assumed that the user has login privileges to the current host, and is not prompted for a username and password.
- 5 After authentication, a login successful message and the SOL Proxy main menu prompt appear. You are ready to use SOL Proxy. By default, you will be logged in the menu mode. See "SOL Proxy Main Menu" for further instructions.



The following line edit functions are supported during the SOLProxy session:

- 1 Up and Down arrow keys to browse command history.
- 2 Left and Right arrow keys to move the input cursor.

### Using a Linux Shell

To connect and use SOL Proxy:

- 1 Open a Linux shell on your management station.
- 2 Enter the **telnet** command and provide the IP address of the SOL Proxy Server and the port number you specified in SOL Proxy installation. For example:

```
telnet 192.168.1.24 623
```



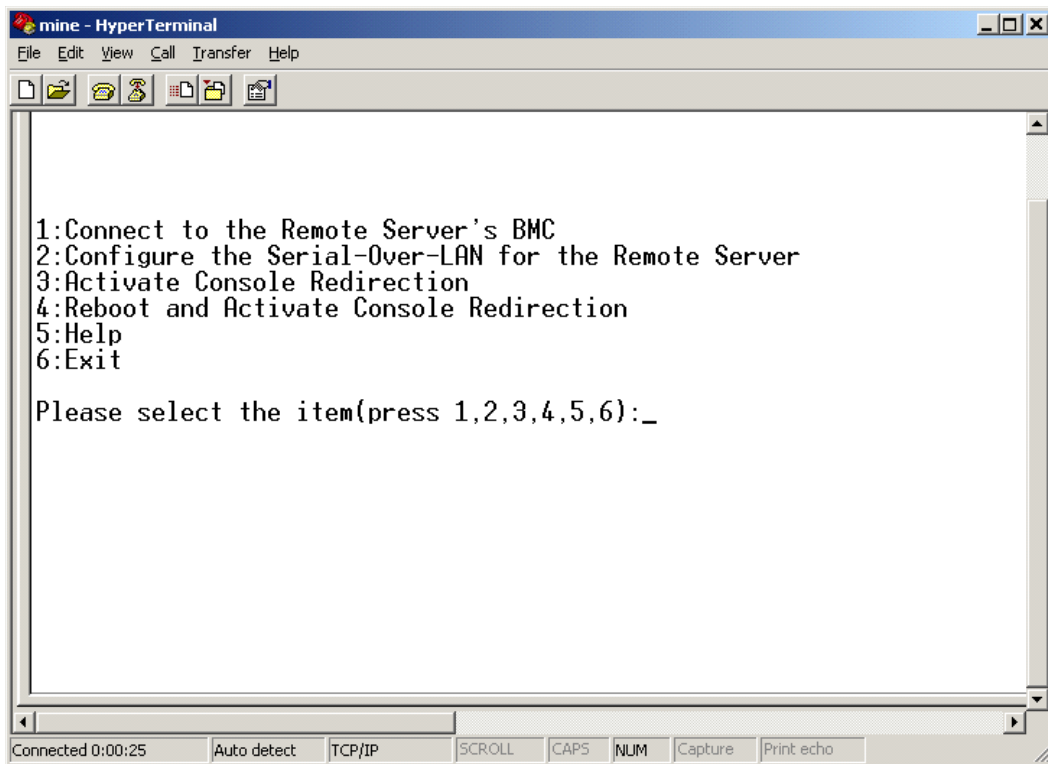
**NOTE:** The IP address and port number you provide should conform to the ones defined in the SOL Proxy configuration file. For more details, see "Configuring the SOL Proxy Configuration File."

- 3 If you are prompted for a username, provide the operating system login credentials of SOL Proxy Server.
- 4 Provide a password when prompted. SOL Proxy will use this combination of operating system username and password to authenticate you on the SOL Proxy Server. The specific authentication scheme will depend on the operating system configuration for the SOL Proxy Server. However, if **localhost** or an IP address of 127.0.0.1 is used, it is assumed that the user has login privileges to the current host, and is not prompted for a username and password.
- 5 After authentication, a login successful message and the SOL Proxy main menu prompt appear. You are ready to use SOL Proxy. See "SOL Proxy Main Menu" for further instructions.

## SOL Proxy Main Menu

After the telnet connection with SOL Proxy is successfully established, you are presented with the following menu of choices. See Figure 3-15.

**Figure 3-15. SOL Proxy Main Menu Example**



The SOL Proxy main menu allows you to change the SOL settings of a remote managed system's BMC, reboot the remote BMC, or activate console redirection.


When you select menu option 1, **Connect to the Remote Server's BMC**, you are prompted for the BMC IP address and BMC login. After you enter the required information and make a successful connection, the internal state SLP is changed to "connected." If you select menu options 2, 3, or 4, and the application state is not "connected," you are prompted to connect to a BMC.

Menu option 2 allows you to enable, disable, and configure the SOL defaults, including the minimum user privilege level required for activating SOL and the communication baud-rate.

Menu options 3 and 4 allow you to establish a SOL remote console session through the SOL Proxy main menu. Menu option 3 establishes a SOL session without changing the remote system's state. This option is ideal for connecting to the Microsoft SAC/EMS or the Linux console. Menu option 4 reboots the remote managed system and establishes a SOL session. This option is best suited for performing BIOS setup and system configuration tasks.

To exit an active SOL session, use the <~><.> character sequence. This sequence terminates SOL and returns you to the top-level menu.

### Connecting to the Remote Managed System's BMC

 **NOTE:** While multiple SOL sessions can be active at the same time, only one console redirection session can be active at any given time for a managed system.

- 1 Select option 1 in the main menu.
- 2 Enter the BMC IP address of the remote managed system.
- 3 Provide the BMC username and password for the BMC on the managed system. The BMC username and password must be assigned and stored in the BMC non-volatile storage. See "Configuring Your Managed System" for more information about configuring BMC users. Only one SOL session with one BMC is permitted at one time.

The connection status displays on the main menu. See Figure 3-16.

- 4 Provide the IPMI encryption key if it was configured in the BMC.

**Figure 3-16. Connecting to the Remote System's BMC**

```
Please select the item(press 1, 2, 3, 4, 5, 6):1
Server Address:192.168.154.56
Username:root
Password:
Key:

SOLProxy Status:Connected.

Powered by Avocent
BMC Management Utility - SOL Manager v2.0 Release 25
Copyright 2005 - Avocent Corporation(http://www.avocent.com/dell/bmu)

Current connection:192.168.154.56:root

1:Connect to the Remote Server's BMC
2:Configure the Serial-Over-LAN for the Remote Server
3:Activate Console Redirection
4:Reboot and Activate Console Redirection
5:Help
6:Exit

Please select the item(press 1, 2, 3, 4, 5, 6):
```

## Configuring the SOL for the Remote Managed System

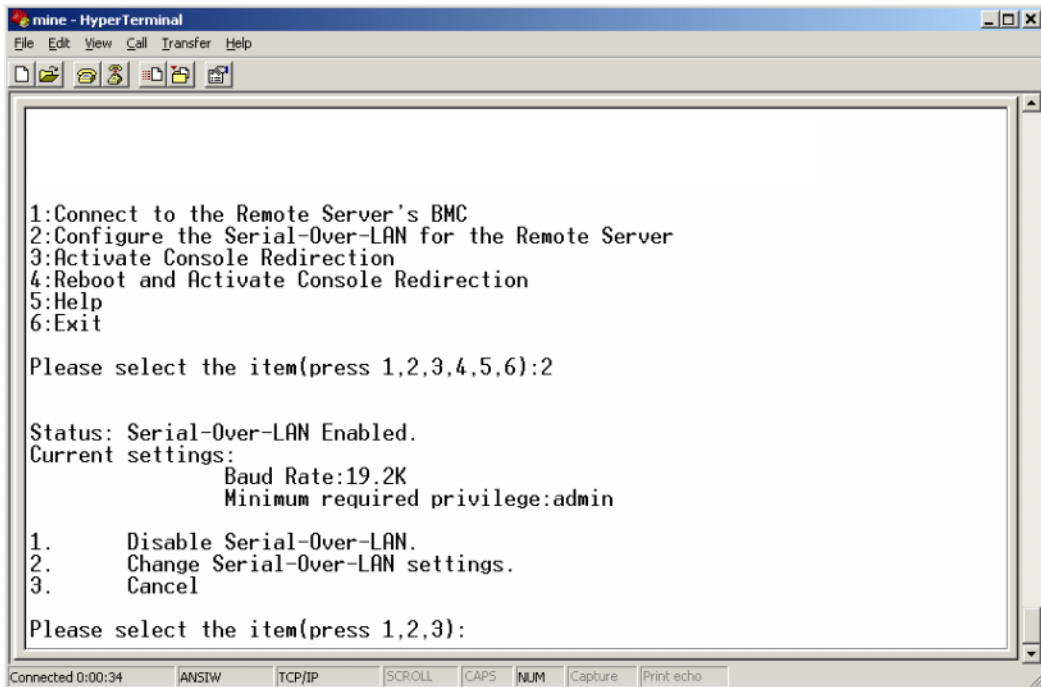
Select option 2 in the main menu.

**NOTE:** You must be connected to the managed system's BMC before you can configure the SOL features. If SOL Proxy is not yet connected to the managed system's BMC, you are prompted for an IP address, a username/password combination, and a IPMI encryption key. The IPMI encryption key value will be ignored if no key was set at the BMC on the target server. See "Connecting to the Remote Managed System's BMC" for more information.

