

IBM Cluster Systems Management for Linux<sup>®</sup>



# Remote Control HOWTO

*Version 1 Release 1*



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*Version 1 Release 1*

**Note!**

Before using this information and the product it supports, read the information in "Notices" on page 17.

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This edition of the *IBM Cluster Systems Management for Linux Remote Control HOWTO* applies IBM Cluster Systems Management for Linux Version 1 Release 1, program number 5799-GNJ, and to all subsequent releases of this product until otherwise indicated in new editions.

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## About This HOWTO

This HOWTO is a description of how to use the IBM Cluster Systems Management for Linux Remote Control functions. It describes the administrative tasks that can be accomplished with greater ease and efficiency by using these functions.

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## Who Should Use This HOWTO

This HOWTO is intended for system administrators who want to use IBM Cluster Systems Management for Linux. The system administrator should have experience in UNIX<sup>®</sup> administration and networked systems.

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## Typographic Conventions

This HOWTO follows these typographic conventions:

Typographic	Usage
<b>Bold</b>	<ul style="list-style-type: none"><li>• <b>Bold</b> words or characters represent system elements that you must use literally, such as commands, flags, and path names.</li></ul>
<i>Italic</i>	<ul style="list-style-type: none"><li>• <i>Italic</i> words or characters represent variable values that you must supply.</li><li>• <i>Italics</i> are also used for book titles and for general emphasis in text.</li></ul>
Constant width	Examples and information that the system displays appear in constant width typeface.
[ ]	Brackets enclose optional items in format and syntax descriptions.
{ }	Braces enclose a list from which you must choose an item in format and syntax descriptions.
	A vertical bar separates items in a list of choices. (In other words, it means “or.”)
< >	Angle brackets (less-than and greater-than) enclose the name of a key on the keyboard. For example, <b>&lt;Enter&gt;</b> refers to the key on your terminal or workstation that is labeled with the word Enter.
...	An ellipsis indicates that you can repeat the preceding item one or more times.
<b>&lt;Ctrl-x&gt;</b>	The notation <b>&lt;Ctrl-x&gt;</b> indicates a control character sequence. For example, <b>&lt;Ctrl-c&gt;</b> means that you hold down the control key while pressing <b>&lt;c&gt;</b> .
\	The continuation character is used in coding examples in this book for formatting purposes.

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## Related Information

- Conserver open source software Web site (<http://www.conserver.com>)
- IBM Advanced System Management PCI Adapter Firmware Update Diskette
- *IBM Advanced Systems Management PCI Adapter Software user's guide*
- *IBM Cluster Systems Management for Linux Monitoring HOWTO*, SA22-7852-00
- *IBM Cluster Systems Management for Linux Overview HOWTO*, SA22-7857-00
- *IBM Cluster Systems Management for Linux Set-Up HOWTO*, SA22-7853-00
- *IBM Cluster Systems Management for Linux Technical Reference*, SA22-7851-00
- IBM Linux Clusters Web site (<http://www.ibm.com/eserver/clusters/linux>)
- *Universal Management Services user's guide*

For information on using serial devices, see these Linux HOWTO documents, located at /usr/doc/HOWTO or on the Linux Documentation Project Web site (<http://metalab.unc.edu/mdw/index.html>):

- *Serial-HOWTO*

- *Serial-Programming-HOWTO*
- *Modem-HOWTO*

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## How to Obtain Publications

The IBM Cluster Systems Management for Linux publications are available as HTML and PDF files on the CD-ROM in the /doc directory or on the installed system in the /opt/csm/doc directory. The README is available on the CD-ROM in the root directory (/). The file names are as follows:

- *IBM Cluster Systems Management for Linux Monitoring HOWTO*, csmadm.pdf
- *IBM Cluster Systems Management for Linux Overview HOWTO*, csmovrvw.pdf
- *IBM Cluster Systems Management for Linux Remote Control HOWTO*, csmremot.pdf
- *IBM Cluster Systems Management for Linux Set-Up HOWTO*, csmsetup.pdf
- *IBM Cluster Systems Management for Linux Technical Reference*, csmtech.pdf

Publications for IBM Cluster Systems Management for Linux were also available at the time of this release at the IBM Linux Clusters Web site (<http://www.ibm.com/eserver/clusters/linux>). The IBM Linux Clusters Web site also includes links to the following resources:

- Conserver open source Web site.
- IBM Netfinity system management utility and documentation Web site.
- Linux Documentation Project HOWTOs Web site.



