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SGI ProPack™ 6 for Linux® Start Here

Record of Revision

Version	Description
001	July 2008 Original publication.

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About This Guide

Note: SGI ProPack 6 for Linux requires the SGI Foundation Software 1 release. For more information, see the *SGI Foundation Software Start Here* available at http://docs.sgi.com.

This guide provides information about the SGI ProPack 6 for Linux release. It is divided into the following chapters:

- Chapter 1, "Release Features," describes the major features of this release, the CD contents, SGI Open Source software, SGI system controller software, and documentation information.

- Chapter 2, "Software Planning and Installation," describes the flowcharts of disk partitions and file configurations and layouts that you need to get started, and provides instructions for installing SGI ProPack for Linux.

- Chapter 3, "Product Support," documents the product components that are supported on SGI Altix systems.

Online versions of this document, the SGI ProPack 6 release notes, which contain the latest information about software and documentation in this release, the list of RPMs distributed with SGI ProPack 6, and a useful migration guide, which contains helpful hints and advice for customers moving from earlier versions of SGI ProPack to SGI ProPack 6, can be found in the /docs directory on the on the SGI ProPack 6 for Linux CD.

This Preface covers the following topics:

- "Helpful Online Resources" on page xiv
- "Novell Documentation" on page xvi
- "Red Hat Documentation" on page xvi
- "Intel Compiler Documentation" on page xvii
- "Other Intel Documentation" on page xvii
- "SGI Documentation" on page xviii

- "Obtaining SGI Publications" on page xxiv

Helpful Online Resources

This section describes the electronic support services available for your SGI system running SGI ProPack 6 for Linux, as follows:

- Supportfolio

  Supportfolio, the SGI support web site, including the SGI Knowledgebase, SGI YaST Update Online (YOU) server, SUSE YaST Online Server, links for software supports and updates, as described in this listing.

  https://support.sgi.com/login

- Supportfolio SGI Knowledgebase

  The SGI Knowledgebase available from Supportfolio has answers to common questions, problem resolutions, how-to documents, and many other useful articles for system administrators.

  https://support.sgi.com/kb/publisher.asp

- SGI YaST Online Update Server

  The SGI YaST Update Online (YOU) server is available for your convenience. Get updates to SGI ProPack 6 for Linux and SUSE Linux Enterprise Server 10 (SLES10) using the YaST install tool right from your system. The *YaST Online Update - Patch Media Instructions* describes how to update your system using patch media. Use your Supportfolio account name and password, and point YaST to this location:

  https://update.sgi.com/

- Supportfolio Software Updates

  Check for new updates to your purchased SGI software, and download or order CDs all in one convenient place. Supportfolio Software Updates provides one-stop shopping to check for and get new updates for your SGI software.

  https://support.sgi.com/software?cmd=order

- SGI Customer Support Center

  You can open calls to the SGI Customer Support Center on-line, keep track of all your cases, and receive automatic update information when your case is updated via the Supportfolio Problem Resolution Tools at:

https://support.sgi.com/caselist

- SGI Software Licensing

  If you need to get your license for SGI software, you can order your software licenses conveniently via e-mail or on-line.

  You can send a blank email to license@sgi.com, and you will receive a simple template to fill out. You will quickly receive your new license back with complete instructions for installing it back via E-Mail.

  Or, you can go on-line to the SGI Key-O-Matic at:

  http://www.sgi.com/support/licensing/

Related Publications

Documents listed in this section contain additional information that might be helpful, as follows:

- "Novell Documentation" on page xvi
- "Red Hat Documentation" on page xvi
- "Intel Compiler Documentation" on page xvii
- "Other Intel Documentation" on page xvii
- "SGI Documentation" on page xviii

Novell Documentation

Documentation for SUSE Linux Enterprise Server 10 is located on your system in the `/usr/share/doc` directory. There are also several helpful documents provided on SLES10 CD1 in the `/docu/en` directory.

The following documentation is available:

Note: Novell makes SUSE Linux Enterprise Server documentation available online at: http://www.novell.com/documentation/

- SUSE Linux Enterprise Server 10 Installation and Administration (manual.pdf)
- SUSE Linux Enterprise Server 10 Start-Up Guide (startup.pdf)
- SUSE Linux Enterprise Server 10 Package Descriptions available online at http://www.novell.com/products/linuxenterpriseserver/packages.html
- Novell YES CERTIFIED Bulletins for SGI available online at http://developer.novell.com/yessearch/Search.jsp (select "SGI" as the Company and "SUSE Linux Enterprise Server 10 " as the Novell Product and click Search)

Red Hat Documentation

Documentation for RHEL5 is located in the `/usr/share/doc` directory. It contains package-specific documentation. If you install the `zisofs` module, additional

documentation in the form of READMEs can be found in
`/usr/share/doc/zisofs-tools-1.x.x.`

On the RHEL5 DVD, `README-`{*lang*} and `RELEASE-NOTES-`{*lang*} files are found in the root directory.

Note: Red Hat makes Red Hat Enterprise Linux 5 (RHEL5) documentation available online at:
http://www.redhat.com/docs/manuals/enterprise/RHEL-5-manual/index.html

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The following documentation is available:

- Release Notes for *x86_64 architecture*

- Release Notes *ia64 architecture*

- *Red Hat Enterprise Linux Deployment Guide*

- *Red Hat Enterprise Linux Installation Guide*

- *Red Hat Virtualization*

Intel Compiler Documentation

Documentation for the Intel compilers is located on your system in the `/docs` directory of the directory tree where your compilers are installed. If you have installed the Intel compilers, the following documentation is available:

- *Intel C++ Compiler User's Guide* (`c_ug_lnx.pdf`).

- *Intel Fortran Compiler User's Guide* (`for_ug_lnx.pdf`).

- *Intel Fortran Programmer's Reference* (`for_prg.pdf`).

- *Intel Fortran Libraries Reference* (`for_lib.pdf`).

Other Intel Documentation

The following references describe the Itanium (previously called "IA-64") architecture and other topics of interest:

- *Intel Itanium 2 Processor Reference Manual for Software Development and Optimization,* available online at http://developer.intel.com/design/itanium2/manuals/251110.htm.

- *Intel Itanium Architecture Software Developer's Manual,* available online at http://developer.intel.com/design/itanium/manuals/iiasdmanual.htm.

- *Introduction to Itanium Architecture,* available online at http://shale.intel.com/softwarecollege/CourseDetails.asp?courseID=13 (secure channel required).

- Intel Xeon processor documentation is available at http://www.intel.com/design/Xeon/documentation.htm

SGI Documentation

Th is section describes SGI documentation and covers these topics:

- "SGI ProPack Manuals" on page xviii
- "Additional SGI Software Manuals" on page xx
- "SGI Hardware Manuals" on page xxi

SGI ProPack Manuals

- *SGI ProPack 6 for Linux Release Notes*
  Provides the latest information about software and documentation in this release. The release notes are on the SGI ProPack for Linux CD in the `root` directory, in a file named `README.TXT`.

- *Porting IRIX Applications to SGI Altix Platforms: SGI ProPack for Linux*
  Provides information about porting an application to the SGI Altix platform.

- *Message Passing Toolkit (MPT) User's Guide*
  Describes industry-standard message passing protocol optimized for SGI computers.

- *REACT Real-Time for Linux Programmer's Guide*
  Describes the facilities of REACT real-time for Linux that supports real-time programs.

- *Performance Co-Pilot Linux User's and Administrator's Guide*
  Describes the Performance Co-Pilot (PCP) software package of advanced
  performance tools for SGI systems running the Linux operating system.

- *Linux Configuration and Operations Guide*
  Provides information on how to perform system configuration and operations for
  SGI Altix servers.

- *Linux Resource Administration Guide*
  Provides a reference for people who manage the operation of SGI Altix servers and
  contains information needed in the administration of various system resource
  management features such as Comprehensive System Accounting (CSA), Array
  Services, CPU memory sets and scheduling, and the Cpuset System.

- *Guide to Administration, Programming Environments, and Tools Available on SGI Altix
  XE Systems*
  Explains how to perform general system configuration and operations and
  describes programming environments and tools available for SGI Altix XE systems.

- *Linux Application Tuning Guide*
  Provides information about tuning application programs on SGI Altix systems.
  Application programs include Fortran and C programs written on SGI Linux
  systems with the compilers provided by Intel.

Additional SGI Software Manuals

- *SGI Foundation Software Start Here*
  Provides information about the SGI Foundation Software 1 release that supports SGI differentiated server solutions.

- *SGI Tempo System Administrator's Guide*
  Describes how to perform general system installation, configuration, and operations on the SGI Altix ICE 8200 series systems.

- *Embedded Support Partner User Guide*
  Provides information about using the Embedded Support Partner (ESP) software suite to monitor events, set up proactive notification, and generate reports. This revision of the document describes ESP version 3.0, which is the first version of ESP that supports the Linux operating system.

- *Event Manager User Guide*
  Provides information about the Event Manger application that collects event information from other applications. This document describes the Event Manager application, the application programming interface that you can use to access it, the procedures that you can use to communicate with it from another application, and the commands that you can use to control it.

- *XFS for Linux Administration*
  Describes XFS, an open-source, fast recovery, journaling filesystem that provides direct I/O support, space preallocation, access control lists, quotas, and other commercial file system features.

- *XVM Volume Manager Administrator's Guide*
  Describes the configuration and administration of XVM logical volumes using the XVM Volume Manager.

- *CXFS Administration Guide for SGI InfiniteStorage*
  Documents CXFS running on a storage area network (SAN). CXFS is clustered XFS, a parallel-access shared clustered filesystem for high-performance computing environments.

- *CXFS MultiOS Client-Only Guide for SGI InfiniteStorage*
  Provides an overview of the installation and configuration procedures for CXFS client-only nodes running SGI CXFS clustered filesystems.

- *Guaranteed-Rate I/O Version 2 Guide*
  Provides information about GRIO version 2, the second-generation guaranteed-rate I/O product from SGI.

- *SGI InfiniteStorage High Availability Using Linux-HA Heartbeat*
  Provides information about the high-availability (HA) resource agents provided for the Linux-HA Heartbeat product in order to support SGI products

- *DMF Administrator's Guide for SGI InfiniteStorage*
  Describes how to perform administration of the Data Migration Facility (DMF). DMF is a hierarchical storage management system for SGI environments. Its primary purpose is to preserve the economic value of storage media and stored data. This manual describes DMF components, features, and architecture; it focuses on the tasks of configuration and ongoing administrative duties.

- *SGI InfiniteStorage Appliance Manager User's Guide*
  Describes the operation of SGI InfiniteStorage Appliance Manager, which is a web-based interface that lets you configure, manage, and monitor a storage server.

- *SGIconsole 2.1 Start Here*
  Provides an introduction to SGIconsole and information about setting up and configuring SGIconsole hardware and software.

- *Console Manager for SGIconsole Administrator's Guide*
  Provides information about the Console Manager software graphical interface allows you to control multiple SGI servers, SGI partitioned systems, and large single-system image servers.

- *SGI L1 and L2 Controller Software User's Guide*
  Describes how to use the L1 and L2 controller commands at your system console to monitor and manage SGI Altix 350 systems, the SGI Altix 3000 and SGI Altix 4000 family of servers and superclusters.