The SOL configuration menu appears. According to the current SOL status, the content of the SOL configuration menu varies:

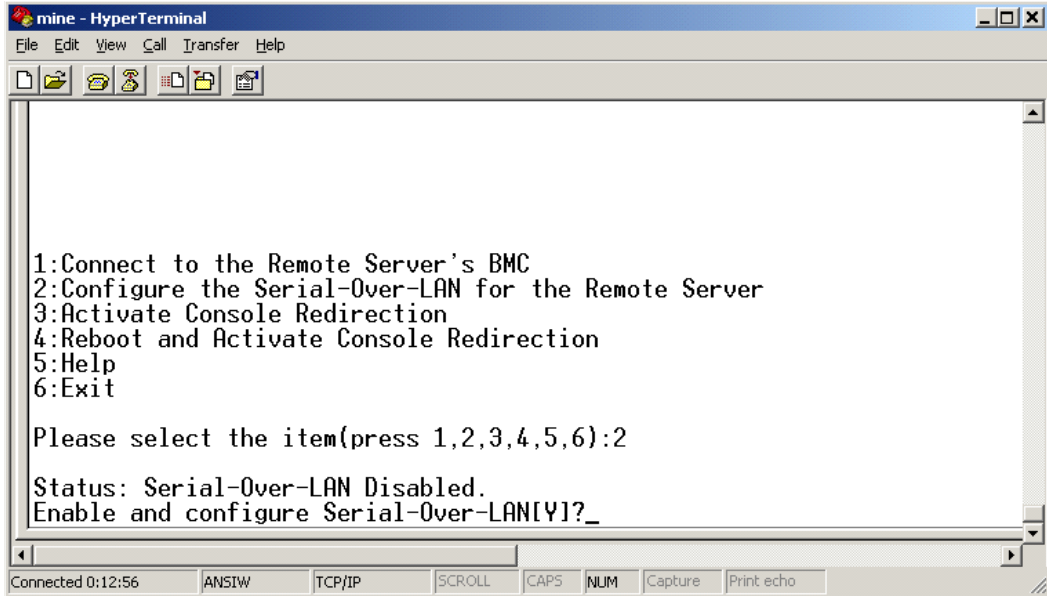
- If SOL is already enabled, the current settings are displayed and you are presented with three choices. See Figure 3-17.

**Figure 3-17. Configuring the Serial-Over-LAN for the Remote System, Example 1**



- If SOL is currently disabled, the options shown in Figure 3-18 are displayed. Type **Y** to enable SOL or **N** to keep SOL disabled. See Figure 3-18.

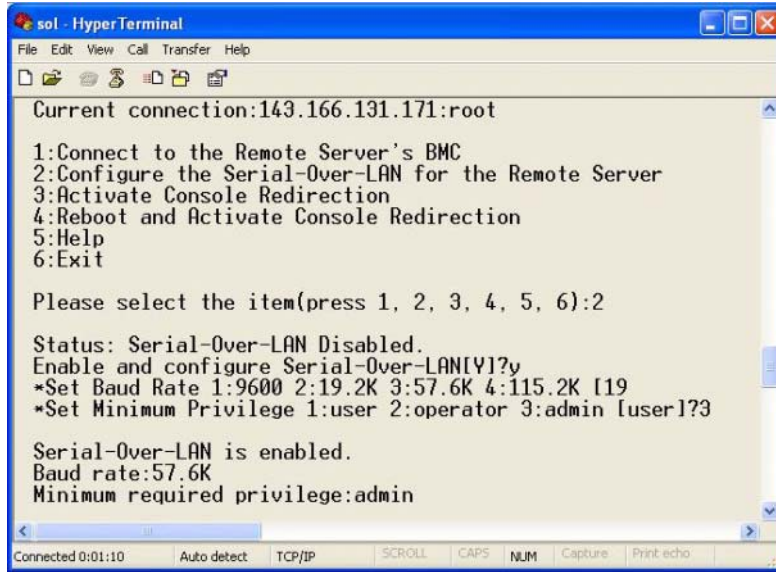
**Figure 3-18. Configuring the Serial-Over-LAN for the Remote System, Example 2**



- If SOL is enabled, two BMC settings are displayed:
  - The communication baud-rate between the system serial port and the BMC
  - The minimum BMC user privilege level required for activating console redirection

SOL Proxy displays a list of valid values for each feature, as well as the current value of the feature enclosed in a pair of brackets. Select the number before a value to set it as the new setting, and press <Enter> to confirm your changes. The new SOL settings are then displayed. See Figure 3-19.

**Figure 3-19. SOL Settings, Example 3**



### Activating Console Redirection

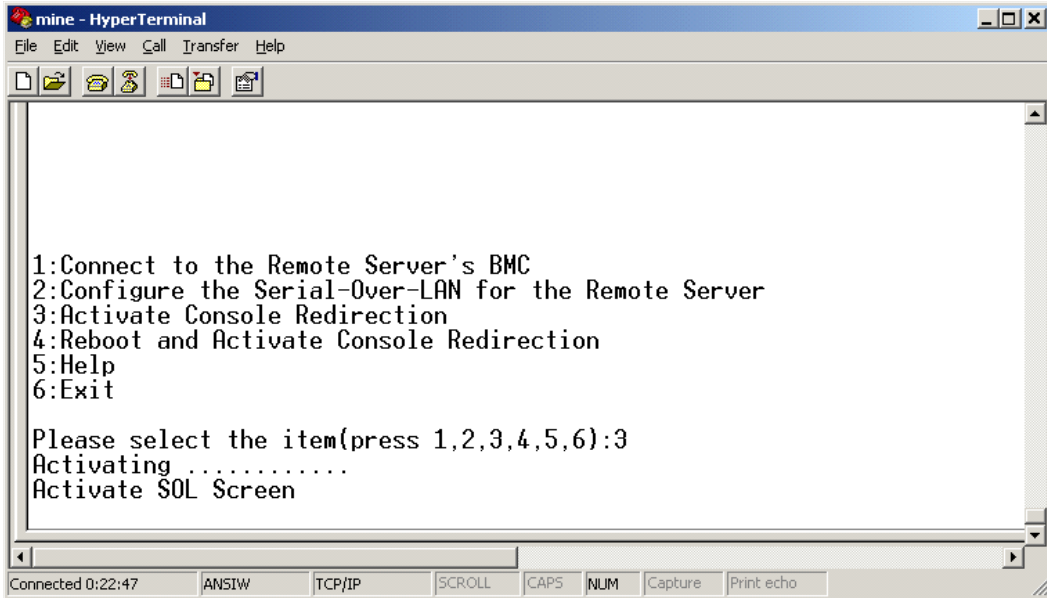
Select option 3 in the main menu.

**NOTE:** You must be connected to the managed system's BMC before you can configure the SOL features. If SOL Proxy is not yet connected to the managed system's BMC, you are prompted for an IP address and a username/password combination. See "Connecting to the Remote Managed System's BMC" for more information.

The remote managed system's text console is redirected to your management station. See Figure 3-20.

**NOTE:** BIOS Console Redirection must be enabled on the managed system and correctly configured before SOL can be successfully activated. See "Configuring Your Managed System" for more information.

**Figure 3-20. Console Redirection Example**



### Rebooting the Managed System and Activating Console Redirection

Select option 4 in the main menu.

**NOTE:** You must be connected to the managed system's BMC before you can configure the SOL features. If SOL Proxy is not yet connected to the managed system's BMC, you are prompted for an IP address, a username/password combination, and a IPMI encryption key. The IPMI encryption key value will be ignored if no key was set at the BMC on the target server. See "Connecting to the Remote Managed System's BMC" for more information.

The power state of the remote managed system is confirmed. If power is on, you are asked to decide between a graceful or forceful shutdown.

Next, the power state is monitored until the status changes to on. Console redirection begins, and the remote managed system text console is redirected to your management station. Use the escape character sequence `<~><.>` to terminate console redirection and return to the top-level menu.

While the managed system reboots, you can enter the BIOS system setup program to view or configure BIOS settings. See Figure 3-21.

**NOTE:** Before activating the console redirection, you must first enable the console redirection features. See "Configuring Your Managed System" for more information.

**Figure 3-21. Reboot Example**

```
Powered by Avocent
BMC Management Utility - SOL Manager v2.0 Release 25
Copyright 2005 - Avocent Corporation(http://www.avocent.com/dell/bmu)

Current connection:192.168.154.56:root

1:Connect to the Remote Server's BMC
2:Configure the Serial-Over-LAN for the Remote Server
3:Activate Console Redirection
4:Reboot and Activate Console Redirection
5:Help
6:Exit

Please select the item(press 1, 2, 3, 4, 5, 6):4

Power Status is ON.
Use graceful shutdown[Y]y
Attempting graceful shutdown...
Powering on...
Activating remote console now.
Remote console is now active and ready for user input.
```

### Getting Help

Select option 5 in the main menu to display detailed descriptions for each option. See Figure 3-22.

**Figure 3-22. Sample Help Screen**

```
1: Connect to the BMC
   Establish a new IPMI session with a remote BMC. The IP address,
   and optionally the BMC username/password of the remote node are
   required. The key needs to match the key set at the remote BMC.
   If no key is set this field should remain blank. The privilege
   level of username determines the operations available to the
   user.

2: Configure Serial-Over-LAN
   Console redirection must be enabled for a remote system before it
   can be activated. BMC administrators can use this option to disable
   or enable SOL. To enable SOL user must specify the serial port
   baud rate used by the system and the minimum privilege required for
   activating SOL.

3: Activate Console Redirection
   Use this option to activate SOL for the connected BMC. SOL must
   be enabled before it can be activated. Your telnet client terminal
   emulation setting must match that of the remote server serial console
   for the result to be displayed correctly. ANSI PC or VT100 settings
   work well for most circumstances.

Press any key to continue
```

### Exit

Select option 6 to end your telnet session and disconnect from SOL Proxy.



## Using SOL proxy in command mode

By default, SOL Proxy is installed for use in the menu mode by the system. See "Configuring the SOL Proxy Configuration File" section for instructions on how to change the default settings to command mode.

### Commands in SOL Proxy

SOL Proxy command mode is similar to the IPMI Shell interactive mode. In addition to supporting all commands of the IPMI Shell interactive mode, the SOL Proxy supports the following additional commands.

#### console

##### *Synopsis*

```
console
```

##### *Description*

This command allows users to establish an SOL session with the connected server.



**NOTE:** BMU responds with an error message if **console** is used before establishing an IPMI session with **connect**.

#### reboot

##### *Synopsis*

```
reboot[-force]
```

##### *Description*

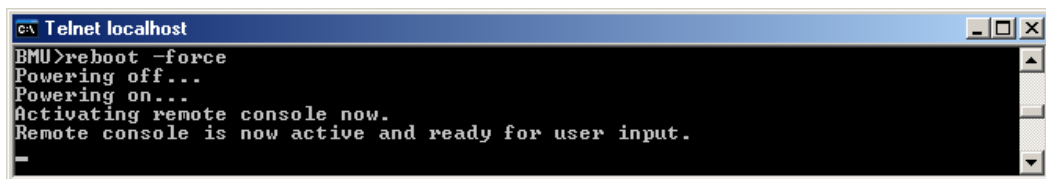
This command allows you to control power configurations and establish an SOL session in one atomic operation. It is equivalent to executing the menu command of "Reboot and Activate Console Redirection".

##### *Options*

```
-force
```

This option is used to force the system to shut down. If this option is omitted, the "reboot" command is executed using a graceful shutdown.