---

## Chapter 1. Cluster Systems Management Remote Control Overview

IBM Cluster Systems Management for Linux (CSM) Remote Control software allows a system administrator to control nodes in a Linux cluster from a remote location. This essentially frees the CSM cluster from any restrictions associated with geographic node location. The two main functions for CSM Remote Control are the remote power and remote console commands. The **rpower** command allows an administrator to query, power on, power off, and reset remote nodes. The **rconsole** command allows an administrator to open a console for a remote node. The CSM administrator runs the **rpower** and **rconsole** commands from a control node called the management server. See the man pages or the *IBM Cluster Systems Management for Linux Technical Reference* for detailed command usage information.

---

### Hardware Configuration

CSM Remote Control cluster software is dependent upon the hardware configuration. For IBM Netfinity clusters, CSM hardware control point and internal service processor database attributes have to match the IBM Netfinity Advanced System Management (ASM) PCI adapter and the IBM Netfinity Internal Service Processors (ISP) names, respectively. (This relationship will be explained in more detail in this section.) This will ensure that the physical connections are correct and that the relationship between the hardware control and nodes is defined correctly in the CSM database.

The remote power command, **rpower**, is directly related to the physical cabling of the Netfinity Advanced System Management PCI adapter and the internal processors that it controls. It is also dependent on the names defined to the internal processors. The remote console command, **rconsole** is dependent on the cabling of the remote console server and the cabling description in the CSM database. These details will be explained in the remote power and remote console sections to help you understand the interdependencies between the hardware and software. With the correct definitions, the **rpower** and **rconsole** commands will target the intended node or node group. (You can control hardware other than Netfinity hardware by writing custom power and console methods, which is discussed in later sections.)

---

### Networking Configuration

For security reasons, the networking configuration must separate the remote control functions **rpower** and **rconsole** from other clusters functions. An efficient way to do this is to create a virtual LAN (VLAN) for the remote control functions, which is separate and distinct from the more general purpose VLAN connecting the cluster's nodes. Optionally, the cluster VLAN can be isolated from the larger network. See the following sections for more details.

#### Management VLAN

The management VLAN connects the management server to the cluster's terminal server(s) and to the ASM PCI adapter(s) installed in some of the nodes. Since this is intended to be an isolated network, traffic flows without encryption using clear text authentication. Access to the **rpower** and **rconsole** commands is limited to root user on the management server. All other nodes have no access to the Management VLAN.

#### Cluster VLAN

A cluster VLAN subdivides the Ethernet switch so each node can use the cluster VLAN for Network I/O (NFS, tftp, ftp) and job control traffic.

#### Public VLAN

Each node connects to a public VLAN to allow authorized access to the nodes in the cluster. You may choose to combine the cluster VLAN and public VLAN.

---

## Hardware and Networking Configuration Diagrams

The following diagram (Figure 1) shows the hardware and networking configuration required for using CSM remote control. The Management Server connects to the Management VLAN and the Cluster VLAN through Ethernet adapters. The terminal server (an Equinox ESP in this example) connects to the Management VLAN through an Ethernet adapter, and to the cluster nodes through their serial (COM) ports as shown. (An Equinox ESP-16 can connect up to 16 nodes. Other terminal servers may have different capacities.) The nodes must be connected to the Cluster VLAN through their Ethernet adapters, and directly or indirectly to an ASM PCI adapter through their ISP ports. The Management VLAN connects to the ASM PCI adapters in select nodes. (One ASM PCI adapter is required for every 10 nodes.) The ASM PCI adapters connect to their own node's ISP port, and up to 9 more node ISP ports are daisy-chained from there. Configuration for a Public VLAN is optional and can be defined by the system administrator.