- *Platform Manager On SGI Altix ICE Systems Quick Reference Guide*
  Describes how to use Platform Manager management software to perform general system discovery, installation, configuration, and operations on SGI Altix ICE 8200 series systems.

- *Reconfigurable Application-Specific Computing User's Guide*
  Provides information about the SGI reconfigurable application-specific software computing (RASC) program that delivers scalable, configurable computing elements for the SGI Altix family of servers and superclusters.

SGI Hardware Manuals

- *SGI Altix ICE 8200 Series System Hardware User's Guide*
  Describes the features of the SGI Altix ICE 8200 series systems and provides operating instructions and general troubleshooting information.

- *SGI Altix XE210 System User's Guide*
  Describes the features of the Altix XE210 server system as well as troubleshooting, upgrading, and repairing.

- *SGI Altix XE240 System User's Guide*
  Describes the features of the Altix XE240 server system as well as troubleshooting, upgrading, and repairing.

- *SGI Altix XE250 System User's Guide*
  Describes the features of the Altix XE250 server system as well as troubleshooting, upgrading, and repairing.

- *SGI Altix XE310 System User's Guide*
  Describes the features of the Altix XE310 server system as well as troubleshooting, upgrading, and repairing.

- *SGI Altix XE320 System User's Guide*
  Describes the features of the Altix XE320 server system as well as troubleshooting, upgrading, and repairing.

- *SGI Altix XE Clusters Quick Reference Guide*
  Provides an overview of some of the common operations that system administrators may have to perform to set-up, boot, re-configure (upgrade) or troubleshoot an SGI Altix XE cluster.

- *SGI Altix 330 System User's Guide*
  Provides an overview of the Altix 330 system components, and it describes how to set up and operate this system

- *SGI Altix 350 System User's Guide*
  Provides an overview of the Altix 350 system components, and it describes how to set up and operate this system.

- *SGI Altix 350 Quick Start Guide*
  Guides a knowledgeable user through the installation, setup, and simple configuration of most SGI Altix 350 systems.

- *SGI Altix 3000 User's Guide*
  Provides an overview of the architecture and describes the major components of the SGI Altix 3000 family of servers and superclusters. It also describes the standard procedures for powering up and powering down the system, provides basic troubleshooting information, and includes important safety and regulatory specifications.

- *SGI Altix 3700Bx2 User's Guide*
  This guide provides an overview of the architecture and descriptions of the major components that compose the SGI Altix 3700Bx2 family of servers. It also provides the standard procedures for powering on and powering off the system, basic troubleshooting information, and important safety and regulatory specifications.

- *SGI Altix 450 System User's Guide*
  Provides an overview of the Altix 450 system components, and it describes how to set up and operate this system.

- *SGI Altix 4700 User's Guide*
  This guide provides an overview of the architecture and descriptions of the major components that compose the SGI Altix 4700 family of servers. It also provides the standard procedures for powering on and powering off the system, basic troubleshooting information, and important safety and regulatory specifications.

- *SGI Virtu VN200 Hardware User's Guide*
  Provides information on how to install, configure, administrate, and repair an SGI Virtu VN200 graphics node.

Obtaining SGI Publications

You can obtain SGI documentation in the following ways:

- See the SGI Technical Publications Library at http://docs.sgi.com. Various formats are available. This library contains the most recent and most comprehensive set of online books, release notes, man pages, and other information.

- You can view man pages by typing `man` <*title*> on a command line.

Conventions

The following conventions are used throughout this publication:

Convention	Meaning
`command`	This fixed-space font denotes literal items such as commands, files, routines, path names, signals, messages, and programming language structures.
variable	Italic typeface denotes variable entries and words or concepts being defined.
`user input`	This bold, fixed-space font denotes literal items that the user enters in interactive sessions. (Output is shown in nonbold, fixed-space font.)
`manpage(`*x*`)`	Man page section identifiers appear in parentheses after man page names.
GUI element	This font denotes the names of graphical user interface (GUI) elements such as windows, screens, dialog boxes, menus, toolbars, icons, buttons, boxes, fields, and lists.

Reader Comments

If you have comments about the technical accuracy, content, or organization of this document, contact SGI. Be sure to include the title and document number of the manual with your comments. (Online, the document number is located in the front matter of the manual. In printed manuals, the document number is located at the bottom of each page.)

You can contact SGI in any of the following ways:

- Send e-mail to the following address:

  techpubs@sgi.com

- Contact your customer service representative and ask that an incident be filed in the SGI incident tracking system.

- Send mail to the following address:

  Technical Publications
  SGI
  1140 East Arques Avenue
  Sunnyvale, CA 94085-4602

SGI values your comments and will respond to them promptly.

Release Features

This chapter provides an introduction to SGI ProPack 6 for Linux and describes the CD contents, provides documentation information, and provides a brief overview of the installation process. It covers the following topics:

- "Software Introduction" on page 1

- "CD Contents" on page 2

- "System Controller Software 1.22 CD" on page 4

- "Getting Updates" on page 4

- "SGI Open Source Information" on page 5

- "Installation Overview" on page 6

- "Documentation Updated for This Release" on page 6

Note: SGI ProPack 6 for Linux requires the SGI Foundation Software 1 release. For more information, see the *SGI Foundation Software Start Here* available at http://docs.sgi.com.

Software Introduction

The SGI ProPack 6 for Linux product includes capabilities and performance improvements ideal for enabling technical and creative users to solve their big compute and data problems by using the Linux operating system and Intel processors. This product adds to or enhances features in the base SUSE Linux Enterprise Server 10 (SLES10) Service Pack 2 (SP2) Linux distribution or Red Hat Enterprise Linux 5.2 (RHEL 5.2) distribution. SGI ProPack 6 designed to run on any SGI Altix, SGI Altix XE, or SGI Alitx ICE 8200 system.

SGI hardware platforms and OS configuration settings supported by SGI in this release are documented at the following URL:

http://www.sgi.com/servers/altix/

CD Contents

This section describes the contents of the SGI ProPack 6 for Linux CD, as follows:

- Array Session Module

- Linux Comprehensive System Accounting (CSA)

- Linux jobs (Commands, init scripts, libraries and PAM module)

- LSI Fusion-MPT host adapter management utility

- NUMA tools to manage CPU placement of processes (`bcfree`, `dplace`, `dlook` utilities)

- Performance Co-Pilot, system-level performance monitoring and performance management tool

- Open Source SGI profile tools

- SGI ProPack configuration recommendations

- Flexible File I/O (FFIO) system

- Cpuset Facility workload manager tool

- Performance Co-Pilot visualization tools (`pcp-sgi` package, the SGI proprietary part of Performance Co-Pilot)

- Intel Compiler runtime libraries

- Array Services

- Message-Passing Toolkit (MPT)

- XVM Command line tools and graphical user interface (GUI)

- SGI ProPack documentation

- REACT Real-time for Linux libraries and documentation

- libarena: Custom memory allocator interface

> **Note:** Not all SGI ProPack 6 features are available on x86_64 systems. For the list of supported products on the x86_64 architecture, see "SGI ProPack 6 for Linux Products" on page 45.

The Scientific Computing Software Library (SCSL) software is no longer delivered with the SGI ProPack release. SCSL continues to be available via web release in courtesy mode. Login to Supportfolio Online at http://support.sgi.com. Click on the Downloads link under Supportfolio areas on the left. Enter `scsl` in the **Enter a Product type or keywords** search box and then select `Linux OS` in the **Select the download type** list.

Software Package License Information

SGI ProPack contains software packages released under a variety of licenses. The licensing terms for all proprietary software packages allow users to install the software only on SGI systems. See the PACKAGE_LICENSES.txt file that is available in the /docs directory of the SGI ProPack 6 for Linux CD for more details.

SGI ProPack 6 for Linux CDs

The following CDs ship with each SGI Propack 6 for Linux release:

- SGI ProPack 6 for Linux for Intel Itanium CD
- SGI ProPack 6 for Linux for AMD64/EM64T CD

Release Information, Documentation, and Release Notes

For a complete list of RPMs included in the SGI ProPack 6 release, see the file called RPMS.txt that is available in the /docs directory on the SGI ProPack 6 for Linux CD.

For the latest information about software and documentation in this release, see the release notes that are in a file named README.TXT that is available in /docs directory on the SGI ProPack 6 CD.

The SGI ProPack 6 for Linux release notes get installed to the following location on a system running SGI ProPack 6:

/usr/share/doc/packages/sgi-propack-6/README.txt

System Controller Software 1.22 CD

The System Controller software provides a system control platform for field service and system maintenance applications. For information on the system controller software, see the *SGI Foundation Software Start Here.*

Getting Updates

This section describes how to get software updates for SGI ProPack 6 for Linux system.

Detailed instructions for downloading and installing SGI ProPack 6 for Linux updates are available from the SGI ProPack 6 product pages on Supportfolio: https://support.sgi.com/content_request/961100/index.html.

Note: You must have a Supportfolio account to access this page and the SGI update server.

SLES10 Updates

SGI SLES10 SP2 customers are encouraged to use the YaST Online Update tool to keep the software on their systems updated with the latest maintenance fixes.

Software updates for SLES10 SP2 are provided by Novell. In order to configure your system to enable online updates, you must register with Novell. For more help with this, you can use the **Novell Customer Center Configuration** tool available in the Software section of the YaST Control Center.

Customers that received SGI ProPack 6 pre-installed on their new SGI Altix system may run the following command to add the proper update source for SGI ProPack 6:

```
$ /usr/sbin/sgi-propack-update-source
```

This script will prompt you for your Supportfolio login and then add the proper SGI update source for the given architecture.

For additional information on how to configure YaST Online Update to download updates for SGI ProPack 6, login to Supportfolio and then point your browser to http://support.sgi.com/content_request/961100/index.html.

RHEL5 Updates

Software updates for RHEL 5.2 are provided by Red Hat. As a Red Hat Enterprise Linux customer, you receive access to the Red Hat Network. This allows you to download updates for your system. For more information on the Red Hat Network and getting updates, see *Red Hat Network Overview* and the **Update** link at https://www.redhat.com/rhn/.

You can also use the `yum` software package manager to get updates, as follows:

```
% yum update
```

The `yum` software package manager checks for updates and then updates your system appropriately. You must be registered with RHN, for `yum` to get RHN RHEL 5.2 updates.

You can also use the Package Update (`pup`), which is a graphical tool for locating and installing updates, as follows:

```
% pup
```

You can configure the `updatesd`(8) notifier daemon to notify you of updates and potentially install the updates for you. Configuration is done via the `yum-updatesd.conf`(5) file.

SGI Open Source Information

SGI maintains the following website for open source information that describes projects related to its open source efforts:

http://oss.sgi.com

You can also access open source information (such as LKCD) from the following website:

http://sourceforge.net

Installation Overview

SGI ProPack 6 for Linux will most likely come pre-installed on your SGI platform. Installation is described in Chapter 2, "Software Planning and Installation".

This release also supports installing your Linux software over the network as described in "SLES and SGI ProPack Network Installation for Experts" on page 37.

For information on installing RHEL 5.2 and SGI ProPack 6, see "Installing RHEL 5.2 and SGI ProPack 6" on page 42.