**Figure 3-23. reboot Option Example**



## Configuring the SOL Proxy Configuration File

Certain parameters, for IPMI Shell and SOL Proxy, must be correctly configured in the SOL Proxy Configuration file, - `SOLProxy.cfg`, which is located in the default installation BMC directory.

The parameters and their descriptions are as follows:

### Comments

Any line starting with a “#” is treated as a comment. For example:

```
#The file is an example.
```

### IP Address

Specifies the specific IP address used to connect to SOL Proxy. This item defines what kind of connection can be accepted to establish a SOL Proxy telnet session. There are three possible values:

- `INADDR_ANY` — SOL proxy listens for input on any interface on the server.
- `127.0.0.1` — SOL proxy listens for input on the localhost only.
- *IP address* — SOL proxy listens for input on this IP address only.

For example:

```
ip=INADDR_ANY
```

### Port Binding

Specifies the port at which the SOL Proxy listens for incoming connections. By default, the port is set to 623 and can be modified by the user.

This item defines the port when you telnet SOL Proxy. If this item is absent, 623 is set as the default port. For example:

```
port=623
```

### Session Timeout

Specifies the time in minutes before the SOL Proxy session times out.

If there is no keyboard activity for the specified timeout period, the telnet session and the SOL session will be closed. The timeout value is specified in minutes and can be changed during SOL Proxy installation. For example:

```
session_timeout=30
```

### Power-off Timeout

Specifies the time in seconds before the SOL Proxy gives up polling for the managed system's power status. If the SOL Proxy issues the power off command and the system does not power off within the specified interval, the SOL Proxy returns with a message, indicating that the SOL Proxy was unable to power off the system due to the timeout interval.



**NOTE:** When **Reboot and Activate Console Redirection** is selected and power for the remote managed system is on, a **power off IPMI** command is issued. The power status is then continually monitored until the power status reports “off.” If power status remains “on” longer than this timeout period, **Reboot and Activate Console Redirection** reports an error and returns to the top-level menu. This timeout value is specified in seconds and can be changed during SOL Proxy installation.

For example:

```
power_off_timeout=60
```

### **Retry Interval**

Specifies the period of time in seconds that the BMC waits before it tries to resend a packet. The **retry\_interval** unit is half a second. Therefore, a value of 2 means that the software waits one second for the BMC to respond before it tries to resend the packet, a value of 4 means that it waits two seconds, and so on. For example:

```
retry_interval=2
```

### **Retry Count**

Specifies the maximum number of times that the software tries to resend a packet if it does not receive a response from the BMC. Before each retry, the software waits for the interval specified by the **retry\_interval** parameter. For example:

```
retry_count=10
```

### **User Interface**

Specifies the default settings for SOL Proxy startup. The user can edit and set this comment in the command or menu mode. For example:

```
user_interface=menu
```

### **Sol Loss Silent**

Specifies system behaviour when one or more SOL packets is lost. The possible values are 0 and 1. If it is set to 0 or is absent, the system will print an error message on the screen each time an SOL packet is lost. If it is set to 1, the system will not print error messages for loss of SOL packets. For example:

```
sol_loss_silent=0 or 1
```

### **Sol Loss Threshold**

Specifies number of SOL packets that can be lost before SOL deactivation. The default value is 0, which means that the system will deactivate SOL, if any SOL packets are lost. For example,

```
sol_loss_silent_threshold=0
```

**Sdr Cache**

Specifies whether the system probe information is saved. This information enhances speed of providing sensor and System Event Log (SEL) data. The possible values are on and off. Default value is on. For example,

```
sdr_cache=on
```

**Sdr cache Path**

Specifies path where the system probe information is saved. Default location is the installed BMC directory on your hard drive. For example,

```
sdr_cache_path=<specified path directory>
```

**Max Session**

Specifies the maximum number of concurrent SOL sessions possible. This default value is 1; any value less than 1 will be ignored or treated as 1. You cannot set more than 20 sessions. For example,

```
max_session=2
```

**Logpath**

Specifies the path for storing the log files. Two log files, solproxy.log and solproxyipmi.log, are created at the specified path. For example,

```
logpath=<specified location for log file>
```

**debug**

Specifies if the debug data will be logged. The default is off.

```
debug=off
```

# Known Issues and Frequently Asked Questions

This section discusses known issues with using the BMC Management Utility, along with frequently asked questions.

## Known Issues

### General Issues

- You must assign a valid BMC user name and password before you can connect to your system's BMC using the BMC Management Utility. If you do not explicitly provide a valid BMC user name and password when using the BMC Management Utility to log in to your system's BMC, the BMC firmware will use a null user name and null password as defaults, resulting in a "Login Not Authorized" error.

### SOL Proxy Issues

- SOL Proxy on IP port 623 allows connections from a Web browser. However, if you connect from a Web browser, SOL Proxy displays only jumbled and unusable data. You must close the Web session and connect through a telnet connection to run the application.
- Microsoft® SAC does not implement hardware control flow. Therefore, when console redirection is enabled with EMS SAC, you will see corrupted data. As SAC does not implement hardware flow control, you are unable to effectively use SOL Proxy to activate console redirection to EMS SAC. This can result in corrupted screen output caused by missed characters. Slower baud rates correct this situation and still provide good user experience.

### IPMI Shell Issues

- If you type "ipmish" from any directory other than the directory where the BMU is installed, you will receive a "command not found" error from DOS. This is because the BMU install directory is not included in the system search path. You can execute IPMISH directly by specifying a fully qualified path or by first navigating to the BMC directory and then executing the command.. You may also manually add the BMU install directory to the execution search path.

## Frequently Asked Questions

**Q:** Do IPMI Shell commands correspond one-to-one to IPMI commands?

**A:** IPMI Shell provides only the most useful IPMI commands. It includes a definitive set of commands that can accomplish the most common management tasks. Therefore, IPMI Shell commands may not correspond one-to-one to IPMI commands.

**Q:** Can I manage a system by accessing multiple IPMI instances simultaneously?

**A:** Yes, you can manage a system by accessing multiple IPMI instances at the same time as long as your system's BMC supports more than one concurrent connection. Change the `solproxy.cfg` file, as by default, only one connection at a time is permitted.

**Q:** Can I manage a system by accessing multiple SOL Proxy connections simultaneously?

**A:** No, a managed system can handle only one SOL Proxy connection at a time.

**Q:** Can my SOL Proxy server handle multiple connections at a time?

**A:** Yes, each SOL Proxy server can handle a maximum of 20 SOL Proxy connections simultaneously.

**Q:** How do I unlock an SOL session occupied by another user?

**A:** Your system's BMC only supports one SOL session at a time. You must wait for the current user's session to time out before you can access a new SOL proxy session. See "Session Timeout" for more information about configuring the session timeout parameters.

**Q:** Why can't I enter the BIOS setup interface during the process of remote system rebooting?

**A:** When you select item **4, Reboot and activate console redirection**, in the **SOL Proxy** main menu, the managed system is rebooted first. Press <F2> to enter the BIOS setup interface, if the telnet client you are using supports VT100 or ANSI.

**Q:** Why can't I connect to a console using the terminal emulation software included with my Microsoft Windows® operating system?

**A:** The version of HyperTerminal included with Windows does not provide many functions required during console redirection. Either upgrade to HyperTerminal Private Edition 6.1 or later, or select any other terminal emulation software that supports VT100 or ANSI emulation mode.

**Q:** What is the Spanning Tree feature?

**A:** Most quality routers use the Rapid Spanning Tree Protocol (RSTP) to optimize performance and remove loops. This can cause delays upto 30 seconds or more whenever a NIC is reset. Resets are known to happen during BIOS POST, driver initialization, and some network software installation and configuration. The delay can cause errors when running IPMISH commands. It can also cause a SOL proxy session to become inactivated. You can configure your router to reduce or eliminate the delay by enabling the router option edge-port (Dell™ PowerConnect™) or port fast (Cisco). This will allow the link to remain constant and handle the optimization in real time.

**Q:** a: I performed a **Reboot and Activate Console Redirection** command using SOL Proxy, but the option to press <F2> to enter the BIOS setup never appeared.

**b:** Why do I see a connection time-out error message when I perform the **Power Reset** command using the IPMISH command line tool?

**A:** When the network switch has spanning-tree enabled, it takes about 30-40 seconds for the spanning-tree check to make sure there are no loops in the network. During this time, packet forwarding by the switch is blocked. Therefore, the software cannot communicate with the BMC until the spanning tree check is complete. When the spanning tree feature is enabled on a edge-port or port fast router, the network link can be broken for periods of time in excess of 30 seconds while the router analyzes the network. IPMISH commands can timeout during this process.

**a.** Disable spanning-tree on the edge-port or port fast router or enable the **Spanning Tree Fast** option and try performing a **Reboot and Activate Console Redirection** command using SOL Proxy again. You should now be able to enter BIOS setup by pressing <F2>.

**b:** Disabling spanning-tree will reset the power without an error message.

**Q:** Why do some key and key combinations, such as <F10> and <Ctrl><Alt><Del>, not work during console redirection?


**A:** Console redirection uses ANSI or VT 100/220 terminal emulation, which is limited to basic ASCII characters. Function keys, arrow keys, and control keys are not available in the ASCII character set, and most utilities require function keys and control keys for ordinary operations. See "Escape key sequences" for more information on the same.

**Q:** Can you use terminal mode simultaneously with BIOS console redirection?

**A:** Yes. BMC terminal mode can function simultaneously with BIOS console redirection. You can *escape* between the BMC's terminal mode and the BIOS console redirection using the following Escape sequences:

Press <Esc><q> to switch the system serial port to the BIOS console redirection text stream.

Press <Esc><( > to switch the system serial port to the BMC terminal mode text stream.

 **NOTE:** Because you are switching back and forth between two independently active text streams, data may be lost.

See your system *User's Guide* for more information about configuring and using BIOS console redirection and see "Terminal Mode Commands" for more information about using Terminal Mode commands.



## BMC Management Utility Error Codes

The following is a list of error messages for the BMC Management Utility. In case of a functional failure, an error message will be printed to `stderr`. The text of the error message is listed in the **Message** column in Table A-1.