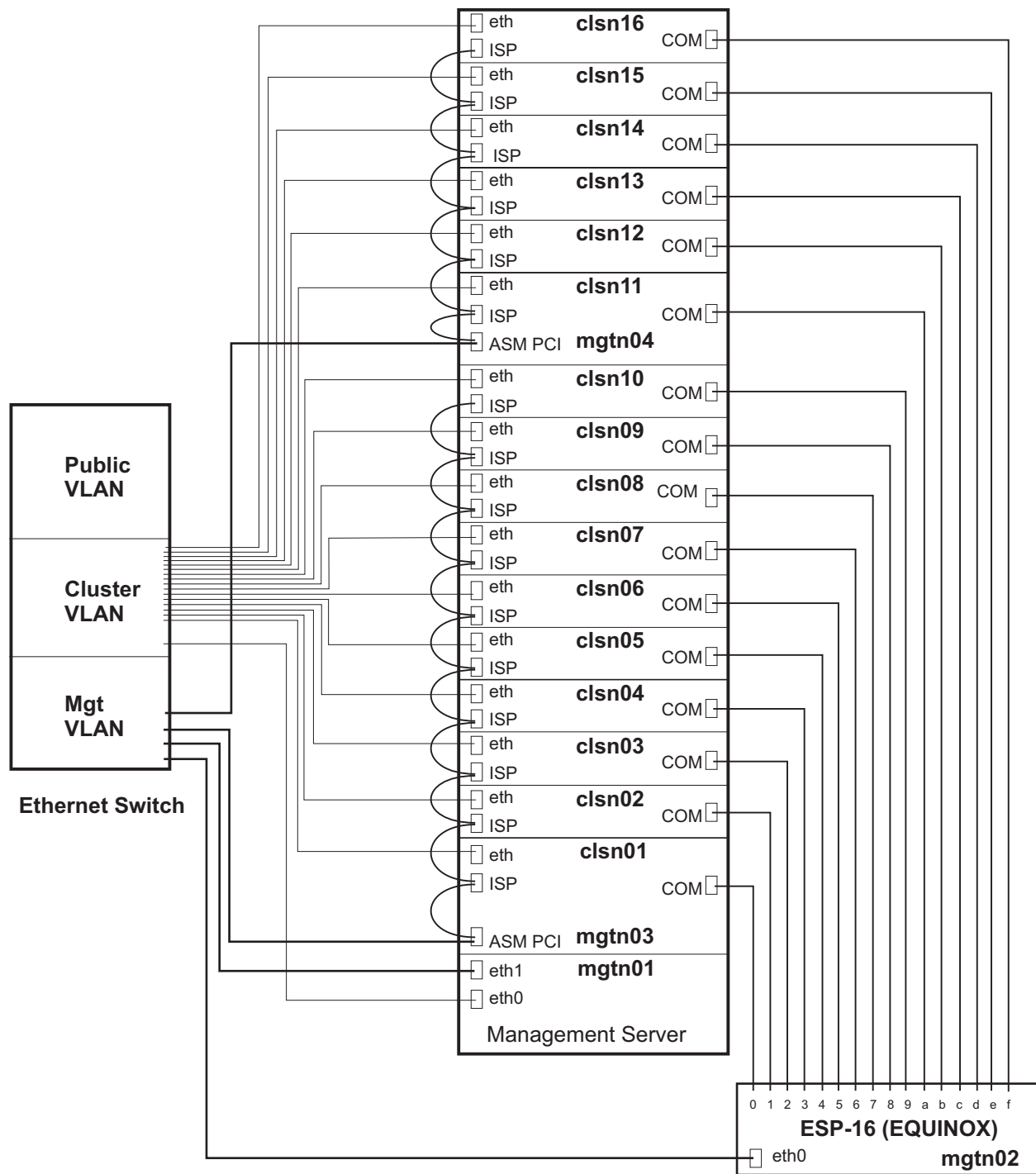


Figure 1. CSM Remote Control Hardware and Networking Configuration

The following diagram (Figure 2) shows the relationship between the ManagedNode database attributes and the actual (internal) hardware names used in the example. The Management Server database attribute names match those for the Management Server internal hardware names. The ISP database attribute names match those for the ISP internal hardware names. For remote power and remote console to work as expected, this matching of database attribute names to the internal hardware names must be correct for all Management Servers, ISPs, and ESPs in the cluster.