Documentation Updated for This Release

The following manuals are new or have been updated for this release:

- *REACT Real-Time for Linux Programmer's Guide*, 007-4746-010

  Added the following:

  - Support for SGI ProPack 6 on SUSE Linux Enterprise Server 10 Service Pack 2 (SLES 10 SP 2).

  - SGI ProPack 6 on Red Hat Enterprise Linux 5.2 (RHEL 5.2).

    Note: RHEL 5.2 does not support the frame scheduler in this release.

  - Improvements to the `tracevisualizer`(1) graphical user interface (GUI).

- *SGI Tempo System Administrator's Guide, 007-4993-005*

  Updated for the SGI Tempo v1.4 release. Added the following:

  - Updated information in "Installing Software on the System Admin Controller " in Chapter 2.

  - Information about the "crepo Command" in Chapter 3.

  - Information about the "cinstallman Command" in Chapter 3.

  - A new section on "Using cinstallman to Install Packages into Software Images" in Chapter 3.

  - An updated section "Using yum to Install Packages on Running Service or Leader Nodes" in Chapter 3.

- A new section on "Creating Compute and Service Node Images Using the cinstallman Command" in Chapter 3.

- Updated information in "Installing a Service Node with a Non-default Image" in Chapter 3.

- Updated infomration in "Using a Custom Repository for Site Packages" in Chapter 3.

- A new section on "Switching Compute Nodes to a tmpfs Root" in Chapter 3.

- A new section on "RAID Utility" in Chapter 3.

• *Message Passing Toolkit (MPT) User's Guide*, 007-3773-008

Added the following:

- A new section "Running MPI Jobs with Torque" in Chapter 2.

- Information about the MPT mpiexec_mpt(1) command -tv option and TotalView in "Using the TotalView Debugger with MPI programs" in Chapter 4.

- Additional information about the omplace(1) command in "Tuning MPI/OpenMP Hybrid Codes" in Chapter 6.

- Updated information in "MPI_IB_RAILS" in Chapter 6.

- Updated information in "MPI_CONNECTIONS_THRESHOLD" in Chapter 6.

- Information about the run-time environmental setting when tuning applications for running over the InfiniBand fabric in "MPI_CTRL_RING" in Chapter 6.

- Information about the run-time environmental setting when tuning applications for runing over the InfiniBand farbic in "MPI_IB_PAYLOAD" in Chapter 6.

- Updated information in Chapter 8, "Troubleshooting and Frequently Asked Questions".

• *Linux Application Tuning Guide*, 007-4639-009

- Removed runon(1) documentation. Replaced by the taskset(1) command in Chapter 4, "Monitoring Tools", Chapter 5, "Data Placement Tools", and Chapter 6, "Performance Tuning".

- Updated "Data Placement Tools Overview" in Chapter 5.

- *Linux Resource Administration Guide*, 007-4413-013

  - Removed information about `arsess` kernel module and added information about the process sets service (procset), which provides the same functionaly, in Chapter 3, "Array Services".

- *Linux Configuration and Operations Guide*, 007-4633-013

  - Updated information in "Supported Configurations" in Chapter 1.

  - Editing changes throughout the manual.

- *SGI Foundation Software Start Here*, 007-5488-001

  Not part of the SGI ProPack release but required for all systems running SGI ProPack and new for this release, describes the following:

  - Direct Access Programming Library (DAPL) for high performance communication between processes

  - SGI Itanium 2 PROM (System controller software)

  - SGI x86_64 Baseboard Management Controller (BMC), chassis management control (CMC), and Basic Input/Output System (BIOS) software

  - OFED OpenSM software package and InfiniBand libraries, management tools and diagnostic tools

  - Device driver libraries

  - LSI Logic LSIUtil (lsiutil) configuration utility

  - Memory logging utility

  - `kdump` utility

  - Embedded Support Partner (ESP)

  - SGI support tools

  - SGI LK software licensing mechanism

Software Planning and Installation

Note: SGI ProPack 6 for Linux **requires** the SGI Foundation Software 1 release. For more information, see the *SGI Foundation Software Start Here* available at http://docs.sgi.com.

This chapter describes the planning that you need to do to get started and provides instructions for installing SGI ProPack 6 for Linux.

Your SGI Altix system comes with a base Linux distribution of SUSE Linux Enterprise Server 10 (SLES10) SP2 or Red Hat Enterprise Linux 5.2 (RHEL 5.2) and the SGI ProPack 6 for Linux software preinstalled. This chapter describes how to install the software from the CD if it should ever become necessary to reinstall it.

Note: For information on how to install, configure, and operate or update software on an SGI Altix ICE 8200 system, see the *SGI Tempo System Administrator's Guide* available at http://docs.sgi.com.

For security reasons, Linux requires a root password for login. The default password for your preinstalled software is `sgisgi`. After you have logged in, change this root password to a string of your own choice.

The SGI ProPack 6 for Linux software works only with the SLES10 SP2 environment or RHEL 5.2 environment. Earlier versions of these distributions, or any other distributions, are not compatible with SGI ProPack 6 for Linux software. Note that if you are currently running SGI ProPack 4 for Linux with SLES9 SP1 (or later), you cannot update only the SLES9 base operating system to SLES10 SP2. You must also update the SGI ProPack 4 software with SGI ProPack 6 in order to continue using the SGI ProPack features.

Before you install or configure your system, please read Chapter 1, "Release Features" so that you understand the features of SGI ProPack 6 for Linux software. You might also want to familiarize yourself with some or all of the documentation listed in "Related Publications" on page xvi.

This chapter covers the following topics:

- "Software Planning" on page 10
- "License Manager Updates" on page 15
- "Read Me First - Installing SLES10 SP2 or RHEL 5.2 on Your SGI System" on page 16
- "Installing SLES10 SP2 and SGI ProPack 6" on page 19
- "SLES and SGI ProPack Network Installation for Experts" on page 37
- "Upgrading From an Earlier SGI ProPack 5 Release to SGI ProPack 6" on page 39
- "Upgrading From SGI ProPack 5 SP5 to SGI Propack 6" on page 39

Software Planning

This section provides disk and file information you need to have about the software that has been shipped to you and covers the following topics:

- "Table of Disk Partitions" on page 11
- "Systems with Multiple Ethernet Configurations" on page 12
- "XVM Volumes Access in Rescue Mode" on page 12
- "Adding the xfs_quota Variable to the initrd Boot Image" on page 12
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Table of Disk Partitions

SGI ships Altix systems with Itanium processors from the factory running SGI ProPack 6 with SLES 10 SP2 with the partition layout as shown in Table 2-1

Table 2-1   Disk Partitions for SGI ProPack 6 with SLES10 SP2

Partition	Type	Mount Point	Size
part1	VFAT	/boot/efi	500 MB
part2	SWAP	/swap	10 GB
part3	XFS	/	25 GB
part4	XFS	/data1	remainder of disk

SGI ships Altix XE systems with Xeon processors from the factory running SGI ProPack 6 with SLES 10 SP2 with the partition layout shown in Table 2-2.

Table 2-2   Disk Partitions for x86_x64 Systems with SLES10 SP2

Partition	Type	Mount Point	Size
/dev/sda1	SWAP	swap	8 GB
/dev/sda2	XFS	/	25 GB
/dev/sda3	XFS	/data1	remainder of disk

SGI ships Altix systems with Itanium processors or Altix XE systems with Xeon processors from the factory running SGI ProPack 6 with RHEL 5.2 with the partition layout as shown in Table 2-3.

Table 2-3   Disk Partitions for SGI ProPack 6 with RHEL 5.2

Partition	Type	Mount Point	Size
/dev/sda1	ext3	/boot	100 MB
/dev/sda2	LVM	LVM	35 GB
/dev/sda3	ext3	/data1	remainder of disk

Systems with Multiple Ethernet Configurations

On SGI Altix systems running SGI ProPack 6 with multiple Ethernet connections, there is no guarantee that the Ethernet MAC address of the base I/0 IO9 or IO10 card becomes `eth0`. Putting a dual-port Gigabit Ethernet card in the PCI slot right next to the IO9 card in an Altix 350 system renders the IO9 tg3 port eth2. The dual-port GigaBit Ethernet card gets `eth0` and `eth1`. This can make SUSE network installs very confusing. See the SGI ProPack 6 release notes for a work around to this problem.

Note: This section does not apply to SGI Altix XE systems.

XVM Volumes Access in Rescue Mode

You cannot access XVM Volumes in Rescue Mode on SGI ProPack 6 systems. It is possible to boot into rescue mode from the SLES10 SP2 DVD, but that DVD does not contain the `xvm` kernel module. This makes it is impossible to perform maintenance on XVM volumes from rescue mode at this time. SGI recommends that you do not migrate any system directories to XVM since there is no way to access them from rescue mode.

Note: This section does not apply to systems running SGI ProPack 6 with RHEL 5.2. For this release, RHEL 5.2 does not support XFS or XVM.

Adding the `xfs_quota` Variable to the `initrd` Boot Image

You need to add `xfs_quota` to the `INITRD_MODULES` variable in the `/etc/sysconfig/kernel` file when `rootflags=quota` is set or the `initrd` boot loader will panic your system at boot time.

Note: This section does not apply to systems running SGI ProPack 6 with RHEL 5.2. For this release, RHEL 5.2 does not support XFS.

irqbalance Utility on SGI ProPack 6 Systems Running RHEL 5.2

On SGI ProPack 6 systems running RHEL 5.2, the `irqbalance` utility is configured off. This utility distributes device interrupts across all the CPUs on a multiprocessor system with the purpose of spreading the load. On a distributed shared memory (DSM) multiprocessor computer system, such as an SGI Altix system, the distance (that is, the latency) to a given CPU from a given device, varies quite substantially as you add router hops. Because of this, the PROM on an SGI Altix system, does not pick a random CPU to process the interrupts of a device; it picks the optimum CPU to handle the interrupts. This `irqbalance` utility breaks this optimum CPU assignment. Therefore, it is configured off.

SLES10 SP2 or RHEL 5.2 Kernels

For ia64 systems, SLES10 SP2 contains two kernel variants, kernel-default and kernel-debug. During installation, if you do not explicitly select to install kernel-debug, your SGI Altix system will boot with the kernel-default variant after installation. For x86_64 systems, SLES10 SP2 contains kernel-default (1CPU), kernel-debug, kernel-smp (multi-CPU) and kernel-xen. SGI recommends and pre-installs kernel-smp for x86_64 systems.

RHEL 5.2 has two kernel images, kernel and kernel-xen for ia64 and x86_64 systems. The kernel-xen variant is only provided as a technology preview for ia64 systems, but is a fully supported kernel for x86_64 systems.

Linux Kernel Crash Dump

The two methods for getting crash dumps are, as follows:

- `kdb/lkcd` for SLES10 on Altix 4000 series systems
- `kexec/kdump` for RHEL 5 and SLES10 on Altix XE and Altix ICE systems

This section describes these two methods.

LKCD Crash Dump Facility

In the event of a system crash on systems running SGI ProPack 6 running SLES10 SP2, the Linux Kernel Crash Dump (LKCD) facility will save a crash dump that will appear

in the `/var/log/dump` directory after your system reboots. SGI support personnel can analyze this file to determine the cause of the system crash.