Errors will always be printed in a parsable format such as:

```
Error (<hex-code>):<message>!
```

The following is an example:

```
Error(0xC1):Invalid Command!
```

**Table A-1. BMC Management Utility Error Codes**

Code	Classification	Message	Description	IPMI Error
A1h	Connection errors.	Connection timeout.	BMC not responding.	
		Invalid authentication type.	Authentication type error.	
A2h	Communication errors.	Communication error.	Network stack or serial communication error.	
		Data error.	Data packet format error.	0xC6, 0xC7, 0xC8, 0xCA
		Not connected.	Not connected to a remote server yet.	
A3h	Authorization errors.	Insufficient privilege for command.	Insufficient privilege level to execute command.	0xD4
		Login not authorized.	Invalid BMC username/password.	0x86
A5h	Initialization errors.	Authentication failure.	Request for a session from the local or remote proxy was rejected.	

**Table A-1. BMC Management Utility Error Codes (continued)**

Code	Classification	Message	Description	IPMI Error
		Access denied.	Trying to access the proxy from a forbidden IP address.	
		Unknown language.	Unknown language code.	
		Invalid IP address.	IP resolving error.	
		Session buffer limit exceeded.	Length exceeds the limit of telnet input.	
A6h A8h	Syntax errors.	Command syntax error.	Unable to parse command.	
		Unrecognized command.	Unrecognized command.	
		Conflicting option.	Conflicting option (-last and -max).	
		Invalid parameter.	Invalid parameter.	
A7h	Parameter value errors.	Parameter out of range.	Parameter out of range.	0xC9
		Parameter out of range (1-255).	The value is out of range (1-255).	
		Parameter out of range(1-65535)	The value is out of range (1-65535).	
		Invalid data field.	Invalid data field.	0xCC
		Invalid index value.	Index cannot be zero or a negative number.	
		First index larger than the last.	The first index is larger than the last.	
		First index larger than total SEL records.	The first index is larger than the total SEL records.	
A8h	H/W or F/W errors.	Unsupported command.	Unsupported operation.	0xC1
		Sensor not present.	Request sensor, data, or record not present.	0xCB
		Sensor command error.	Command illegal for specified sensor or record type.	0xCD

**Table A-1. BMC Management Utility Error Codes (continued)**

<b>Code</b>	<b>Classification</b>	<b>Message</b>	<b>Description</b>	<b>IPMI Error</b>
		Firmware error.	Command response could not be provided.	0xCE
		Destination error.	Cannot deliver request to destination.	0xD3
		Device error.	Device specific (OEM) errors.	0x01–0x7E
A9h	Processing errors (transient errors that may disappear upon retry of command).	BMC busy.	BMC out of processing resources.	0xC0
		Destination timeout error.	BMC timeout while processing command	0xC3
		BMC out of storage space.	BMC out of storage space required to process command.	0xC4
		Invalid reservation ID.	Invalid reservation ID.	0xC5
		Duplicate command.	Cannot execute duplicated request.	0xCF
		SDR busy.	Sensor Data Record Repository in update mode.	0xD0
		Device busy.	Device in firmware update mode.	0xD1
		BMC unavailable.	BMC initialization in progress.	0xD2
		Bad BMC state.	Request not supported in present BMC state.	0xD5
		BMC out of sessions.	No session slots are available for connection request.	0x81, 0x82, 0x83
AEh	Unexpected IPMI errors.	Invalid LUN.	Invalid Logical Unit Number (LUN) in request.	0xC2
		Unspecified error.	Unspecified error.	0xFF
AFh	Unknown error	Unknown error.	Unknown error.	



# Terminal Mode Commands

This appendix provides information about terminal mode commands.

Terminal mode allows you to directly connect to the system's Baseboard Management Controller (BMC) using a serial port connection and execute text-based commands. Two types of text commands are supported:

- A limited selection of text commands
- Standard binary Intelligent Platform Management Interface (IPMI) hex-ASCII commands

## Configuring Terminal Mode



**NOTE:** Terminal Mode can be configured through Server Administrator and the Deployment Toolkit (DTK).

To configure Terminal Mode through Server Administrator, complete the following steps:

- 1 Log in to the Server Administrator home page for the target system.
- 2 Click the **System** object.
- 3 Click the **Main System Chassis** object.
- 4 Click the **Remote Access** object.
- 5 The **BMC Information** window is displayed.
- 6 Click the **Configuration** tab.  
Under the Configuration tab, click **Serial Port**.
- 7 Click the **Terminal Mode Settings** button.

You can configure the Connection Mode Setting, Baud Rate, Flow Control, Channel Privilege Level Limit attributes on this screen.

- The Serial communication connection mode for the BMC must be set to "Direct Connect terminal Mode" for Dell™ PowerEdge™ x8xx and x9xx systems.
- "External Serial Connector" must be configured and set to "Remote Access" for PowerEdge x9xx systems. This option is available under the "Serial Communication" submenu in the BIOS setup.
  - Disable the "RAC serial Console" if you have a DRAC 5 installed. Login to the DRAC GUI, navigate to Serial from Remote Access, and disable "Enable Serial console."
- Set "Serial port 1" to "BMC Serial" for PowerEdge x8xx systems. This option is available in the BIOS Setup, under the Integrated Devices menu.

## Using Terminal Mode

Use the Terminal Mode feature to perform the following tasks:

- Power the server on or off.
- Reset the server.
- Retrieve the server's health status.
- Configure and retrieve the server management subsystems boot options.
- Configure and retrieve the BMC's terminal mode configuration.
- Execute any platform supported binary command specified in the IPMI specification using the hex-ASCII format.



**NOTE:** Many of the Terminal Mode features described in this section require an extensive knowledge of IPMI. It is strongly recommended that Terminal Mode users have an advanced understanding of IPMI before using the commands documented in this section.

## Security Information

Access to the BMC using terminal mode is governed by the proper setup of user names and password. See "Configuring Your Managed System" for more information. A session must be established with the BMC prior to accepting any terminal mode commands. A limited selection of text commands and binary hex-ASCII commands that are assigned the lowest IPMI privilege level are available prior to session establishment with the BMC.

Since the terminal mode password is sent using clear text, it is highly desirable that the terminal mode session takes place in a secure location over a secure link by using a direct connection.

## Syntax

Terminal mode messages follow the general syntax below:

```
[<message data>]<newline sequence>
```

Each terminal mode message must be preceded with the left bracket "start" character and must be ended with a right bracket "stop" character and the appropriate input new-line sequence.

No input characters are accepted until the start character has been received.



**NOTE:** Hex-ASCII commands can either use upper or lower-case letters for ASCII representations of hex digits.

## Command Length

Terminal mode messages are limited to a maximum length of 122 characters. This includes the left- and right-brackets, but not control characters.

## Character Support

Terminal mode messages are composed of standard printable ASCII characters. All other characters are treated as illegal characters.

### Special Character Handling — <ESC> character

The <ESC> character deletes an entire message prior to submission to the BMC for processing. If line editing is enabled, and the <ESC> key is followed by an input newline sequence, the BMC responds by outputting an output newline sequence. Otherwise, the BMC looks for the next start character.

### Special Character Handling — <DEL> or <BKSP> character

The <BKSP> or <DEL> key deletes the last character entered if the message has not been submitted to the BMC yet.

### Special Character Handling — Line Continuation character

Long IPMI messages can be split across multiple lines by using the line continuation <BACKSLASH> character followed immediately by an input newline sequence. Line continuation character usage is supported for both text and hex-ASCII commands.

### Special Character Handling — Illegal characters

Any illegal characters received by the BMC clear the message in progress and the BMC looks for the next start character.

## Hex-ASCII Command Format

Binary IPMI commands are sent and received as a series of case-insensitive hex-ASCII pairs, where each is separated from the preceding pair by a single <space> character. Table B-1 lists the terminal mode requests to BMC and Table B-2 lists the terminal mode responses from BMC. The following is an example of a binary IPMI request message:

```
[18 00 22]<newline sequence>
```

**Table B-1. Terminal Mode Request to BMC**

Byte	Explanation
1	[7:2] – Net Function (even) [1:0] – Responder’s LUN
2	[7:2] – Requester’s Sequence Number [1:0] – Bridge field
3	Command Number
4:N	Data

**Table B-2. Terminal Mode Response from BMC**

Byte	Explanation
1	[7:2] – Net Function (odd) [1:0] – Responder’s LUN
2	[7:2] – Requester’s Sequence Number [1:0] – Bridge field
3	Command Number
4	Completion Code
5:N	Data

## Text Command Format

Text commands do not support the bridging and sequence number fields present in the hex-ASCII commands. In addition, text commands are preceded by a prefix consisting of the string `SYS`. Table B-3 lists the terminal mode text commands and Table B-4 lists the terminal mode configuration.

### Examples

Hex-ASCII command example (IPMI Reset Watchdog Cmd):

```
[18 00 22] <CR>
```

```
[1C 00 22 00] <CR-LF>
```

Text command example:

```
[SYS TMODE] <CR>
```

```
[OK TMODE] <CR-LF>
```



**Table B-3. Terminal Mode Text Commands**

<b>Command</b>	<b>Switches</b>	<b>Description</b>
SYS PWD	-U USERNAME <password>	<p>-U activates a terminal mode session. USERNAME corresponds to the ASCII text for the username. &lt;password&gt; represents a printable password (up to 16 characters). If &lt;password&gt; is not provided, then a Null password (all binary 0's) is submitted. Passwords are case sensitive.</p> <p>Either the <b>SYS PWD</b> command or the Activate Session IPMI message must be successfully executed before any command or IPMI messages are accepted.</p> <p><b>NOTE: A modem connection may be automatically dropped if multiple bad passwords are entered.</b></p>
	-N <password>	<p>-N represents a Null username and &lt;password&gt; represents a printable password (up to 16 characters). If &lt;password&gt; is not provided, then a Null password (all binary 0's) is submitted. Passwords are case sensitive.</p> <p>Either the <b>SYS PWD</b> command or the Activate Session IPMI message must be successfully executed before any command or IPMI messages are accepted.</p> <p><b>NOTE: A modem connection may be automatically dropped if multiple bad passwords are entered.</b></p>
	-X	<p>-X immediately logs out any presently active session.</p> <p><b>NOTE: Entering an invalid password with -U or -N does not allow you to log on.</b></p>
SYS TMODE		<p>Used as a no-op confirm that Terminal Mode is active. The BMC returns an OK response followed by TMODE.</p>
SYS SET BOOT XX YY ZZ AA BB		<p>Sets the boot flags to direct a boot to the specified device following the next IPMI command or action initiated reset or power-on. XX...BB represent five hex-ASCII encoded bytes, which are the boot flags parameter in the Boot Option Parameters.</p> <p>Upon receiving this command, the BMC automatically sets the valid bit in the boot options and sets all the Boot Initiator Acknowledge data bits to 1b.</p>