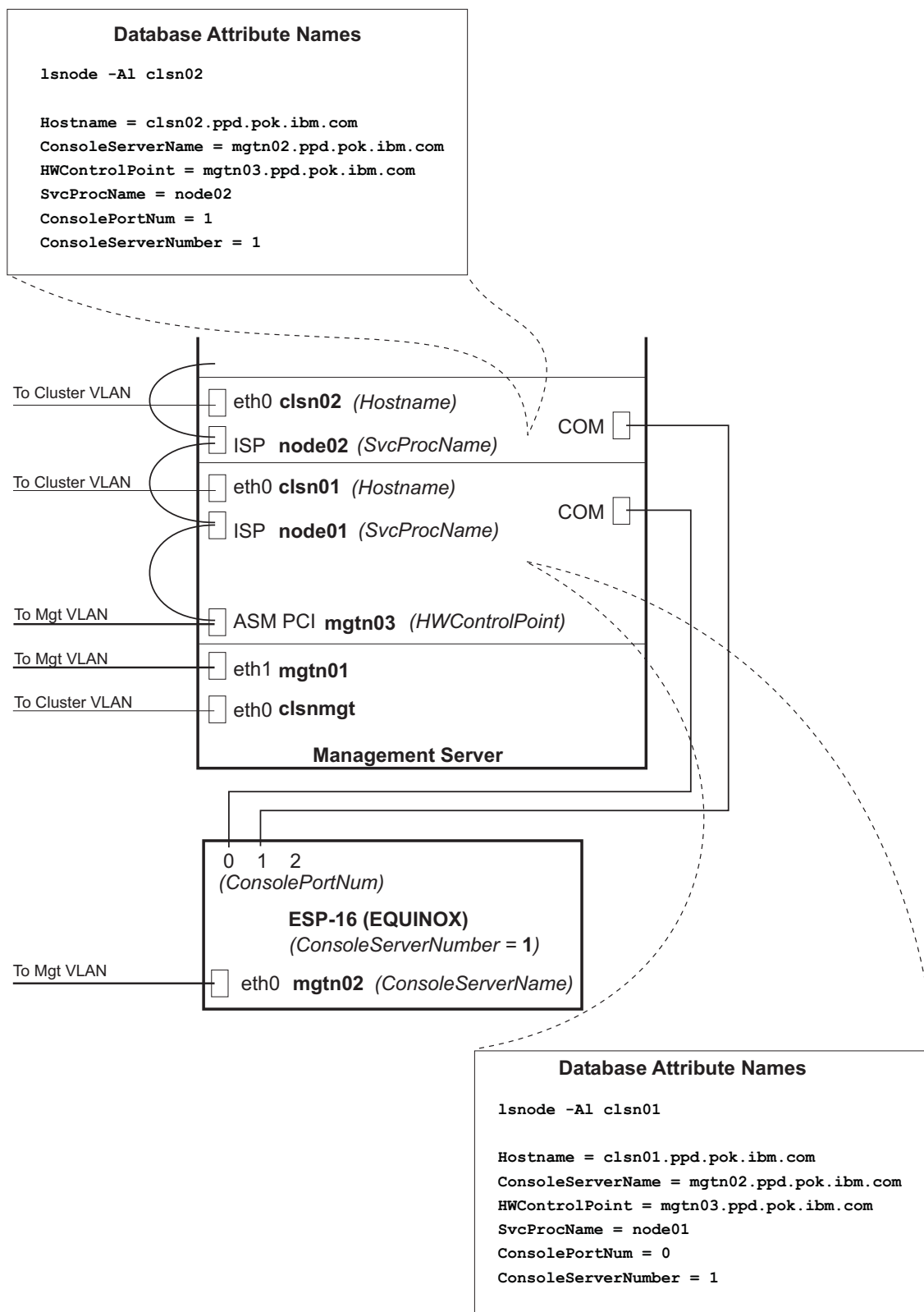


Figure 2. CSM Remote Control Database Attributes

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## Node Attributes Table

For planning purposes, it is helpful to fill out a table describing all of the nodes' attributes. In the example, the cluster has 20 nodes. The following page contains a blank template you can fill out.

*Table 1. Node Attributes Table: Example*

<i>Hostname*</i>	<i>HW ControlPoint*</i>	<i>Power Method</i>	<i>Svc ProcName</i>	<i>ConsoleServer Name*</i>	<i>ConsoleServer Number</i>	<i>Console Method</i>	<i>Console PortNum**</i>	<i>HWTtype</i>
clsn01	mgtn03	netfinity	node01	mgtn02	1	esp	0	netfinity
clsn02	mgtn03	netfinity	node02	mgtn02	1	esp	1	netfinity
clsn03	mgtn03	netfinity	node03	mgtn02	1	esp	2	netfinity
clsn04	mgtn03	netfinity	node04	mgtn02	1	esp	3	netfinity
clsn05	mgtn03	netfinity	node05	mgtn02	1	esp	4	netfinity
clsn06	mgtn03	netfinity	node06	mgtn02	1	esp	5	netfinity
clsn07	mgtn03	netfinity	node07	mgtn02	1	esp	6	netfinity
clsn08	mgtn03	netfinity	node08	mgtn02	1	esp	7	netfinity
clsn09	mgtn03	netfinity	node09	mgtn02	1	esp	8	netfinity
clsn10	mgtn03	netfinity	node10	mgtn02	1	esp	9	netfinity
clsn11	mgtn04	netfinity	node01	mgtn02	1	esp	a	netfinity
clsn12	mgtn04	netfinity	node02	mgtn02	1	esp	b	netfinity
clsn13	mgtn04	netfinity	node03	mgtn02	1	esp	c	netfinity
clsn14	mgtn04	netfinity	node04	mgtn02	1	esp	d	netfinity
clsn15	mgtn04	netfinity	node05	mgtn02	1	esp	e	netfinity
clsn16	mgtn04	netfinity	node06	mgtn02	1	esp	f	netfinity
clsn17	mgtn04	netfinity	node07	mgtn03	2	esp	0	netfinity
clsn18	mgtn04	netfinity	node08	mgtn03	2	esp	1	netfinity
clsn19	mgtn04	netfinity	node09	mgtn03	2	esp	2	netfinity
clsn20	mgtn04	netfinity	node10	mgtn03	2	esp	3	netfinity

\* These are short names. A long name is clsn01.pok.ibm.com, for example.