If you wish to save crash dumps to a different location, edit the `DUMPDIR` variable in `/etc/sysconfig/dump` and then run the following command: `lkcd config`.

Note: Depending on which kernel you have installed, the system may enter the KDB kernel debugger after a crash. If a **kdb>** prompt appears on the console, type **sr d** to initiate a crash dump.

`kexec/kdump` **Crash Dump Utility**

In the event of a system crash on systems running SGI ProPack 6 running RHEL 5.2, the system uses the `kexec/kdump` crash dump utility. The `kexec/kdump` utility creates a Linux kernel crash dump at `/var/crash/`*timestamp*`/vmcore` if `kexec/kdump` is installed, enabled, and configured. After SGI ProPack 6 is installed, your system is set up to take dumps when needed. In order to analyze a crash dump, you need the `debuginfo` packages installed. For more information, see the SGI ProPack 6 release notes.

Latest PROM Firmware

Note: This section only applies to ia64 systems. For x86_64 systems, see "Getting the Latest Firmware/Software for Your SGI Altix XE System" on page 15.

Unless you have the most current PROM, the kernel may fail to boot during the installation procedure. The prom version is printed when the system resets in the prom banner.

The prom RPM is now part of the SGI Foundation Software release. For more information, see the *SGI Foundation Software Start Here*.

Note: SGI Altix 450 or SGI Altix 4700 systems running SGI ProPack 6 for Linux should use the PROM located in `shub2snprom.bin`. The System Controller 1.21 release provides a `sys_ctrl-ProPackICE_1.21.tar` file that installs onto an SGI Altix ICE 8200 system to service an Altix 450 that provides NAS support. All other SGI systems

should use the PROM located in `shub1snprom.bin`. This note does **not** apply to SGI Altix XE systems (instead see "Getting the Latest Firmware/Software for Your SGI Altix XE System" on page 15). Software support contract customers can download the most recent PROM versions from SGI Supportfolio: https://support.sgi.com/

You can determine the PROM level installed on your machine, as follows:

```
% cat /proc/sgi_prominfo/node*/version

4.74
SGI SAL Version 4.74 rel070313 IP41 built 10:14:15 AM Mar 13, 2007
```

On an SGI Altix 4700 system, the output from the version file looks similar to the following:

```
% cat /proc/sgi_prominfo/node*/version
SGI SAL Version 1.21 rel070201 IP65 built 08:38:57 AM Feb  1, 2007
```

The PROM RPM on the SGI Foundation Software CD contains all of the appropriate flash images for SGI systems running SGI ProPack 5. The flash utility chooses the appropriate image for your machine from this RPM.

Getting the Latest Firmware/Software for Your SGI Altix XE System

For information on the latest firmware for you Altix XE system, see the *SGI Foundation Software Start Here* available at http://docs.sgi.com.

License Manager Updates

Please backup your license key files prior to installing SLES10 SP1 and/or SGI ProPack 6. A license key file is **not** included in these RPMs. Your original license key files will need to be restored after you complete your installation.

In terms of software licensing support, the Redhat and SUSE distributors do not ship any code. ISVs are responsible for obtaining and including software licensing components into their products.

For information on the SGI software licensing mechanism called LK, see the *SGI Foundation Software Start Here* available at http://docs.sgi.com.

Read Me First - Installing SLES10 SP2 or RHEL 5.2 on Your SGI System

> **Note:** For information on how to install, configure, and operate software on an SGI Altix ICE 8200 system, see the *SGI Tempo System Administrator's Guide* available at http://docs.sgi.com.

This section provides some information about installing SLES10 SP2 on SGI Altix systems. You need to have SLES10 SP2 or RHEL 5.2 installed before you can install SGI ProPack 6 for Linux.

> **Note:** If you are installing Red Hat Enterprise Linux 5.2 (RHEL 5.2), you can proceed to "Installing RHEL 5.2 and SGI ProPack 6" on page 42.

For installation instructions, see "Installing SLES10 SP2 and SGI ProPack 6" on page 19.

> **Note:** If you are currently running SLES10 GA (SLES10 with no service pack), SGI recommends that you to do an online update of SLES10 to get it to the latest level and then install SGI ProPack 6. For installation instructions, see "Installing SLES10 SP2 and SGI ProPack 6" on page 19

In general, the documentation that comes with SUSE applies to installing software on an SGI Altix system. This section provides some notes to get you started, as follows:

> **Note:** Please read all the notes below before attempting installation.

- **Find installation documentation.**

  You can find installation documentation on the SLES10 SP2 DVD in the `docu/en` directory. It contains these `.pdf` documentation files:

  `apparmor-admin.pdf` `preparation.pdf` `sles-admin.pdf` `startup.pdf`
- **Find and read the SLES10 SP2 release notes.**

It is important to read the SLES10 SP2 release notes as well. You will find them in a text file named `RELEASE-NOTES.en.txt` in the `root` directory of the SLES10 SP2 DVD. The YaST installation tool can also get the latest version of the release notes directly from Novell. On the installed system, the latest version of the release notes are at the following location:

`/usr/share/doc/release-notes/SUSE_Linux_Enterprise_Server_10/RELEASE-NOTES.en.html`

- **How to erase everything and start with a clean root drive.**

  The YaST installer does not allow you to remove older partitions and create a clean root by default. To do so, you must run the YaST Partitioner in "Expert Mode" (see the *SLES10 Installation and Administration* manual). The default filesystem type for partitions is `reiserfs`. To create partitions with the XFS filesystem type, manually "Edit" the partition and then select XFS. Boot partitions on SGI Altix systems should always use the FAT filesystem.

- **Find the best installation method for SLES10 SP2 for your site.**

  There are several different methods to install SLES10 SP2. To use the graphical YaST installation, SGI recommends using the `vnc` or `ssh` methods, assuming the SGI system is connected to a network.

  Insert the media in the DVD drive and reset the machine. The BIOS on x86_64 systems should already be configured to attempt booting from CD first. The SLES10 SP2 media should boot when the system comes back up.

  To use this mode on ia64 systems, SGI suggests the **EFI Shell [Built-in]** from the **Boot Maintenance** menu. A list of fs# devices will be presented before you get to the `Shell>` prompt. One from the list, will have the word CDROM in the display. If the fs# associated with the CDROM is 1, enter the following commands:

  ```
  Shell> fs1:
  fs1:\> cd efi\boot
  ```

  You are now ready to launch the installer. Issue the following command:

  ```
  fs1:\efi\boot> bootia64
  ```

  You now will see a list of choices including **Installation**, **Installation** - **Safe Settings**, and so on. Keep the default **Installation** choice highlighted. In the **boot:** prompt, your selection depends on the type of system you are booting.

  If you prefer to install using `vnc` or `ssh`, enter **vnc=1** or **usessh=1** in the **Boot:** line.

If you are installing software on an Altix system you need to specify information about the serial console on the boot line. If you wish to use `vnc` or `ssh`, you can supply those options as well. An example boot line specifying the serial console for installation and the use of `vnc` is similar to the following:

For ia64:

```
boot: console=ttySG0,38400n8 vnc=1
```

For x86_64:

If you are using a VGA monitor/keyboard to install, you do not need to supply any options.

If you are using a serial console, the setting depends on how the system is configured. An example is, as follows:

```
boot: console=ttyS1,38400n8 vnc=1
```

Note: If ttyS1 does not work, try ttyS0. The serial cable might be attached to the other serial port

For ia64 systems, if you choose to install over the serial console or an L2 controller with xterm, note that the serial console may not be 100% clean and that you may run into "screen corruption". Often this can be cleared up by entering `Ctrl-L` from the command line, which re-draws the screen. When using xterm, remember to set the encoding to UTF-8. The following command line options have yielded fairly good results:

```
xterm -sb -en UTF-8 -geometry 130x40 -e "cu -s 38400 -l /dev/ttySG0"
```

- **Find out how to perform a network installation.**

  If you plan to set up a system to do network installations, you may find the "Network Install Server Setup" in this document helpful. This section describes how to integrate SGI ProPack 5 with SUSE operating system repositories.

- **Find information on AutoYaST.**

  For information on AutoYaST, see "Using AutoYaST" on page 38.

Installing SLES10 SP2 and SGI ProPack 6

> **Note:** SGI ProPack 6 for Linux **requires** the SGI Foundation Software 1 release. For more information, see the *SGI Foundation Software Start Here* available at http://docs.sgi.com.

To install SUSE Linux Enterprise Server 10 Service Pack 2 (SLES10 SP2) from the DVD media, perform the procedures described in this section.

> **Note:** Before starting a fresh install of SLES 10 SP2 and SGI ProPack 6 over the existing operating system, it is a good idea to remove the production root drive from your system. Perform the fresh install over the operating system on your backup root drive. This provides a fall back route to your previous operating system, in case of application compatibility issues.

Installation Overview

A general overview of the procedure steps are, as follows:

- Power down your system and replace the production root drive with the backup drive.

- Insert the SLES 10 SP2 DVD in your DVD-ROM, and boot your system.

- Start the installation, using `vnc=1` option to start a VNC server and be sure to set the console= setting appropriately to use the serial console (see "Read Me First - Installing SLES10 SP2 or RHEL 5.2 on Your SGI System" on page 16).

- On an SGI Altix XE system, make sure that BIOS is configured to boot from the DVD before the hard drive.

- Using a VNC client or compatible web browser that can run the VNC client java applet, connect to YaST remotely.

- Configure the partition layout of the drive, by changing the partition type of the root partition from `Reiser` to `XFS`.

- Modify the default software selections, by adding the `Apache Server` to the installation.

Installation Procedure

Note: Read Part 1 "Deployment" in *SUSE Linux Enterprise Server Installation and Administration* manual that resides in `sles-admin.pdf` file in the `docu` directory of the SLES10 SP2 DVD before beginning this installation procedure.