**Table B-3. Terminal Mode Text Commands (continued)**

Command	Switches	Description
SYS SET BOOTOPT XX YY...NN		<p>This is a text version of the IPMI <b>Set System Boot Options</b> command. It allows any of the boot option parameters to be set, not just the boot flags. XX YY...NN represent the hex-ASCII encoding for the data bytes that are passed in the Set System Boot Options request.</p> <p>XX — Parameter valid.</p> <p>[7] — 1b = Mark parameter invalid / locked. 0b = Mark parameter valid / unlocked.</p> <p>[6:0] — Boot option parameter selector .</p> <p>YY...NN — Boot Option Parameter Data.</p> <p>Passing 0-bytes of parameter data allows the parameter valid bit to be changed without affecting the present parameter setting.</p>
SYS GET BOOTOPT XX YY ZZ		<p>This is a text version of the IPMI <b>Get System Boot Options</b> command. It allows any of the boot option parameters to be retrieved.</p> <p>XX YY ZZ represents the hex-ASCII for the data bytes that are passed in the Get System Boot Options request.</p> <p>The BMC returns the data from the command in hex-ASCII format.</p> <p>XX—Parameter selector.</p> <p>[7]—Reserved.</p> <p>[6:0]—Boot option parameter selector.</p> <p>YY—Set Selector.</p> <p>[7:0]—Selects a particular block or set of parameters under the given parameter selector.</p> <p>Write as 00h if the parameter does not use a Set Selector.</p> <p>ZZ—Block Selector.</p> <p>Selects a particular block within a set of parameters</p> <p>Write as 00h if the parameter does not use a Block Selector.</p> <p><b>NOTE:</b> There are no IPMI-specified Boot Options parameters that use the block selector. However, this field is provided for consistency with other configuration commands and as a placeholder for future extension of the IPMI specification.</p>

**Table B-3. Terminal Mode Text Commands (continued)**

<b>Command</b>	<b>Switches</b>	<b>Description</b>
SYS SET TCFG		Returns the Terminal Mode Configuration bytes where XX and YY represent hex-ASCII encoding for the volatile version of data bytes 1 and 2 as specified in Table B-4, and AA BB represent hex-ASCII encoding of the non-volatile version. V:XX <output termination sequence> N:AA BB <output termination sequence>
	-V XX YY	Sets the volatile Terminal Mode Configuration. XX and YY represent hex-ASCII encoding for data bytes 1 and 2 as specified in Table B-4. The BMC returns the same output as for SYS SET TCFG, above.
	-N XX YY	Sets the non-volatile Terminal Mode Configuration. XX and YY represent hex-ASCII encoding for data bytes 1 and 2 as specified in Table B-4. The BMC returns the same output as for SYS SET TCFG, above.
SYS RESET		Directs the BMC to perform an immediate system hard reset.
SYS POWER OFF		Directs the BMC to perform an immediate system power off.
SYS POWER ON		Causes the BMC to initiate an immediate system power on.

**Table B-3. Terminal Mode Text Commands (continued)**

Command	Switches	Description
SYS HEALTH QUERY		<p>Causes the BMC to return a high level version of the system health status in "terse" format. The BMC returns a string with the following format if the command is accepted.</p> <pre>PWR:zzz H:xx T:xx V:xx PS:xx C:xx D:xx S:xx O:xx</pre> <p>Where:</p> <p>PWR is system POWER state.</p> <p>H is overall Health.</p> <p>T is Temperature.</p> <p>V is Voltage.</p> <p>PS is Power Supply subsystem.</p> <p>C is cooling subsystem (Fans).</p> <p>D is Hard Drive / RAID Subsystem.</p> <p>S is physical Security.</p> <p>O is Other (OEM).</p> <p>zzz is: ON, OFF (soft-off or mechanical off), SLP (sleep - used when sleep level cannot be distinguished), S4, S3, S2, S1, ?? (unknown).</p> <p>and xx is: ok, nc, cr, nr, uf, or ?? where:</p> <p>ok = OK (monitored parameters within normal operating ranges).</p> <p>nc = non-critical ("warning": hardware outside normal operating range).</p> <p>cr = critical ("fatal": hardware exceeding specified ratings).</p> <p>nr = non-recoverable ("potential damage": system hardware in jeopardy or damaged).</p> <p>uf = unspecified fault (fault detected, but severity unspecified).</p> <p>?? = status not available/unknown (typically because system power is OFF).</p>

**Table B-3. Terminal Mode Text Commands (continued)**

<b>Command</b>	<b>Switches</b>	<b>Description</b>
SYS HEALTH QUERY	-V	<p>Causes the BMC to return a high level version of the system health status in multi-line "verbose" format. The BMC returns a string of the following format:</p> <p>SYS Health:xx&lt;output termination sequence&gt;.</p> <p>Power: <b>ON</b>, <b>OFF</b> (soft-off or mechanical off), <b>SLEEP</b> (sleep - used when can't distinguish sleep level), S4, S3, S2, S1, Unknown.</p> <p>Temperature:xx&lt;output termination sequence&gt;.</p> <p>Voltage:xx&lt;output termination sequence&gt;.</p> <p>PowerSystem:xx&lt;output termination sequence&gt;.</p> <p>Cooling:xx&lt;output termination sequence&gt;.</p> <p>Drives:xx&lt;output termination sequence&gt;.</p> <p>Security:xx&lt;output termination sequence&gt;.</p> <p>Other:xx&lt;output termination sequence&gt;.</p> <p>Where xx is:</p> <p><b>OK</b> (monitored parameters within normal operating ranges).</p> <p><b>Non-critical</b> ("warning": hardware outside normal operating range).</p> <p><b>Critical</b> ("fatal" :hardware exceeding specified ratings).</p> <p><b>Non-recoverable</b> ("potential damage": system hardware in jeopardy or damaged).</p> <p><b>Unspecified fault</b> (fault detected, but severity unspecified).</p> <p><b>Unknown</b> (status not available/unknown (typically because system power is OFF)).</p>
SYS IDENTIFY		<p>Causes the BMC to indicate the system's location in a rack of systems, for example, with a blinking led or beep. The BMC will indicate the system's location only for fifteen seconds. This is a text version of the optional <b>Chassis Identify</b> command.</p>
SYS IDENTIFY	-ON<XX>	<p>Causes the BMC to indicate the system's location, for example, with a blinking LED or beep for a specific period of time.</p> <p>XX is an optional hex-ASCII byte representing the number of seconds the BMC is to cause the system to identify itself. If XX is not provided, the BMC will indicate the system's location only for fifteen seconds. This is a text version of the optional <b>Chassis Identify</b> command.</p>
SYS IDENTIFY	-OFF	<p>Causes the BMC to stop indicating the system's location. This has no effect if the system is not currently identifying itself. This is a text version of the optional <b>Chassis Identify</b> command.</p>

**Table B-4. Terminal Mode Configuration**

Byte	Explanation
1	<p>[7:6]—Reserved.</p> <p>[5]—Line Editing.</p> <p>0b = Disable.</p> <p>1b = Enable (Factory default).</p> <p>[4]—Reserved.</p> <p>[3:2]—Delete control (only applies when line editing is enabled).</p> <p>00b = BMC outputs a &lt;DEL&gt; character when &lt;BKSP&gt; or &lt; DEL &gt; is received.</p> <p>01b = BMC outputs a &lt; BKSP &gt;&lt; SP &gt;&lt; BKSP &gt; sequence when &lt; BKSP &gt; or &lt; DEL &gt; is received (Factory default).</p> <p>[1]—Echo control 0b = No echo 1b = Echo (BMC echoes characters it receives) (Factory default).</p> <p>[0]—Handshaking—BMC outputs a [SYS]&lt;newline&gt; after receiving each terminal mode IPMI message and is ready to accept the next message.</p> <p>0b = Disable.</p> <p>1b = Enable (Factory default).</p>
2	<p>[7:4] - Output newline sequence (BMC to console). Selects what characters the BMC uses as the &lt;newline&gt; sequence when the BMC writes a line to the console in Terminal Mode.</p> <p>0h = no termination sequence.</p> <p>1h = &lt;CR-LF&gt; (Factory default)</p> <p>2h = &lt;NULL&gt;</p> <p>3h = &lt;CR&gt;</p> <p>4h = &lt;LF-CR&gt;</p> <p>5h = &lt;LF&gt;</p> <p>All other = reserved</p> <p>[3:0] - Input newline sequence (Console to BMC). Selects what characters the console uses as the &lt;newline&gt; sequence when writing to the BMC in Terminal Mode.</p> <p>0h = reserved</p> <p>1h = &lt;CR&gt; (Factory default)</p> <p>2h = &lt;NULL&gt;</p> <p>All other = reserved</p>

## Escape key sequences

Console redirection uses ANSI or VT100/220 terminal emulation, which are limited to basic ASCII characters. There are no function keys, arrow keys, or control keys in this character set. However, most BIOS software requires the use of function keys and control keys for ordinary actions. Specific function keys and escape keys can be emulated by using a special key sequence, called an escape sequence, to represent a specific key.

Use the Escape sequences, listed in the following table, for keys while setting console redirection in BIOS through serial port. These keys are also listed during BIOS POST. Press the spacebar to pause and view the list. Supported sequences are also listed in the history of the system's telnet client.

**Table C-1. Escape sequences for specific keys**

Key	Supported sequences
F10	<Esc><0>
F12	<Esc><@>
<Ctrl><M>	<Esc><Ctrl><M>
<Ctrl><H>	<Esc><Ctrl><H>
<Ctrl><I>	<Esc><Ctrl><I>
<Ctrl><J>	<Esc><Ctrl><J>
<Alt><X>	<Esc><X><X>
<Ctrl><Alt><Del>	<Esc><R><Esc><r><Esc><R>






# Serial Port Console Redirection

The Serial Port Console Redirection (SPCR) table provides information about how the system firmware and service processor use the out-of-band (OOB) management port. For example, if the OOB Management port is a serial port, the SPCR table contains information such as serial port number, baud terminal type, and other settings used for OOB communication. The SPCR table is read by the Special Administrative Console (SAC) for console redirection and configures itself automatically during a bootable CD installation.

The SPCR table is automatically enabled if the system service processor supports Emergency Management Services (EMS) such as console redirection. If it is not configured automatically, you must configure SPCR to match BMC settings by adding the following parameters to the `unattend.txt` file.

 **NOTE:** The `unattend.txt` file is automatically created after installation.

[Data]

*EMSPort*

*EMSBAudrate*

Where,


EMSPort = Port used for serial communication. For example, COM1 or COM2.