\*\* The console port number is the physical port the node's serial port is connected to in the console server hardware.

*Table 2. Node Attributes Table: Template*

[illegible]

\* These are short names. A long name is clsn01.pok.ibm.com, for example.

\*\* The console port number is the physical port the node's serial port is connected to in the console server hardware.





---

## Chapter 2. Remote Power

The remote power command, **rpower**, boots and resets hardware, powers hardware on and off, and queries node power state. See the **rpower** man page or the *IBM Cluster Systems Management for Linux Technical Reference* for detailed usage information.

The **rpower** command is structured so it can be easily expanded for another hardware type. It uses the *PowerMethod* attribute in the CSM database to determine which underlying hardware control routine will be used. If the *PowerMethod* attribute is *netfinity*, the hardware control routine called is **/opt/csm/bin/netfinity\_power**. To use other hardware types you need to change the entry in CSM and write a new custom power method named **/opt/csm/bin/PowerMethod\_power**. See “Writing a Custom Power Method” on page 10.

---

### Remote Power Architecture

CSM hardware configuration consists of the following components:

- Management Server
- Isolated Management Network
- Up to ten Internal Service Processors (ISPs) for each ASM PCI adapter
- Advanced Systems Management (ASM) PCI adapters
- Ethernet PCI Adapters.

For optimal security, the components must be configured so that the management server is the only node attached to the management VLAN, and has sole access to the console servers and the ASM PCI adapter.

Internal service processor names must correlate with the internal node names defined in the ASM PCI adapter. The names must match for the management server to power on and off the correct target nodes.

- The host name *HWControlPoint* attribute defines the ASM PCI adapter.
- The ISP name *SvcProcName* attribute defines the ISPs (for example, node01 – node10).

For each node definition in the CSM database, the *HWControlPoint* attribute must match the ASM PCI adapter host name. Likewise, the node *SvcProcName* attribute in the database must match the text ID for the node's ISP.

Each ASM PCI adapter manages a group of up to ten nodes. By default, each group contains nodes with *SvcProcName* attributes node01 – node10. Since you may have more than one group of nodes, the host name *HWControlPoint* attribute specifies the ASM PCI adapter associated with each group.

**Note:** For the *SvcProcName* attribute, the node short host name can be used instead of the node01 – node10 format.

---

### Remote Power Configuration

There is a direct relationship between the hardware configuration and the CSM database information created with the **definenode** command. Planning is required prior to running **definenode** to ensure that nodes are defined correctly. For detailed information on the **definenode** command, see the man page or the *IBM Cluster Systems Management for Linux Technical Reference*. For the define node procedure, see the *IBM Cluster Systems Management for Linux Set-Up HOWTO*.

When replacing a node, the new service processor's text ID must be changed to match the *SvcProcName* attribute of the replaced node. You can use the **lsnode** command to verify the *SvcProcName* of the node. Likewise, you can use the **lsnode** command for debugging problems. For example, if an unexpected node

powers off, use the **lsnode** command to verify that the CSM database *SvcProcName* attribute name of the node matches the text ID specified in the service processor. The same procedure is required when replacing an ASM PCI adapter. The service processor allows for a telnet or an http connection to the host name of the ASM PCI adapter, where you can use ASM panels to perform tasks such as checking node configuration and status. To check the ID and password see the **/etc/opt/csm/bin/netfinity\_power.config** file. To change text IDs for ASM or ISP adapters, you must use the ASM PCI Adapter Firmware Update Diskette utility, which is downloadable from the Netfinity Web site. The Netfinity Web site is accessible from the IBM Linux Clusters Web site (<http://www.ibm.com/eserver/clusters/linux>).