To install SUSE Linux Enterprise Server 10 (SLES10) SP2 from the DVD media, perform the following steps:

Note: These steps correspond to Section 3.2.2 "Selecting the Source of the Installation Data" of *SUSE Linux Enterprise Server Installation and Administration* manual. In this example, the source of installation will be "**Installing from SUSE Linux Enterprise Media**". (DVD)

1. Insert the SLES 10 SP2 Installation DVD in the DVD drive and reboot your system.

EFI Boot Manager

2. When the system returns to the **EFI Boot Manager Menu**, boot the system on the SLES10 SP2 Install DVD via the Boot CDROM/DVD boot option as shown in Figure 2-1.
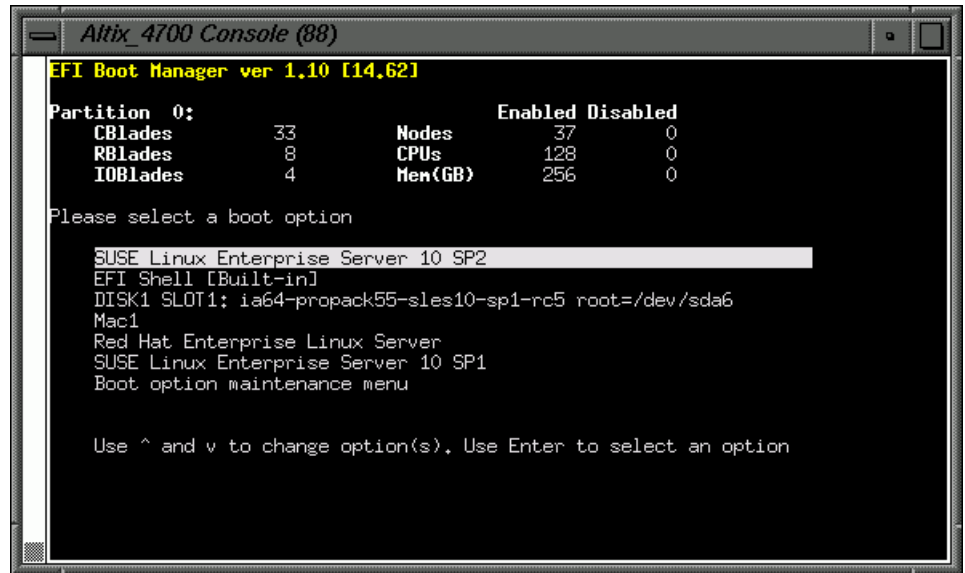
Figure 2-1   EFI Boot Manager Menu

3. If there is not a **Boot CDROM/DVD** option, it can be added to the boot menu as follows:

   a. Select **Boot option maintenance menu**

   b. Select **Add a boot option**

   c. Highlight the **Removable media boot** line

   d. Enter **Boot CDROM/DVD** for the name

   e. For **New Boot Option Data**, enter **n**

   f. Save to nvram

   g. Choose **Exit** on the next two screens to return to the main menu

   h. Select your new **Boot CDROM/DVD** option to boot from the CD

4. From the boot screen, select **Installation** and add the appropriate **Boot Options** to start the installation, as shown in Figure 2-2.

Note: This section corresponds to the Section 3.3, "The Boot Screen" in the *SUSE Linux Enterprise Server Installation and Administration* manual.
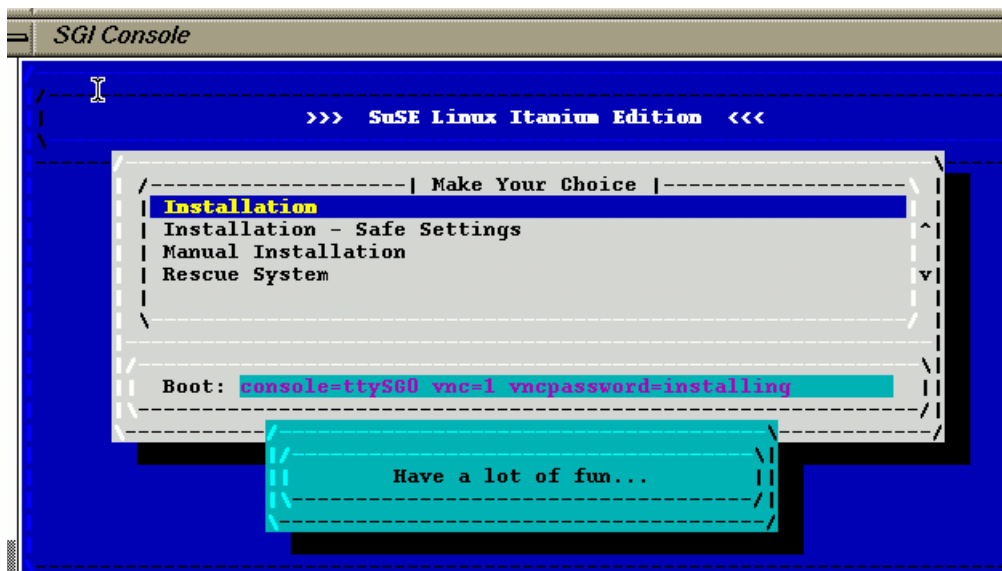
Figure 2-2 Boot Screen

5. These Boot Options will start the installation via the serial console and finish by using YaST on a remote system using VNC:

- **console=ttySG0,38400** - Select the serial console as the output source for ia64 systems. Sets the baud rate to 38400.

- **console=ttyS1,38400** - Select the serial console as the output source for x86_64 systems. Sets the baud rate to 38400. Set ttyS1 or ttyS0 depending on the port to which the serial cable is connected.

- **vnc=1** - **Start a VNC Server**, to allow using a web browser, or VNC client program.

- **vncpassword=your_password** - The password the VNC server will use to authenticate the user. Must be at least 6 characters.

There is no **console=** selection for VGA screen installs.

Once the proper Boot Options are added, return starts the install program, and brings up the **Network Configuration Screen** as shown in Figure 2-3.
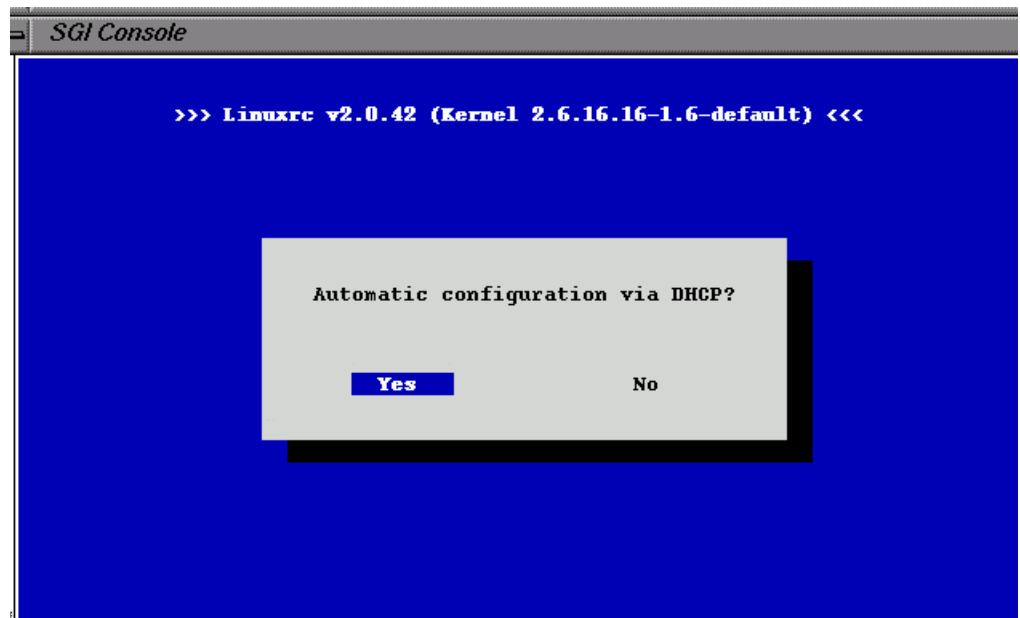
Figure 2-3   Network Configuration Screen

6. Choose DHCP by clicking on **Yes** or enter your information manually.

Note: If you manually enter the information, you will need system IP address, netmask, broadcast, and nameserver (if applicable).

There may be a delay here, while the system displays **Loading Data Into Ramdisk.**

The install program starts the VNC Server, once the network has been configured as shown in Figure 2-4.

Figure 2-4   Starting the VNC Server

Note: Control now changes to a web browser on a remote system for the duration of the install. Use the URL specified above if you will be using a web browser, otherwise specify the <IP address:number> shown above when connecting using a VNC client.

Figure 2-5 shows a connection to the VNC Server via a web browser running remotely:
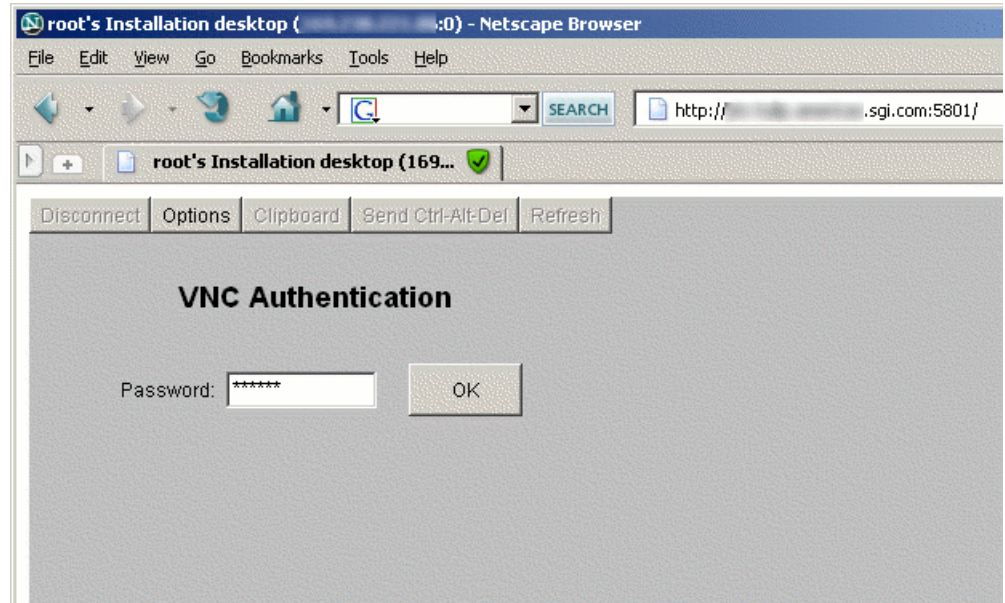
Figure 2-5   VNC Server via a Web Browser

The browser connects to your SGI Altix system, and the VNC Server prompts for the password set earlier in the Boot Options (see step 6).

Language Selection

> **Note:** See Section 3.4, "Language Selection" in the *SUSE Linux Enterprise Server Installation and Administration* manual.

7. Select the appropriate language from the **Language Selection** window and then click on the **Next** button to continue.

License Agreement

> **Note:** See Section 3.6 "License Agreements" in the *SUSE Linux Enterprise Server Installation and Administration* manual.

8. The **License Agreement** window appears. Click on the **Next** button to continue.

Installation

Note: See Section 3.7, "System Analysis" in the *SUSE Linux Enterprise Server Installation and Administration* manual.

---

9. From the **Installation Mode** window as shown in Figure 2-6, click on the New **Installation button** and the **Include Add-On Products from Separate Media** button, since you will also be adding SGI ProPack 6 software and then click on the **Next** button to continue.