EMSBAudrate = Configured baud rate for communication. The minimum supported baud rates for supported Dell™ PowerEdge™ systems is 19200.

## Serial Console redirection with SOL Proxy

### Configuring Linux for Serial Redirection During Boot

The "SysRq key" is a key sequence that allows basic commands to be passed directly to the kernel for debugging. Under some circumstances, it can also be used to reboot remote managed systems. The serial console uses the RS-232 break function as the SysRq key. A "break" is a period of no transmission on the serial line. To configure the "Sysrq" key in systems running Linux, follow the instructions given below:

 **NOTE:** The following instructions are specific to the Linux GRand Unified Bootloader (GRUB). Similar changes would be necessary for using a different boot loader.

 **NOTE:** In configuring the client VT100 emulation window, you must set the window or application that is displaying the redirected console to 25 rows x 80 columns to ensure proper text display; otherwise, some text screens may be garbled.

Edit the file `/etc/grub.conf`, as follows. See the sample file that follows, which shows the changes described in this procedure.

- 1 Add the following two new lines in the *general settings* section of the file:  
`serial --unit=0 --speed=19200`  
`terminal --timeout=10 serial`
- 2 Append two options to the kernel line:  
`kernel ..... console=ttyS0,19200`
- 3 If the `/etc/grub.conf` contains a `splashimage` directive, you must comment it out.

**Table D-1. Sample File: `/etc/grub.conf`**

---

```
# grub.conf generated by anaconda
#
Note that you do not have to rerun grub after making changes to this file
# NOTICE:  You do not have a /boot partition.  This means that
#           all kernel and initrd paths are relative to /, e.g.
#
#           root (hd0,0)
#           kernel /boot/vmlinuz-version ro root=/dev/sda1
#           initrd /boot/initrd-version.img
#boot=/dev/sda
default=0
timeout=10
#splashimage=(hd0,2)/grub/splash.xpm.gz

serial --unit=0 --speed=19200
terminal --timeout=10 serial

title Red Hat Linux Advanced Server (2.4.9-e.3smp)
  root (hd0,0)
  kernel /boot/vmlinuz-2.4.9-e.3smp ro root=/dev/sda1 hda=ide-scsi
console=tty0 console=ttyS0,19200
  initrd /boot/initrd-2.4.9-e.3smp.img
title Red Hat Linux Advanced Server-up (2.4.9-e.3
  root (hd0,00)
  kernel /boot/vmlinuz-2.4.9-e.3 ro root=/dev/sda1 s
  initrd /boot/initrd-2.4.9-e.3.im
```

---

Additional information for editing the `grub.conf`:

- 1 You may need to disable GRUB's graphical interface and use the text-based interface instead; otherwise, the GRUB screen will not be displayed in BMU console redirection. To do so, comment out the line starting with `splashimage`.
- 2 If you have multiple options in GRUB and you want all of them to start a console session through the BMU serial connection, add `console=ttyS1,19200` to all options. The preceding example shows `console=ttyS0,19200` added to only the first option.

## Enabling Login to the Console After Boot

Edit the file `/etc/inittab`, as follows:

Add a new line to configure a `getty` on the COM1 serial port:

```
co:2345:respawn:/sbin/agetty -h -L 19200 ttyS0 vt100
```

See the sample file, which shows the addition of the new line.

**Table D-2. Sample File: `/etc/inittab`**

---

```
#
# inittab      This file describes how the INIT process should set up
#              the system in a certain run-level.
#
# Author:      Miquel van Smoorenburg, <miquels@drinkel.nl.mugnet.org
#              Modified for RHS Linux by Marc Ewing and Donnie Barnes
#
# Default runlevel. The runlevels used by RHS are:
#  0 - halt (Do NOT set initdefault to this)
#  1 - Single user mode
#  2 - Multiuser, without NFS (The same as 3, if you do not have
#     networking)
#  3 - Full multiuser mode
#  4 - unused
#  5 - X11
#  6 - reboot (Do NOT set initdefault to this)
#
id:3:initdefault:

# System initialization.
si::sysinit:/etc/rc.d/rc.sysinit
```

**Table D-2. Sample File: `/etc/inittab` (*continued*)**

---

```
l0:0:wait:/etc/rc.d/rc 0
l1:1:wait:/etc/rc.d/rc 1
l2:2:wait:/etc/rc.d/rc 2
l3:3:wait:/etc/rc.d/rc 3
l4:4:wait:/etc/rc.d/rc 4
l5:5:wait:/etc/rc.d/rc 5
l6:6:wait:/etc/rc.d/rc 6

# Things to run in every runlevel.
ud::once:/sbin/update

# Trap CTRL-ALT-DELETE
ca::ctrlaltdel:/sbin/shutdown -t3 -r now

# When our UPS tells us power has failed, assume we have a few
# minutes of power left. Schedule a shutdown for 2 minutes from now.
# This does, of course, assume you have power installed and your
# UPS is connected and working correctly.
pf::powerfail:/sbin/shutdown -f -h +2 "Power Failure; System Shutting Down"
# If power was restored before the shutdown kicked in, cancel it.
pr:12345:powerokwait:/sbin/shutdown -c "Power Restored; Shutdown Cancelled"

# Run gettys in standard runlevels
co:2345:respawn:/sbin/agetty -h -L 19200 ttyS0 vt100
1:2345:respawn:/sbin/mingetty tty1
2:2345:respawn:/sbin/mingetty tty2
3:2345:respawn:/sbin/mingetty tty3
4:2345:respawn:/sbin/mingetty tty4
5:2345:respawn:/sbin/mingetty tty5
6:2345:respawn:/sbin/mingetty tty6

# Run xdm in runlevel 5
# xdm is now a separate service
x:5:respawn:/etc/X11/prefdm -nodaemon
```

---

Edit the file `/etc/securetty`, as follows:

Add a new line, with the name of the serial tty for COM1:

```
ttyS0
```

See the sample file, which shows the addition of the new line.

**Table D-3. Sample File: /etc/securetty**

---

vc/1  
vc/2  
vc/3  
vc/4  
vc/5  
vc/6  
vc/7  
vc/8  
vc/9  
vc/10  
vc/11  
tty1  
tty2  
tty3  
tty4  
tty5  
tty6  
tty7  
tty8  
tty9  
tty10  
tty11  
ttyS0

---



# Glossary

The following list defines or identifies technical terms, abbreviations, and acronyms used in your system documents.

## **adapter card**

An expansion card that plugs into an expansion-card connector on the system's system board. An adapter card adds some specialized function to the system by providing an interface between the expansion bus and a peripheral device. Examples of adapter cards include network cards, sound cards, and SCSI adapters.

## **ANSI**

Abbreviation for American National Standards Institute.

## **API**

Abbreviation for application program interface, which is a set of routines, protocols, and tools for building software applications that act as an interface between the operating system and application programs.

## **Argument**

The value supplied with an option, such as in the following command line instance:

```
utilname --option=argument
```

## **ARP**

Acronym for Address Resolution Protocol, which is a method for finding a host's Ethernet address from its Internet address.

## **ASCII**

Acronym for American Standard Code for Information Interchange. A text file containing only characters from the ASCII character set (usually created with a text editor, such as Notepad in Microsoft® Windows®), is called an ASCII file.

## **asset tag code**

An individual code assigned to a system, usually by a system administrator, for security or tracking purposes.

## **autoexec.bat file**

The **autoexec.bat** file is executed when you boot your system (after executing any commands in the **config.sys** file). This start-up file contains commands that define the characteristics of each device connected to your system, and it finds and executes programs stored in locations other than the active directory.

## **backup**

A copy of a program or data file. As a precaution, you should back up your system's hard drive on a regular basis. Before making a change to the configuration of your system, you should back up important start-up files from your operating system.

## **baud rate**

A measurement of data transmission speed. For example, modems are designed to transmit data at one or more specified baud rate(s) through the COM (serial) port of a system.

## **binary**

A base-2 numbering system that uses 0 and 1 to represent information. The system performs operations based on the ordering and calculation of these numbers.

## **BIOS**

Acronym for basic input/output system. Your system's BIOS contains programs stored on a flash memory chip. The BIOS controls the following:

- Communications between the microprocessor and peripheral devices, such as the keyboard and the video adapter
- Miscellaneous functions, such as system messages

**bit**

The smallest unit of information interpreted by your system.

**BMC**

Abbreviation for baseboard management controller, which is a controller that provides the intelligence in the IPMI structure.

**boot routine**

When you start your system, it clears all memory, initializes devices, and loads the operating system. Unless the operating system fails to respond, you can reboot (also called warm boot) your system by pressing <Ctrl><Alt><Del>; otherwise, you must perform a cold boot by pressing the reset button or by turning the system off and then back on.

**bootable diskette**

You can start your system from a diskette. To make a bootable diskette on a system running Windows, insert a diskette in the diskette drive, type `sys a:` at the command line prompt, and press <Enter>. Use this bootable diskette if your system will not boot from the hard drive.

**bus**

An information pathway between the components of a system. Your system contains an expansion bus that allows the microprocessor to communicate with controllers for all the various peripheral devices connected to the system. Your system also contains an address bus and a data bus for communications between the microprocessor and RAM.

**byte**

Eight contiguous bits of information, the basic data unit used by your system.

**cache**

A fast storage area that keeps a copy of data or instructions for quicker data retrieval. For example, your system's BIOS may cache ROM code in faster RAM. Or, a disk-cache utility may reserve RAM in which to store frequently accessed information from

your system's disk drives; when a program makes a request to a disk drive for data that is in the cache, the disk-cache utility can retrieve the data from RAM faster than from the disk drive.

**CD-ROM**

Abbreviation for compact disc read-only memory. CD drives use optical technology to read data from CDs. CDs are read-only storage devices; you cannot write new data to a CD with standard CD drives.

**CHAP**

Acronym for Challenge-Handshake Authentication Protocol, an authentication scheme used by PPP servers to validate the identity of the originator of the connection upon connection or any time later.

**CLI**

Abbreviation for command line interface.

**Command**

The combination of an option and argument or just an option if no argument is required, such as in the following command line instances:

```
utilname --option
```

```
utilname --option=argument
```

**command line instance**

A series of valid commands, options, and arguments typed in the command line. For example, the Deployment Toolkit utility name and all necessary options and arguments as they are entered through the OS shell:

```
A:>utilname --option --option=argument
```

**COM<sub>n</sub>**

The device names for the first through fourth serial ports on your system are COM1, COM2, COM3, and COM4. The default interrupt for COM1 and COM3 is IRQ4, and the default interrupt for COM2 and COM4 is IRQ3. Therefore, you must be careful when configuring software that runs a serial device so that you don't create an interrupt conflict.