## Writing a Custom Power Method

You can write a custom power method to suit your hardware environment. Each environment has its own routine (in **/opt/csm/bin/PowerMethod\_power**). The **rpower** command runs the power method and passes the following parameters. If you write a new power method to manage another power type, you must include these parameters in the order shown in the interface definition:

1. *option\_string*
2. *target\_system\_hostname*
3. *HWControlPoint\_hostname*
4. *SvcProcName*
5. *remote\_action*

## Node Configuration

Remote power requires the following CSM attributes for each node:

### *HWControlPoint*

Host name of the ASM PCI adapter to which this node's ISP is connected. For example: mgtn03.

*PowerMethod* Determines the program to invoke for a specific type of hardware power control. For example: netfinity (which corresponds to **/opt/csm/bin/netfinity\_power**).

*SvcProcName* The internal service processor name. For example: node01.

To specify the passwords and user IDs for remote power, edit the **/etc/opt/csm/netfinity\_power.config** file.

To replace a node, set the user ID, password, and text ID on the internal processor to the values which were configured for the replaced node. For details, see "ISP Remote Passwords" on page 11.

## Adding a New Node

Adding a new node requires some initial planning using the "Node Attributes Table" on page 6 and the **lsnode** command. The text ID of the Internal Service Processor and the *SvcProcName* attribute must match, and the PCI Adapter host name and *HWControlPoint* attribute must match. You should verify that these attributes are correct before running the **definenode** command.

---

## Verifying Remote Power Configuration

To verify the remote power configuration, use the **lsnode** command. By viewing the output you can verify that the ASM PCI adapter and ISPs are configured correctly. For example, the command:

```
lsnode -A1 c1sn03
```

lists all the attributes for the specified node. Output is similar to:

```
Hostname = c1sn03.ppd.pok.ibm.com
OSVersion =
UniversalId = 0
InstallDisk =
```

```
ConsoleServerName = mgtn02.ppd.pok.ibm.com
ConfigChanged = 0
Status = 1
HWControlPoint = mgtn03.ppd.pok.ibm.com
OSType =
SvcProcName = node03
InstallMethod =
PowerMethod = netfinity
Macaddr =
PowerStatus = 127
ConsolePortNum = 2
HWType = netfinity
HWModel =
OSDistribution =
ConsoleMethod = esp
LParID =
OSKernel =
InstallDiskType =
ConsoleServerNumber = 1
HWSerialNum =
```

The service processor allows for a telnet or an http connection to the host name of the ASM PCI adapter, where you can use ASM panels to perform tasks such as checking node configuration and status. To check the ID and password see the **/etc/opt/csm/netfinity\_power.config** file.

---

## ISP Remote Passwords

IBM suggests that you change the ISP and ASM PCI adapter user IDs and passwords immediately upon system configuration. To change user IDs and passwords you must boot the node using the ASM PCI Adapter Firmware Update Utility diskette, which can be downloaded from the IBM Linux Clusters Web site (<http://www.ibm.com/eserver/clusters/linux>).

To change user IDs and passwords using the ASM PCI Adapter Firmware Update Utility diskette:

1. Boot the node using the diskette.
2. Navigate to the Login Profiles.
3. Select "USERID".
4. Enter the new user ID and password.
5. Click "Save".
6. Update the **/etc/opt/csm/netfinity\_power.config** file.

See the IBM Linux Clusters Web site (<http://www.ibm.com/eserver/clusters/linux>) for a link to ASM PCI adapter utility information.

---

## Testing Remote Control

You should test the remote control functions before using them in a production environment. Run query, power on, and power off to verify that the nodes are configured correctly and are responding accordingly. See the **rpower** man page or the *IBM Cluster Systems Management for Linux Technical Reference* for detailed examples.



---

## Chapter 3. Remote Console

The remote console command, **rconsole**, opens a remote console for each node specified with the command. The method used for opening a remote console is dependent upon the hardware and software supporting the remote console. This section describes remote console hardware configuration, software support, and the relationship between them.

### Notes:

1. For Equinox ESP terminal servers, you must install Equinox espx RPM version 3.02 or later on the Management Server, because this is the minimum level required by Red Hat version 7.1
2. Ethernet adapters on some Equinox terminal servers are only 10 Mb/s, so you must ensure the ports on the Ethernet switches are set accordingly.

---

## Hardware Console Configuration

The console or terminal server is connected to the management VLAN by an Ethernet connection. Each console port is connected to the serial port of a node. The default console configuration is Equinox ESP; any other terminal server hardware requires different configuration by the system administrator.

### ESP and Serial Ports

The serial ports' connection from the ESP to the nodes must be in the same order that the nodes are defined for the Equinox console server in CSM. The CSM database has a number associated with each ESP, and with each port within the ESP. Attention to detail is required when configuring both the hardware connectivity and the definitions of this relationship in the CSM database. More detailed information on this relationship is covered in "Remote Console Configuration".