Note: SGI ProPack 6 for Linux **requires** the SGI Foundation Software 1 release be installed. For more information, see the *SGI Foundation Software Start Here* available at http://docs.sgi.com. If SGI Foundation Software 1 release is not installed, a **Dependency Conflict** error message appears.
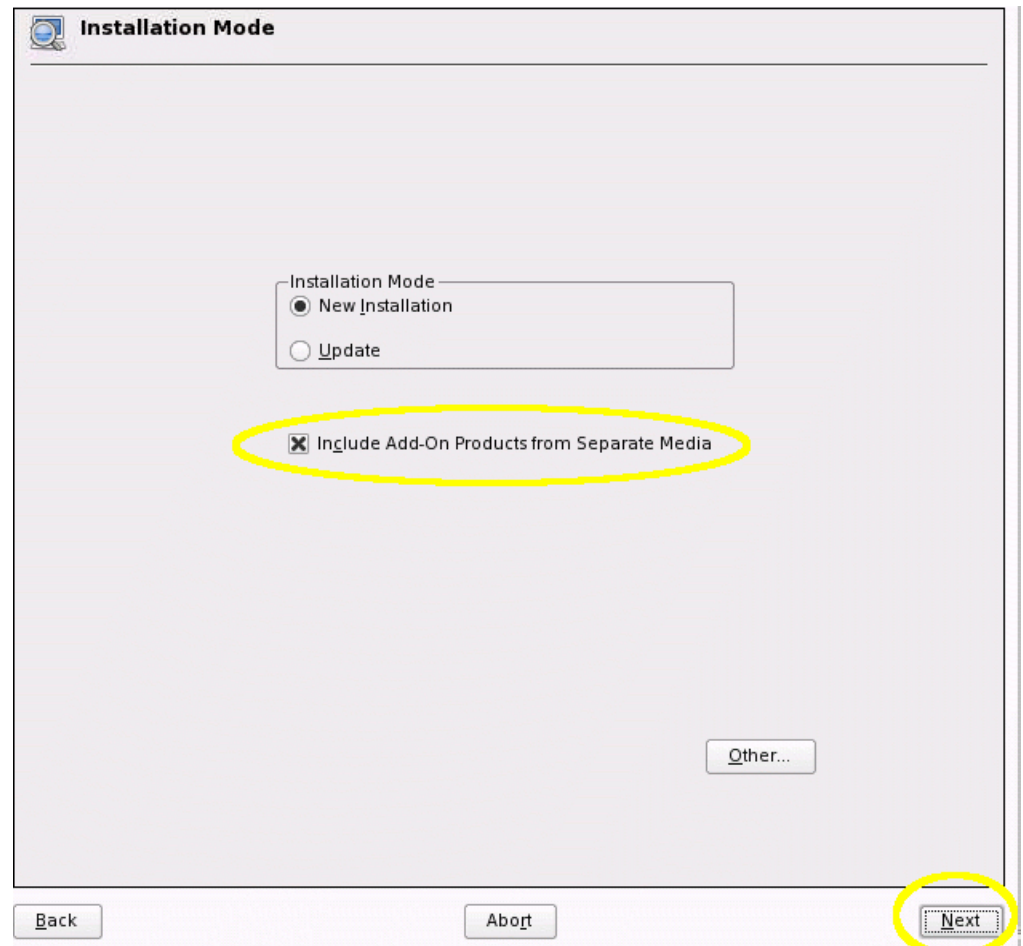
Figure 2-6   **Installation Mod**e Window

10. From the **Add**-**On Product Installation** window, click on the **Add** button and then click the **Next** button to continue.

11. From the **Add**-**On Product Media** window, click on the **CD** button and then the **Next** button to continue.

Installation of Add-on Products (especially SGI ProPack 6)

12. Remove and replace the SLES10 SP2 DVD with the SGI ProPack 6 CD when prompted and then from the **Insert the Add-on Product DVD** screen, click on the **Continue** button to continue.

13. From the **Import Untrusted GnuPG Key** screen as shown in Figure 2-7, click on the **Import** button to import the SGI Key into YaST.

The owner of the key may distribute updates, packages, and package repositories that your system will trust and offer for installation and update without any further warning. In this way, importing the key into your keyring of trusted keys allows the key owner to have a certain amount of control over the software on your system.

A warning dialog opens for every package that is not signed by a trusted (imported) key. If you do not import the key, packages created by the owner of key 590A5B8C0DB30327 show this warning.

⚠ **Import Untrusted GnuPG Key**

The following GnuPG key has been found:
ID: 590A5B8C0DB30327
Fingerprint: 1ACF 206C F31A 006D BCD3 D1D1 590A 5B8C
Name: SGI, Silicon Graphics, Inc. (SGI ProPack RPM signin

You can choose to import it into your keyring of trusted public keys, meaning that you trust the owner of the key. You should be sure that you can trust the owner and that the key really belongs to that owner before importing it.

[Import] [Do Not Import]

Figure 2-7   **Import Untrusted GnuPG Key** Screen

14. Choose **SGI ProPack** pattern to install SGI ProPack. Optionally, choose **SGI REACT** if you are an SGI Real-Time customer.

15. Verify that SGI ProPack 6 is now selected for installation as an **Add-On Product** (and **SGI REACT** if needed) and then click on the **Next** button to continue.

> **Tip:** Additional Add-On Products can be added at this point.

Clock and Time Zone

> **Note:** See Section 3.8, "Time Zone" in the *SUSE Linux Enterprise Server Installation and Administration* manual.

16. From the **Clock and Time Zone** window, choose the appropriate **Region** and **Time Zone** and then click on the **Next** button to continue.

Partitioning Set Up

> **Note:** See Section 3.9.1, "Partitioning " in the *SUSE Linux Enterprise Server Installation and Administration* manual.

17. From the **Installation Settings** window, click on the **Change**->**Partitioning** pull down menu, to bring up the **Expert Partitioner Tool**.

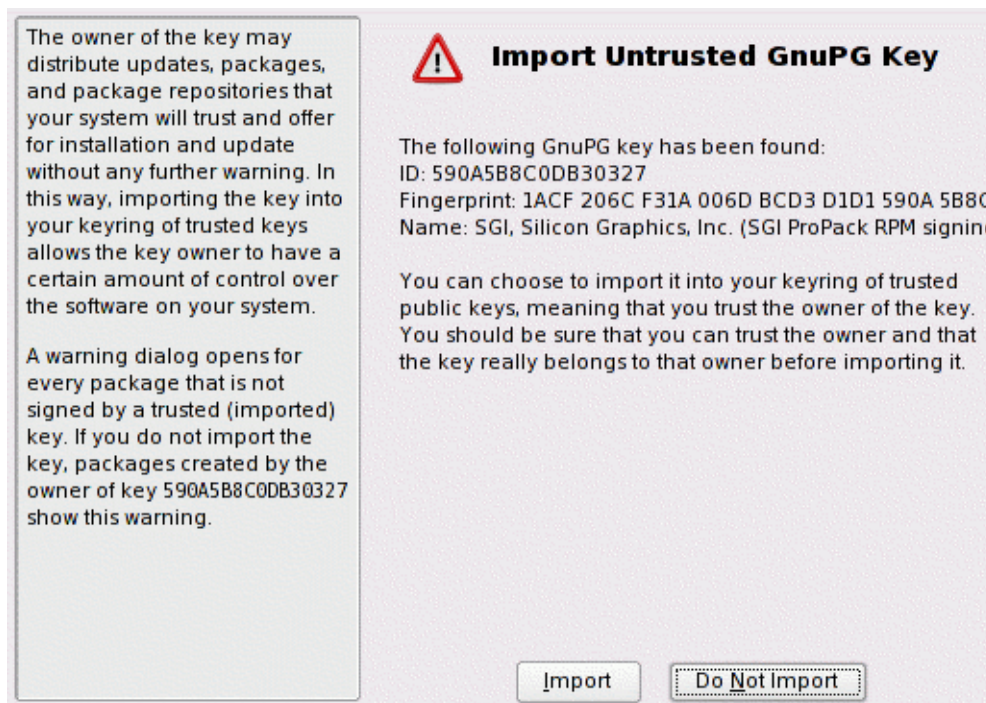> **Note:** The first time, the tool asks how to initialize the configuration.

The following steps show partitioning on a very basic level. Read the partitioning section in the *SUSE Linux Enterprise Server Installation and Administration* manual. Additional information can be found in Section 7.5.8 "Partitioner". The YaST partitioning utility is very powerful and flexible, but must be used with care, by knowledgeable personnel. Select **Create Custom Partition Setup** if you need to tailor the size or number of partitions beyond what YaST has chosen or you wish to delete existing partitions and create new ones. Follow these guidelines in all cases:

- The EFI boot partition file system format type for ia64 systems should be **FAT**.

- If creating a new partition structure, always create the EFI boot partition for ia64 systems first or the system may not boot.

- Pay attention to whether or not you wish the partition to be formatted. The default is to format the partition.

- SGI suggests using **XFS** for all root filesystems.

- Always review the actions shown in the **Installation Settings** Window.

18. From the **Suggested Partitioning** window, click on the **Base Partition Setup on This Proposal** button to reuse the existing partitions. YaST defaults to the **Reiser** filesystem type, so you will need to change the root filesystem type to **XFS** and format both it and the boot partition before starting the install and then click on the **Next** button to continue.

19. From the **Expert Partitioner** window, select the root partition as shown and click on the **Edit** button and change the filesystem type to XFS.

20. From the **Edit Existing Partition** window, perform the following:

    • Verify that the **Format** button is selected.

    • Set the filesystem type to **XFS** using the pull-down menu

    • Verify the **Mount Point** is set to "/"

    Note: Changes made at this point are not yet being written to the drive. No action will be taken until **Accept** is clicked in the **Installation Settings** Window to accept the final configuration.

    Click the OK button which will close the **Edit** window and then go back to the **Expert Partitioner** window.

21. Click on the **Edit** button on the E**xpert Partitioner** window.

22. For ia64 systems only, from the **Edit Existing Partition** window, perform the following:

    • Verify that the **Format** button is selected

    • Set the filesystem type to FAT using the drop-down menu

    • Verify the **Mount Point** is set to "/boot/efi"

    • Clicking the **OK** button, will close the **Edit** window, and go back to the **Expert Partitioner**

23. Verify the following settings in the **Expert Partitioner** window:

    • The boot and root partitions now have an **F** in the **F** column, indicating they will be formatted

    • The filesystem type for the root partition is now **XFS**.

    • Click on the **Finish** button to return to the **Installation Settings** screen.

24. Verify the partitioning information in the **Partitioning** section of the **Installation Settings** screen.

Caution: Pay special attention to the actions scheduled to be performed by the **Partitioning** section. There may be some default actions picked by the E**xpert Partitioner** that you did not notice, if you have existing partitions that you want to keep. In the example above, the settings are as specified.

Software Selection and System Tasks

Note: See Section 3.9.2, "Software" in the *SUSE Linux Enterprise Server Installation and Administration* manual.

---

25. Click the **Change**->**Software** menu to bring up the **Software Selection and System Tasks** screen.

26. The left panel of the **Software Selection and System Tasks** screen shows packages grouped by **Filter: Patterns.** Check marks show which packages are presently selected for installation. To install SGI ProPack 6 as an Add-On product, perform the following:

   • Choose **SGI ProPack** pattern to install SGI ProPack.

   • Optionally, choose **SGI REACT** if you are an SGI Real-Time customer.

Note: To install SGI ProPack 6 kernel modules for other kernel variants (for example, debug), click the **SGI ProPack Kernel Modules** pattern for that kernel variant.

---

27. YaST reports all the package changes which your selection has triggered. Click the **Continue** button to continue.

The **Installation Settings** screen now reflects the desired partitioning and formatting of the disk and the addition of **SGI ProPack.**

28. If the language needs to be changed, select **Language**. See Section 3.9.3, "Language" in the *SUSE Linux Enterprise Server Installation and Administration* manual.

Setting Default Runlevel

> **Note:** See Section 3.9.4, "Default Runlevel" in the *SUSE Linux Enterprise Server Installation and Administration* manual.