**config.sys file**

The `config.sys` file is executed when you boot your system (before running any commands in the `autoexec.bat` file). This start-up file contains commands that specify which devices to install and which drivers to use. This file also contains commands that determine how the operating system uses memory and controls files.

**console redirection**

Console redirection is a function that directs a managed system's display screen, mouse functions, and keyboard functions to the corresponding devices on a management station. You may then use the management station's system console to control the managed system.

**controller**

A chip that controls the transfer of data between the microprocessor and memory or between the microprocessor and a peripheral device such as a disk drive or the keyboard.

**control panel**

The part of the system that contains indicators and controls, such as the power switch, hard drive access indicator, and power indicator.

**conventional memory**

The first 640 KB of RAM. Conventional memory is found in all systems. Unless they are specially designed, MS-DOS® programs are limited to running in conventional memory.

**CPU**

Abbreviation for central processing unit. See also microprocessor.

**device driver**

A program that allows the operating system or some other program to interface correctly with a peripheral device, such as a printer. Some device drivers—such as network drivers—must be loaded from the `config.sys` file (with a `device=` statement) or as memory-resident programs (usually, from the `autoexec.bat` file). Others—such as video drivers—must load when you start the program for which they were designed.

**DHCP**

Abbreviation for Dynamic Host Configuration Protocol, a protocol that provides a means to dynamically allocate IP addresses to computers on a LAN.

**DIMM**

Acronym for dual in-line memory module. A small circuit board containing DRAM chips that connects to the system board.

**directory**

Directories help keep related files organized on a disk in a hierarchical, "inverted tree" structure. Each disk has a "root" directory; for example, a `C:\>` prompt normally indicates that you are at the root directory of hard drive C. Additional directories that branch off of the root directory are called subdirectories. Subdirectories may contain additional directories branching off of them.

**DKS**

Abbreviation for dynamic kernel support.

**DTK**

Abbreviation for Deployment ToolKit.

**DMA**

Abbreviation for direct memory access. A DMA channel allows certain types of data transfer between RAM and a device to bypass the microprocessor.

**DRAC II**

Acronym for Dell OpenManage™ Remote Assistant Card, version 2.

**DRAC III**

Acronym for Dell™ Remote Access Card III.

**DRAC III/XT**

Acronym for Dell Remote Access Card III/XT.

**DRAC 4**

Acronym for Dell Remote Access Card 4.

**DRAC MC**

Acronym for Dell Remote Access Card MC.

**DRAM**

Acronym for dynamic random-access memory. A system's RAM is usually made up entirely of DRAM chips. Because DRAM chips cannot store an electrical charge indefinitely, your system continually refreshes each DRAM chip in the system.

**EEPROM**

Acronym for electrically erasable programmable read-only memory.

**EIDE**

Abbreviation for enhanced integrated drive electronics. EIDE devices add one or more of the following enhancements to the traditional IDE standard:

- Data transfer rates of up to 16 MB/sec
- Support for drives other than just hard drives, such as CD and tape drives
- Support for hard drives with capacities greater than 528 MB
- Support for up to two controllers, each with up to two devices attached

**EMM**

Abbreviation for expanded memory manager. A utility that uses extended memory to emulate expanded memory on systems with an Intel386™ or higher microprocessor.

**EMS**

Abbreviation for Expanded Memory Specification.

**EPROM**

Acronym for erasable programmable read-only memory.

**ERA**

Abbreviation for embedded remote access.

**ERA/MC**

Abbreviation for embedded remote access modular computer. See modular system.

**ERA/O**

Abbreviation for embedded remote access option.

**ESM**

Abbreviation for embedded systems management, which is a set of instruction coding in system software and firmware that notifies a user about potential hardware problems on a system.

**expanded memory**

A technique for accessing RAM above 1 MB. To enable expanded memory on your system, you must use an EMM. You should configure your system to support expanded memory only if you run application programs that can use (or require) expanded memory.

**extended memory**

RAM above 1 MB. Most software that can use it, such as the Windows operating system, requires that extended memory be under the control of an XMM.

**external cache memory**

A RAM cache using SRAM chips. Because SRAM chips operate at several times the speed of DRAM chips, the microprocessor can retrieve data and instructions faster from external cache memory than from RAM.

**FAT**

Acronym for file allocation table. FAT and FAT32 are file systems that are defined as follows:

- **FAT** — A file system used by MS-DOS, Windows 3.x, Windows 95, and Windows 98. Windows NT® and Windows 2000 also can use the FAT file system. The operating system maintains a table to keep track of the status of various segments of disk space used for file storage.
- **FAT32** — A derivative of the FAT file system. FAT32 supports smaller cluster sizes than FAT, thus providing more efficient space allocation on FAT32 drives.

**FEPRM**

Acronym for flash erasable programmable read-only memory. Flash memory is a kind of nonvolatile storage device similar to EEPROM, but the erasing is done only in blocks or the entire chip.

**firmware**

Software (programs or data) that has been written onto read-only memory (ROM). Firmware can boot and operate a device. Each controller contains firmware which helps provide the controller's functionality.

**flash bios**

A BIOS that is stored in flash memory rather than in ROM. A flash BIOS chip can be updated in place, whereas a ROM BIOS must be replaced with a newer chip.

**flash memory**

A type of EEPROM chip that can be reprogrammed from a utility on diskette while still installed in a system; most EEPROM chips can only be rewritten with special programming equipment.

**format**

To prepare a hard drive or diskette for storing files. An unconditional format deletes all data stored on the disk.

**FRU**

Abbreviation for field replaceable unit, which identifies a module or component that will typically be replaced in its entirety as part of a field service repair operation.

**function commands**

Commands that specify an action to be performed.

**GB**

Abbreviation for gigabyte(s). A gigabyte equals 1024 megabytes or 1,073,741,824 bytes.

**graphics mode**

A video mode that can be defined as x horizontal by y vertical pixels by z colors.

**GUI**

Acronym for graphical user interface.

**GUID**

Abbreviation for Globally Unique Identifier, which is a random number used in software applications. Each generated GUID is supposed to be unique.

**h**

Abbreviation for hexadecimal. A base-16 numbering system, often used in programming to identify addresses in the system's RAM and I/O memory addresses for devices. The sequence of decimal numbers from 0 through 16, for example, is expressed in hexadecimal notation as: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F, 10. In text, hexadecimal numbers are often followed by h.

**HBA**

Abbreviation for host bus adapter. A PCI adapter card that resides in the system whose only function is to convert data commands from PCI-bus format to storage interconnect format (examples: SCSI, Fibre Channel) and communicate directly with hard drives, tape drives, CD drives, or other storage devices.

**HMA**

Abbreviation for high memory area. The first 64 KB of extended memory above 1 MB. A memory manager that conforms to the XMS can make the HMA a direct extension of conventional memory. Also see XMM.

**host adapter**

A host adapter implements communication between the system's bus and the controller for a peripheral device. (hard drive controller subsystems include integrated host adapter circuitry.) To add a SCSI expansion bus to your system, you must install or connect the appropriate host adapter.

**HPFS**

Abbreviation for the High Performance File System option in the Windows NT operating systems.

**HTTP**

Abbreviation for Hypertext Transfer Protocol. HTTP is the client-server TCP/IP protocol used on the World Wide Web for the exchange of HTML documents.

**HTTPS**

Abbreviation for HyperText Transmission Protocol, Secure. HTTPS is a variant of HTTP used by Web browsers for handling secure transactions. HTTPS is a unique protocol that is simply SSL underneath HTTP. You need to use "https://" for HTTP URLs with SSL, whereas you continue to use "http://" for HTTP URLs without SSL.

**ID**

Abbreviation for identifier, commonly used when referring to a user identifier (user ID), object identifier (object ID), or hardware identifier (controller ID).

**IDE**

Abbreviation for Integrated Drive Electronics. IDE is a computer system interface, used primarily for hard drives and CDs.

**I/O**

Abbreviation for input/output. The keyboard is an input device, and a printer is an output device. In general, I/O activity can be differentiated from computational activity. For example, when a program sends a document to the printer, it is engaging in output activity; when the program sorts a list of terms, it is engaging in computational activity.

**internal microprocessor cache**

An instruction and data cache built in to the microprocessor. The Intel® Pentium® microprocessor includes a 16-KB internal cache, which is set up as an 8-KB read-only instruction cache and an 8-KB read/write data cache.

**IP address**

Abbreviation for Internet Protocol address. See TCP/IP.

**IPMI**

Abbreviation for Intelligent Platform Management Interface, which is an industry standard for management of peripherals used in enterprise systems based on Intel® architecture. The key characteristic of IPMI is that inventory, monitoring, logging, and recovery control functions are available independent of the main processors, BIOS, and operating system.

**IRQ**

Abbreviation for interrupt request. A signal that data is about to be sent to or received by a peripheral device travels by an IRQ line to the microprocessor. Each peripheral connection must be assigned an IRQ number. For example, the first serial port in your system (COM1) is assigned to IRQ4 by default. Two devices can share the same IRQ assignment, but you cannot operate both devices simultaneously.

**KB**

Abbreviation for kilobyte(s), 1024 bytes.

**key combination**

A command requiring you to press multiple keys at the same time. For example, you can reboot your system by pressing the <Ctrl><Alt><Del> key combination.

**LAN**

Acronym for local area network. A LAN system is usually confined to the same building or a few nearby buildings, with all equipment linked by wiring dedicated specifically to the LAN.

**local bus**

On a system with local-bus expansion capability, certain peripheral devices (such as the video adapter circuitry) can be designed to run much faster than they would with a traditional expansion bus. Some local-bus designs allow peripherals to run at the same speed and with the same width data path as the system's microprocessor.

**LPT $n$** 

The device names for the first through third parallel printer ports on your system are LPT1, LPT2, and LPT3.

**LRA**

Abbreviation for local response agent.

**MB**

Abbreviation for megabyte(s). The term megabyte means 1,048,576 bytes; however, when referring to hard drive storage, the term is often rounded to mean 1,000,000 bytes.

**memory**

A system can contain several different forms of memory, such as RAM, ROM, and video memory. Frequently, the word memory is used as a synonym for RAM; for example, an unqualified statement such as "a system with 16 MB of memory" refers to a system with 16 MB of RAM.