---

## Remote Console Configuration

The **definenode** command updates the CSM database with the information describing the console server and each node's associated port number. There is a direct relationship between the hardware configuration and the CSM database information created with this command. Planning is required prior to running **definenode** to ensure that nodes are defined correctly. (A sample worksheet is shown in "Node Attributes Table" on page 6.) This section will expand on the CSM database contents and its relationship to the hardware and the **rconsole** command.

The remote console function supports two software environments: Equinox ESP and Conserver. You specify which environment you want to use for the console for each node with the *ConsoleMethod* attribute. Supported values for this attribute are *esp* and *conserver*. For more information about the Conserver software environment, see the Conserver open source software Web site (<http://www.conserver.com>).

### Writing a Custom Console Method

You can write a custom console method to suit your hardware environment. Each environment has its own routine (in `/opt/csm/bin/ConsoleMethod_console`) that returns the command that **rconsole** uses in the **xterm** window where the command is run. For example:

- *esp\_console*: `cu -l /dev/ttyQ01e0 -s 9600`
- *conserver\_console*: `console - Mlocalhost hostname`

The following parameters are passed to any console method. If you write a new console method to manage another console type, you must include these parameters in the order shown in the interface definition:

1. *console\_server\_hostname*
2. *target\_system\_hostname*

3. *console\_port\_number*
4. *console\_server\_number*

## Node Configuration

The **/etc/lilo.conf** and **/etc/inittab** files on each node must contain the following settings, which direct the console to the serial port. When **installnode** is run, these files are automatically modified.

**Note:** To enable the remote console, you must reboot all new nodes after running **installnode**.

- **/etc/lilo.conf** file:

```
serial = 1,9600n8
append = "console=tty1 console=ttyS1,9600"
```

- **/etc/inittab** file:

```
s1:345:respawn:/sbin/agetty 9600 ttyS1 xterm
```

Remote console requires the following CSM attributes for each node:

<i>ConsoleServerName</i>	The console server host name. For example: mgtn02.pok.ibm.com.
<i>ConsoleServerNumber</i>	The console server number. For example: some number, 1 – N. For ESP this is the ESP number associated with the Equinox ESP system.
<i>ConsoleMethod</i>	Determines the program to invoke for a specific type of console server. The attribute value is one of two options: <i>esp</i>   <i>conserver</i> .
<i>ConsolePortNum</i>	The console port number. For ESP, this must be a 0 – f single hexadecimal digit.

---

## Verifying Remote Console Configuration

The **lsnode – AI** command lists the node attributes in the CSM database. When the host parameter is specified, either by host name or IP address, the command displays all of the host's attributes.

## Verifying Equinox ESP Console

To verify the remote console configuration, use the **esptty** and **lsnode** commands. The **esptty** command opens the Equinox Service Processor (ESP) Port Diagnostic Utility. This utility allows system administrators and users to verify or modify port characteristics or dump status information about Equinox ESP Serial Hub serial ports (ttys).

You can also verify or change a Console Server configuration using the **espcfg** command. This command opens the ESP Configuration Wizard, which allows you to manage Equinox Service Processors. For further information on these verification commands, see the command man pages.

---

## Equinox Configuration and Diagnostics

**Note:** The **espcfg** **espdia**, and **esptty** commands are installed when you install the ESP RPM. For more information about Equinox ESP software configuration, see **/usr/doc/espx-3.00/INSTALL**.

## Equinox Diagnostics

To test the Equinox hardware configuration:

1. Ping the console server from the management server to test the connection.
2. Run the **espcfg** command to:
  - discover ESPs on a network

- configure ESPs
  - install ESPs
  - remove ESPs
  - replace ESPs
  - update ESP flash memory
3. Run the **espdial** command to:
    - obtain ESP device and driver information
    - obtain detailed information about a selected ESP serial port
  4. Verify that the Equinox ESP is on the management network associated with the management server by comparing the IP address and *SubNetMask* attribute in the ESP panel to the **ifconfig** command output.

## Equinox Configuration Examples

1. To query Equinox ESP ports on a remote cluster, type:

```
esptty -c
```

Output is similar to:

ESP Device	UdpState	TcpState	Ports
/dev/esp1	HEARTBEAT	TCP_ACTIVE	16
/dev/esp2	HEARTBEAT	TCP_ACTIVE	16
/dev/esp3	HEARTBEAT	TCP_ACTIVE	16
/dev/esp4	HEARTBEAT	TCP_ACTIVE	16
/dev/esp5	HEARTBEAT	TCP_ACTIVE	16
/dev/esp6	HEARTBEAT	TCP_ACTIVE	16

2. To list the ttys for each port, type:

```
ls /dev/ttyQ*
```

The format of the tty is: **ttyQesp\_numberport\_number** where:

- *esp\_number* is two digits starting with 01
- *port\_number* is one hexadecimal digit 0 – f.