29. Click on the **Expert** button on the **Installation Settings** screen.

30. Select **Change**-->**Default Runlevel** from the **Installation Settings** screen.

31. From the **Set Default Runlevel** Window, select **3: Full multiuser with network** and the click the **OK** button to continue.

    The **Installation Settings** screen now shows **Default Runlevel** as **3: Full multiuser with network**.

Performing the Installation

> **Note:** See Section 3.9.9, "Performing the Installation" in the *SUSE Linux Enterprise Server Installation and Administration* manual.

32. Examine all settings on the **Installation Settings** screen and click **Accept** if satisfied they are all correct.

> **Tip:** The **Expert** tab has additional configuration options.

33. A **Confirm Installation** window appears. This is the last opportunity to make any configuration changes. Any disk formatting will happen now if the **Install** button is clicked. Use the **Back** button to double check if needed.

34. Replace the SGI ProPack 6 CD with the SLES10 SP2 and then click the **OK** button to continue.

    The **Package Installation** window appears. After partitioning is done, the selected software packages are installed

35. When prompted for the SGI ProPack 6 for Linux CD, insert it in the drive and click the **OK** button.

    Once the install of all packages is done, the system will finish the basic installation and prepare the system for initial boot. When the reboot dialog box appears, click the **OK** button and the system will reboot.

Once the system reboots, you should find a SUSE Linux Enterprise Server 10 SP2 boot option in your boot manager.

Without manual intervention, the system will boot automatically into SLES10 SP2. If you are using VNC, the VNC server will be restarted.

36. Reconnect to the VNC server using a VNC client or VNC capable web browser (see step 5).

Setting Up Your Hostname and Domain Name

Note: See Section 3.10.1, "Hostname" in the *SUSE Linux Enterprise Server Installation and Administration* manual.

---

37. Enter your **Hostname** and **Domain Name** and then click the **Next** button to continue.

Setting Up Your root Password

Note: See Section 3.10.2, "root Password" in the *SUSE Linux Enterprise Server Installation and Administration* manual.

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38. Enter the password for the root account and then click the **Next** button to continue.

Network Configuration

Note: See Section 3.10.3, "Network Configuration" in the *SUSE Linux Enterprise Server Installation and Administration* manual.

---

39. Review the information provided in the **Network Configuration** window. If everything is correct, click **Use Following Configuration** button and then click the **Next** button to continue. If the network information is not correct, click the **Change** button and use the options in the pull-down window to make any necessary changes for your specific network configuration.

Note: If your network requires a proxy, make sure it is set correctly before proceeding to the **Test Internet Connection** window.

---

40. From the **Test Internet Connection** window, verify that the device you will use to connect to the Internet is listed on the screen and click the **Next** button to continue. If the device is not correct, make any modifications that are necessary using the **+** button.

    If the system is able to access the Internet, it will try to download the latest SLES10 SP2 release notes and any available product updates. If you are installing SGI ProPack 6 with SLES10 SP2, the error dialog shown in Figure 2-8 appears when the installer goes to check for SGI ProPack 6 updates.
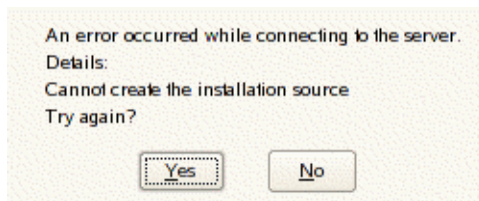
Figure 2-8   Server Connect Error Message

41. Existing SGI customers with Supportfolio accounts should click on the **Yes** button to display the window shown in Figure 2-9.

42. Uncheck the **Anonymous** box and enter your Supportfolio user name and password and then click the **OK** button. This step lets your system know where the SGI ProPack online update source is located. If you are unable to configure the online update sources, you can configure it at a later time via the Software section in the YaST Control Center.

Figure 2-9   Server and Directory Window

Customer Center

Note: See Section 3.10.4, "Customer Center" in the *SUSE Linux Enterprise Server Installation and Administration* manual.

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43. If your Internet connection is successful, the **Novell Customer Center Configuration** window appears. SGI recommends that you check the **Config Now** button and register your system with Novell. If you have your registration number that came with your SLES10 SP2 purchase, you may provide that information when prompted to register your subscription with Novell. If you do not have your registration number at this time, the installer will use a temporary registration code so that you can complete this step. You can re-register using your official registration code at a later time.

Online Update

Note: See Section 3.10.5, "Online Update" in the *SUSE Linux Enterprise Server Installation and Administration* manual.

44. If you were able to complete the previous step and register your product with Novell, the **Online Update** window appears. If you wish to download available updates for SLES10 SP2 and SGI ProPack 6, click the **Run Update** button and click the **Next** button. You will be given the opportunity to select any updates you wish to install. When ready, click the **Accept** button to download and install the updates. After the updates have been installed, click the **Next** button on the **Patch Download and Installation** window. If you choose not to install updates at this time, click the **Skip Update** button and then the **Next** button.

Service

Note: See Section 3.10.6, "Service" in the *SUSE Linux Enterprise Server Installation and Administration* manual.

45. From the **Installation Settings** window, click the Use Following Configuration button and then click the **Next** button to continue.

Users

Note: See Section 3.10.7, "Users" in the *SUSE Linux Enterprise Server Installation and Administration* manual.

46. From the **User Authentication Method** window, click the **Local (/etc/password)** button then click the **Next** button to continue.

47. From the **New Local User** window, fill in the appropriate information and then click the **Next** button to continue.

Release Notes

Note: See Section 3.10.7, "Release Notes" in the *SUSE Linux Enterprise Server Installation and Administration* manual.

48. The **Release Notes** window appears and then click the **Next** button to continue.

Hardware

> **Note:** See Section 3.10.10, "Hardware" in the *SUSE Linux Enterprise Server Installation and Administration* manual.

49. From the **Hardware Configuration** window verify the information. If correct, click the **Use Following Configuration** button and click the **Next** button to continue.

50. From the **Installation Completed** window, click the **Finish** button.

The system will now reboot.

SLES and SGI ProPack Network Installation for Experts

This section describes how to set up a network install server and provides some information on using AutoYaST. It covers these topics:

- "Setting up the Network Install Server" on page 37
- "Using AutoYaST" on page 38

Setting up the Network Install Server

This section provides you with some information on installing SUSE SLES10 SP2 and SGI ProPack 6 for Linux all in one session over the network. This is helpful for systems administrators who have several machines to install and keep up to date.

> **Note:** For information on setting up a network install server, see the "Installing Add-On Products" section in Chapter 7, "System Configuration with Yast" in the *SUSE Linux Enterprise Server Installation and Administration* manual that resides in the `sles-admin.pdf` file in the `docu` directory of the SLES10 SP2 DVD and see "Chapter 4. Configuration and Installation Options" in *AutoYaST* available at http://www.suse.de/~ug/autoyast_doc/index.html.

In SLES10 SP2, you can create a special `add_on_products` file that directs YaST to look at additional install sources. You may list a URL to the SGI ProPack 5 install source in this file.

To create an SGI ProPack 6 install source, you simply mount the SGI ProPack 6 CD and copy all of the contents in to a repository. An example of how to do this is, as follows:

```
mkdir /path/to/new-propack-repository
mount /dev/cdrom /mnt
cp -a /mnt/* /path/to/new-propack-repository/
umount /mnt
```

In the `add_on_products` file that exists in your SLES10 SP2 network repository, you just add a URL pointer to your new target. The URL can be nfs, http, ftp, and so. An example entry for the `add_on_products` file is similar to the following:

```
nfs://server/path/to/new-propack-repository
```

Using AutoYaST

AutoYaST is a tool that allows you to install and configure a system based on control file settings. With AutoYaST, you could install and configure a system over the network automatically. It provides similar functionality to kickstart provided by Red Hat.

You can find information on how to use AutoYaST in *AutoYaST* available at http://www.suse.de/~ug/autoyast_doc/index.html.

You can find information about AutoYaST in Chapter 5, "Automated Installation", of the *SUSE Linux Enterprise Server Installation and Administration* manual. This resides in the `sles-admin.pdf` file in the /docu/en directory of the SLES10 SP2 DVD. Documentation is also available in `/usr/share/doc/packages/autoyast2/html/index.html` on systems running SLES10 SP2.

Caution: With the initial SLES10 SP2release, add-on-products handling with AutoYaST is extremely problematic and SGI recommends you do not use it.

Upgrading From an Earlier SGI ProPack 5 Release to SGI ProPack 6

This section describes how to upgrade from a prior release.

Note: The best way to upgrade a system that is running SLES9 and SGI ProPack 4 is to install both SLES10 SP2 and SGI ProPack 6 at the same time (see "Installing SLES10 SP2 and SGI ProPack 6" on page 19).

Updates from SLES 9 to SLES 10 are supported starting from one of the following bases:

- SLES 9 GA (no Service Pack)
- SLES 9 SP3
- SLES 9 SP4
- SLES 10 GA (no Service Pack)
- SLES 10 SP1

Note: Update a system by starting the SLES10 installation system and choosing **Update** instead of **New Installation**.

Upgrading From SGI ProPack 5 SP5 to SGI Propack 6

This section describes how to upgrade your SLES 10 SP2 system running the SGI ProPack 5 SP5 release to SGI ProPack 6.

During this upgrade, your kernel and several other packages may be upgraded to a newer SLES10 SP2 Online Update version. If you have been keeping up-to-date with SLES10 SP2 online updates, you may already have the newer updated packages installed. The upgrade will work fine in either case.

Caution: Do not use **System Update** to update SGI ProPack. The SLES10 SP2 version of **System Update** is not currently supported by SUSE and will not work correctly.

You need to pay careful attention to the upgrade instructions. If you simply were to mark a pattern for upgrade, you will find only a few packages would be installed. You need to work around a problem in YaST to get the install to proceed properly.

SGI suggests that existing customers upgrade their system from SGI ProPack 5 SP5 to SGI ProPack 6 using media because this ensures you get new packages for SGI ProPack 6. A simple online-update will not automatically offer new packages.

To upgrade from SGI ProPack 5 SP5 to SGI ProPack 6, perform the following steps:

1. Remove any old SGI ProPack 5 SP5 install source that may be present. There are several ways to do this. The following example uses the `yast` command.

    a. Start the graphical or text version of `yast`.

    b. Select **Software** -> **Installation Source**.

    c. Check for an install source named **SGI ProPack 6 for Linux**

    d. If the SGI ProPack 5 install source exists, select it and delete it.

    e. Select `Finish` to exit out of the tool.

2. Add ProPack 6 add-on product, as follows:

    a. Start the graphical or text version of `yast`.

    b. Select **Software** -> **Add-on Product**.

    Note: At this point, you need to select and define your media. This example shows the use of a physical CD.

    c. Select **CD...**.

    You will be prompted to insert the media.

    d. YaST will now add the install source for you.

    Note: You will see an error message that states: "An error occurred while connecting to the server. Details: Cannot create the installation source Try again?"

    This does **NOT** mean the add-on product failed to add. Instead, this is giving you a chance to enter your authentication information for getting updates/patches from SGI.

e. Answer `Yes` to the re-try question.