**memory address**

A specific location, usually expressed as a hexadecimal number, in the system's RAM.

**memory manager**

A utility that controls the implementation of memory in addition to conventional memory, such as extended or expanded memory.

**memory module**

A small circuit board containing DRAM chips that connects to the system board.

**MHz**

Abbreviation for megahertz.

**microprocessor**

The primary computational chip inside the system that controls the interpretation and execution of arithmetic and logic functions. Software written for one microprocessor must usually be revised to run on another microprocessor. CPU is a synonym for microprocessor.

**modem**

A device that allows your system to communicate with other systems over telephone lines.

**modular system**

A system that can include multiple server modules. Each server module functions as an individual system. To function as a system, a server module is inserted into a chassis which includes power supplies, fans, a system management module, and at least one network switch module. The power supplies, fans, system management module, and network switch module are shared resources of the server modules in the chassis. See server module.

**MS-DOS**

Acronym for Microsoft Disk Operating System.

**NIC**

Acronym for network interface controller.

**NTFS**

Abbreviation for the Windows NT File System option in the Windows NT operating system. NTFS is an advanced file system designed for use specifically within the Windows NT operating system. It supports file system recovery, extremely large storage media, and long file names. It also supports object-oriented applications by treating all files as objects with user-defined and system-defined attributes. See also FAT and FAT32.

**NVRAM**

Acronym for nonvolatile random-access memory. Memory that does not lose its contents when you turn off your system. NVRAM is used for maintaining the date, time, and system configuration information.

**option**

An argument to a command that modifies its function rather than providing data and is usually set off by a delimiter such as - or /. Some options may or must be followed by a value, for example:

```
utilname -option=argument
```

**parameter**

A value or option that you specify to a program. A parameter is sometimes called a switch or an argument.

**partition**

You can divide a hard drive into multiple physical sections called partitions with the `fdisk` command. Each partition can contain multiple logical drives. After partitioning the hard drive, you must format each logical drive with the `format` command.

**PCI**

Abbreviation for Peripheral Component Interconnect. The predominant 32-bit or 64-bit local-bus standard developed by Intel Corporation.

**PCMCIA**

Personal Computer Memory Card International Association. An international trade association that has developed standards for devices, such as modems and external hard drives, that can be plugged into portable computers.

**PERC**

Acronym for Expandable RAID controller.

**peripheral device**

An internal or external device—such as a printer, a disk drive, or a keyboard—connected to a system.

**Plug and Play**

An industry-standard specification that makes it easier to add hardware devices to personal computers. Plug and Play provides automatic installation and configuration, compatibility with existing hardware, and dynamic support of mobile computing environments.

**POST**

Acronym for power-on self-test. Before the operating system loads when you turn on your system, the POST tests various system components such as RAM, the disk drives, and the keyboard.

**pre-operating system environment**

A shell environment, such as DOS, used to configure system hardware before a major operating system, such

as Microsoft Windows or Red Hat® Enterprise Linux, is installed.

**program diskette set**

The set of diskettes from which you can perform a complete installation of an operating system or application program. When you reconfigure a program, you often need its program diskette set.

**PXE**

Abbreviation for Pre-boot eXecution Environment.

**RAC**

Acronym for remote access controller.

**RAID**

Acronym for redundant array of independent drives.

**RAM**

Acronym for random-access memory. A system's primary temporary storage area for program instructions and data. Each location in RAM is identified by a number called a memory address. Any information stored in RAM is lost when you turn off your system.

**RAM disk**

A memory-resident program that emulates a hard drive.

**read-only file**

A read-only file is one that you are prohibited from editing or deleting. A file can have read-only status if:

- Its read-only attribute is enabled.
- It resides on a physically write-protected diskette or on a diskette in a write-protected drive.
- It is located on a network in a directory to which the system administrator has assigned read-only rights to you.

**readme file**

A text file included with a software package or hardware product that contains information supplementing or

updating the documentation for the software or hardware. Typically, readme files provide installation information, describe new product enhancements or corrections that have not yet been documented, and list known problems or other things you need to be aware of as you use the software or hardware.

### **ROM**

Acronym for read-only memory. Your system contains some programs essential to its operation in ROM code. Unlike RAM, a ROM chip retains its contents even after you turn off your system. Examples of code in ROM include the program that initiates your system's boot routine and the POST.

### **RPM**

Abbreviation for Red Hat Package Manager.

### **schema**

A collection of class definitions that describes managed objects in a particular environment. A CIM schema is a collection of class definitions used to represent managed objects that are common to every management environment, which is why CIM is called the Common Information Model.

### **SCSI**

Acronym for small computer system interface. An I/O bus interface with faster data transmission rates than standard ports. You can connect up to seven devices (15 for some newer SCSI types) to one SCSI interface.

### **server module**

A modular system component that functions as an individual system. To function as a system, a server module is inserted into a chassis which includes power supplies, fans, a system management module, and at least one network switch module. The power supplies, fans, system management module, and network switch module are shared resources of the server modules in the chassis. See modular system.

### **service tag number**

A bar code label that identifies each system in the event that you need to call for customer or technical support.

### **SMART**

Acronym for Self-Monitoring Analysis and Reporting Technology. A technology that allows hard drives to report errors and failures to the system BIOS, which then displays an error message on the screen. To take advantage of this technology, you must have a SMART-compliant hard drive and the proper support in the system BIOS.

### **SMBIOS**

Acronym for system management BIOS.

### **SNMP**

Abbreviation for Simple Network Management Protocol. SNMP, a popular network control and monitoring protocol, is part of the original TCP/IP protocol suite. SNMP provides the format in which vital information about different network devices, such as network servers or routers, can be sent to a management application.

### **SNMP trap**

A notification (event) generated by the RAC or ESM that contains information about state changes on the managed system or about potential hardware problems.

### **SOL**

Abbreviation for Serial Over LAN. SOL enables suitably designed servers to transparently redirect the serial character stream of a baseboard UART to/from a remote client over a shared LAN. The architecture requires software running on the managed system's BMC and client software running on a management station and/or a central network proxy.

### **SPCR**

Abbreviation for Serial Port Console Redirection table. This table provides information about how the system firmware and service processor use the out-of-band (OOB) management port. The SPCR table is read by the Special Administrative Console (SAC) for console redirection and configures itself automatically during a bootable CD installation.

**support commands**

Commands that specify how an action should be performed.

**syntax**

The rules that dictate how you must type a command or instruction so that the system understands it. A variable's syntax indicates its data type.

**system configuration information**

Data stored in memory that tells a system what hardware is installed and how the system should be configured for operation.

**system diskette**

System diskette is a synonym for bootable diskette.

**system memory**

System memory is a synonym for RAM.

**System Setup utility**

A BIOS-based utility that allows you to configure your system's hardware and customize the system's operation by setting such features as password protection and energy management. Some options in the System Setup utility require that you reboot the system (or the system may reboot automatically) in order to make a hardware configuration change.

**system.ini file**

A start-up file for the Windows operating system. When you start Windows, it consults the **system.ini** file to determine a variety of options for the Windows operating environment. Among other things, the **system.ini** file records which video, mouse, and keyboard drivers are installed for Windows.

Running the Control Panel or Windows Setup program may change options in the **system.ini** file. On other occasions, you may need to change or add options to the **system.ini** file manually with a text editor, such as Notepad.

**TCP/IP**

Abbreviation for Transmission Control Protocol/Internet Protocol. A system for transferring information over a computer network containing dissimilar systems, such as systems running Windows and UNIX.

**text editor**

An application program for editing text files consisting exclusively of ASCII characters. Windows Notepad is a text editor, for example. Most word processors use proprietary file formats containing binary characters, although some can read and write text files.

**text mode**

A video mode that can be defined as x columns by y rows of characters.

**UART**

Acronym for universal asynchronous receiver-transmitter. The UART is a system component that handles asynchronous serial communication by converting parallel bytes from the processor into serial bits for transmission (and vice versa).

**unicode**

A fixed width, 16-bit world wide character encoding, developed and maintained by the Unicode Consortium.

**upper memory area**

The 384 KB of RAM located between 640 KB and 1 MB. If the system has an Intel386 or higher microprocessor, a utility called a memory manager can create UMBs in the upper memory area, in which you can load device drivers and memory-resident programs.

**URL**

Abbreviation for Uniform Resource Locator (formerly Universal Resource Locator).

**USB**

Abbreviation for Universal Serial Bus. A USB connector provides a single connection point for multiple USB-compliant devices, such as mice, keyboards,



printers, and computer speakers. USB devices can also be connected and disconnected while the system is running.

**utility**

A program used to manage system resources—memory, disk drives, or printers, for example.

**utility partition**

A bootable partition on the hard drive that provides utilities and diagnostics for your hardware and software. When activated, the partition boots and provides an executable environment for the partition's utilities.

**UUID**

Abbreviation for Universal Unique Identification.

**variable**

A component of a managed object. A temperature probe, for example, has a variable to describe its capabilities, its health or status, and certain indexes that you can use to help you in locating the right temperature probe.

**VESA**

Acronym for Video Electronics Standards Association.

**virtual memory**

A method for increasing addressable RAM by using the hard drive. For example, in a system with 16 MB of RAM and 16 MB of virtual memory set up on the hard drive, the operating system would manage the system as though it had 32 MB of physical RAM.

**VT-100**

Abbreviation for Video Terminal 100, which is used by the most common terminal emulation programs.

**WAN**

Abbreviation for wide area network.

**Web server**

A secure port server that makes Web pages available for viewing by Web browsers using the HTTP protocol.

**WH**

Abbreviation for watt-hour(s).

**win.ini file**

A start-up file for the Windows operating system. When you start Windows, it consults the **win.ini** file to determine a variety of options for the Windows operating environment. Among other things, the **win.ini** file records what printer(s) and fonts are installed for Windows. The **win.ini** file also usually includes sections that contain optional settings for Windows application programs that are installed on the hard drive. Running the Control Panel or Windows Setup program may change options in the **win.ini** file. On other occasions, you may need to change or add options to the **win.ini** file manually with a text editor such as Notepad.

**write-protected**

Read-only files are said to be write-protected. You can write-protect a 3.5-inch diskette by sliding its write-protect tab to the open position or by setting the write-protect feature in the System Setup program.

**XMM**

Abbreviation for extended memory manager, a utility that allows application programs and operating systems to use extended memory in accordance with the XMS.

**XMS**

Abbreviation for eXtended Memory Specification.

**X Windows system**

The graphical user interface used in the Red Hat Enterprise Linux environment.



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