Output is similar to:

```
/dev/ttyQ01e0 /dev/ttyQ02e4 /dev/ttyQ03e8 /dev/ttyQ04ec /dev/ttyQ06e0
/dev/ttyQ01e1 /dev/ttyQ02e5 /dev/ttyQ03e9 /dev/ttyQ04ed /dev/ttyQ06e1
/dev/ttyQ01e2 /dev/ttyQ02e6 /dev/ttyQ03ea /dev/ttyQ04ee /dev/ttyQ06e2
/dev/ttyQ01e3 /dev/ttyQ02e7 /dev/ttyQ03eb /dev/ttyQ04ef /dev/ttyQ06e3
/dev/ttyQ01e4 /dev/ttyQ02e8 /dev/ttyQ03ec /dev/ttyQ05e0 /dev/ttyQ06e4
/dev/ttyQ01e5 /dev/ttyQ02e9 /dev/ttyQ03ed /dev/ttyQ05e1 /dev/ttyQ06e5
/dev/ttyQ01e6 /dev/ttyQ02ea /dev/ttyQ03ee /dev/ttyQ05e2 /dev/ttyQ06e6
/dev/ttyQ01e7 /dev/ttyQ02eb /dev/ttyQ03ef /dev/ttyQ05e3 /dev/ttyQ06e7
/dev/ttyQ01e8 /dev/ttyQ02ec /dev/ttyQ04e0 /dev/ttyQ05e4 /dev/ttyQ06e8
/dev/ttyQ01e9 /dev/ttyQ02ed /dev/ttyQ04e1 /dev/ttyQ05e5 /dev/ttyQ06e9
/dev/ttyQ01ea /dev/ttyQ02ee /dev/ttyQ04e2 /dev/ttyQ05e6 /dev/ttyQ06ea
/dev/ttyQ01eb /dev/ttyQ02ef /dev/ttyQ04e3 /dev/ttyQ05e7 /dev/ttyQ06eb
/dev/ttyQ01ec /dev/ttyQ03e0 /dev/ttyQ04e4 /dev/ttyQ05e8 /dev/ttyQ06ec
/dev/ttyQ01ed /dev/ttyQ03e1 /dev/ttyQ04e5 /dev/ttyQ05e9 /dev/ttyQ06ed
/dev/ttyQ01ee /dev/ttyQ03e2 /dev/ttyQ04e6 /dev/ttyQ05ea /dev/ttyQ06ee
/dev/ttyQ01ef /dev/ttyQ03e3 /dev/ttyQ04e7 /dev/ttyQ05eb /dev/ttyQ06ef
/dev/ttyQ02e0 /dev/ttyQ03e4 /dev/ttyQ04e8 /dev/ttyQ05ec
/dev/ttyQ02e1 /dev/ttyQ03e5 /dev/ttyQ04e9 /dev/ttyQ05ed
/dev/ttyQ02e2 /dev/ttyQ03e6 /dev/ttyQ04ea /dev/ttyQ05ee
/dev/ttyQ02e3 /dev/ttyQ03e7 /dev/ttyQ04eb /dev/ttyQ05ef
```

3. To query remote nodes, enter:

```
lsnode -A1 c1sn03
```

Output is similar to:

```
Hostname = clsn03.ppd.pok.ibm.com
OSVersion =
UniversalId = 0
InstallDisk =
ConsoleServerName = mgtn02.ppd.pok.ibm.com
ConfigChanged = 0
Status = 1
HWControlPoint = mgtn03.ppd.pok.ibm.com
OSType =
SvcProcName = node03
InstallMethod =
PowerMethod = netfinity
Macaddr =
PowerStatus = 127
ConsolePortNum = 2
HWType = netfinity
HWModel =
OSDistribution =
ConsoleMethod = esp
LParID =
OSKernel =
InstallDiskType =
ConsoleServerNumber = 1
HWSerialNum =
```

## Serial References

For more information on using serial devices, see the following Linux HOWTO documents, located at **/usr/doc/HOWTO** or on the Linux Documentation Project Web site (<http://metalab.unc.edu/mdw/index.html>):

- *Serial-HOWTO*
- *Serial-Programming-HOWTO*
- *Modem-HOWTO*



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