You are now given a chance to set up authentication details

f. Unselect the **Anonymous** box.

g. Enter your SupportFolio login name for **User name**.

h. Enter your SupportFolio password for **Password**.

YaST will now add the update source in addition to the ProPack 6 install source itself.

3. You are now software manager. Perform the following steps:

a. Select **Filter** and then **Patterns**.

Caution: At this point, do not mark the patterns themselves for upgrade. That will cause the upgrade to not complete properly. See the introductory comments to this section ("Upgrading From SGI ProPack 5 SP5 to SGI Propack 6" on page 39).

---

b. In Text mode, perform the following:

Highlight the **SGI ProPack** pattern and select `OK`.

Highlight one of the packages that are part of this pattern (any one will do).

Tab to **Actions** and hit `Enter`.

Select **All Listed Packages...**

Select **Update All Unconditionally**

Now all the packages in this pattern should have '>' next to them.

c. In Graphical mode, perform the following:

Highlight the **SGI ProPack** pattern and right-click on any package in the list.

Select **All In List** and then **Update if newer version available**

4. If you have additional SGI ProPack or REACT patterns to update, go to the Caution in step 3a. and repeat the steps for each additional pattern.

5. Select **Accept** to install.

Your system will now be updated.

Installing RHEL 5.2 and SGI ProPack 6

This section describes how to install Red Hat Enterprise Linux 5.2 (RHEL 5.2) and SGI ProPack 6 for Linux. There are several ways to install SGI ProPack 6 for RHEL 5.2. The following example shows how to install it in graphical mode, which is the easiest method.

Note: It is also possible to install SGI ProPack 6 for RHEL 5.2 using yum in text mode. See the `README-yum-install` file in the `docs` directory of the SGI ProPack 6 CD.

---

1. To install RHEL 5, see Red Hat Enterprise Linux 5 *Installation Guide for x86, Itanium, AMD64, and Intel Extended Memory 64 Technology (Intel EM64T)*

2. If you are not using a VGA display, this example assumes that you have a workstation running UNIX and can display X11 graphics. You should connect from your workstation to the target server with `ssh` using the `-X` option to pass along graphics to your desktop like this:

   # **ssh -X** *root@name-of-host*

3. Make sure you have registered with RHN, that is, Red Hat Network. If you are not registered, perform this command, as follows:

   # **/usr/bin/rhn_register**

4. Insert the SGI ProPack 6 for Linux into your CD-ROM and enter the following command to mount the CD:

   # **mount /dev/cdrom /mnt**

5. Change directory to the `/mnt` directory, as follows:

   # **cd /mnt**

6. Run the install script, as follows:

   # **./INSTALL**

7. Check the box just to the left of SGI ProPack and then click the **FORWARD** button to continue.

   A screen may appear (if you have not pre-installed `sysstat`), as follows:

   ```
   Dependences Added


   ...


   Will continue in 20 seconds.
   ```

   You can wait the 20 seconds or click the **Continue** button.

8. When installation completes, a screen appears, as follows:

   ```
   The software was successfully installed.
   ```

9. Click on the **CLOSE** button to close this screen.

Product Support

This chapter documents the product components that are supported on the SGI Altix 3000 series, SGI Altix 4000 series, SGI Altix ICE 8200 series, and SGI Altix XE systems. (For a list of the products, see Table 3-1 on page 46.)

Descriptions of the product components are grouped in this chapter as follows:

- "SGI ProPack 6 for Linux Products" on page 45
- "Operating System Enhancements" on page 49
- "I/O Subsystems" on page 51
- "HPC Application Tools and Support" on page 53
- "NUMA Data Placement Tools" on page 58

SGI ProPack 6 for Linux Products

Software provided by SGI for the SGI ProPack 6 for Linux release consists of kernel modules for SGI software built against the kernels in SUSE Linux Enterprise Server 10 Service Pack 2 (SLES10 SP2) or Red Hat Enterprise Linux 5.2 (RHEL 5.2) and value-add software developed by SGI specifically to run on SGI Altix or SGI Altix XE systems and some additional third-party software (see VTune in Table 3-1 on page 46).

Table 3-1 SGI ProPack 6 for Linux Products

Product	Architecture Supported	Description
Application performance measuring tools	ia64	VTune - This tool, developed and supported by Intel, uses the performance measurement facilities of the Itanium processor to take profiles based on elapsed time or other architected events within the processor. These profiles can be used to measure, tune, and improve an application's performance. For more information on VTune, go to the following web location: http://developer.intel.com/software/products/vtune/
Array Services	ia64 and x86_64	Array Services includes administrator commands, libraries, daemons, and kernel extensions that support the execution of parallel applications across a number of hosts in a cluster, or array. The Message Passing Interface (MPI) of SGI ProPack uses Array Services to launch parallel applications. For information on MPI, see the Message Passing Toolkit (MPT) User's Guide The secure version of Array Services is built to make use of secure sockets layer (SSL) and secure shell (SSH). For more information on standard Array Services or Secure Array Services (SAS), see the Array Services chapter in the *Linux Resource Administration Guide*.
Cpuset System	ia64 and x86_64	The Cpuset System is primarily a workload manager tool permitting a system administrator to restrict the number of processors and memory resources that a process or set of processes may use. A system administrator can use cpusets to create a division of CPUs and memory resources within a larger system. For more information, see the "Cpusets on SGI ProPack 5 for Linux" chapter in the *Linux Resource Administration Guide*.
CSA	ia64 and x86_64	Provides jobs-based accounting of per-task resources and disk usage for specific login accounts on Linux systems. Linux CSA application interface library allows software applications to manipulate and obtain status about Linux CSA accounting methods. For more information, see the CSA chapter in the *Linux Resource Administration Guide*.

Table 3-1   SGI ProPack 6 for Linux Products **(continued)**

Product	Architecture Supported	Description
IOC4 serial driver	ia64	Driver that supports the Internal IDE CD-ROM, NVRAM, and Real-Time Clock.
		Serial ports are supported on the IOC4 base I/O chipset and the following device nodes are created:

		`/dev/ttyIOC4/0`
		`/dev/ttyIOC4/1`
		`/dev/ttyIOC4/2`
		`/dev/ttyIOC4/3`

Kernel partitioning support	ia64	Provides the software infrastructure necessary to support a partitioned system, including cross-partition communication support. For more information on system partitioning, see the *Linux Configuration and Operations Guide*.
libarena	x86_64	`libarena` is a custom memory allocator interface and implementation. Four allocators are provided: flat LIFO arena allocator, object pool allocator and two `malloc`(3) wrappers: one which returns the pointers unadulterated and one which obeys the requested, arbitrary alignment. These can be used directly, or through their exported prototype interfaces.
MPT	ia64 and x86_64	Provides industry-standard message passing libraries optimized for SGI computers. For more information on MPT, see the *Message Passing Toolkit (MPT) User's Guide*.
NUMA tools	ia64 and x86_64	Provides a collection of NUMA related tools (`dlook`(1), `dplace`(1), and so on). For more information on NUMA tools, see the *Linux Application Tuning Guide*.
Performance Co-Pilot collector infrastructure	ia64 and x86_64	Provides performance monitoring and performance management services targeted at large, complex systems. For more information on Performance Co-Pilot, see *Performance Co-Pilot for IA-64 Linux User's and Administrator's Guide*.

Table 3-1   SGI ProPack 6 for Linux Products **(continued)**

Product	Architecture Supported	Description
Reconfigurable Application-Specific Computing	ia64	Reconfigurable application-specific software computing (RASC) program delivers scalable, configurable computing elements for the SGI Altix family of servers and superclusters and Silicon Graphics Prism visualization systems. For more information, see the *Reconfigurable Application-Specific Computing User's Guide*.
REACT real-time for Linux	ia64 and x86_64	Support for real-time programs. For more information, see the *REACT Real-Time for Linux Programmer's Guide*.
SGI Histx	ia64	SGI Histx is a performance analysis tool designed to complement pfmon, which is included with the SGI ProPack software for the Altix family of servers. The software is designed to run on Altix machines only and is only supported on systems running SGI ProPack 5 SP5 with SLES10. Used internally by SGI developers and benchmarkers, as well as SGI customers, this product is offered as a service to customers with a no-fee end user proprietary license via the Supportfolio website. For more information on SGI Histx, see http://www.sgi.com/products/software/histx.html
Utilities	ia64 and x86_64	udev_xsci, is a udev helper for doing XSCSI device names. sgtools, a set of tools for SCSI disks using the Linux SG driver and lsiutil, the LSI Fusion-MPT host adapter management utility.
XVM	ia64 and x86_64	Provides software volume manager functionality such as disk striping and mirroring. For more information on XVM, see the *XVM Volume Manager Administrator's Guide*.

SGI does not support the following:

- Base Linux software not released by Novell for SLES10 SP2, Red Hat for RHEL 5.2, or other software not released by SGI.

- Other releases, updates, or patches not released by Novell for SLES10, Red Hat for RHEL 5.2, or by SGI for SGI ProPack software.

- Software patches, drivers, or other changes obtained from the Linux community or vendors other than Novell, Red Hat, and SGI.

- Kernels recompiled or reconfigured to run with parameter settings or other modules as not specified by Novell, Red Hat, and SGI.

- Unsupported hardware configurations and devices.

Operating System Enhancements

Building on the Linux operating system's rapid expansion and improvements for general commercial and enterprise environments, SGI has focused on improving Linux capabilities and performance specifically for high performance computing's (HPC's) big compute and big data environments. Thus, SGI has leveraged its experience with NUMAflex and HPC from its IRIX operating systems and MIPS processor-based systems and concentrated on the Linux kernel improvements specifically important to HPC environments.

Cpuset Support

The cpuset facility is primarily a workload manager tool permitting a system administrator to restrict the number of processors and memory resources that a process or set of processes may use. A cpuset defines a list of CPUs and memory nodes. A process contained in a cpuset may only execute on the CPUs in that cpuset and may only allocate memory on the memory nodes in that cpuset. Essentially, cpusets provide you with a CPU and memory containers or "soft partitions" within which you can run sets of related tasks. Using cpusets on an SGI Altix system improves cache locality and memory access times and can substantially improve an applications performance and runtime repeatability. Restraining all other jobs from using any of the CPUs or memory resources assigned to a critical job minimizes interference from other jobs on the system. For example, Message Passing Interface (MPI) jobs frequently consist of a number of threads that communicate using message passing interfaces. All threads need to be executing at the same time. If a single thread loses a CPU, all threads stop making forward progress and spin at a barrier. Cpusets can eliminate the need for a gang scheduler.

Cpusets are represented in a hierarchical virtual file system. Cpusets can be nested and they have file-like permissions.

In addition to their traditional use to control the placement of jobs on the CPUs and memory nodes of a system, cpusets also provide a convenient mechanism to control the use of Hyper-Threading Technology.

For detailed information on cpusets, see Chapter 6, "Cpusets on SGI ProPack 5 for Linux" in the *Linux Resource Administration Guide*.

Comprehensive System Accounting (CSA)

The port of Comprehensive System Accounting (CSA) software packages from IRIX to Linux is the result of an open source collaboration between SGI and Los Alamos National Laboratory (LANL) to provide jobs-based accounting of per-task resources and disk usage for specific login accounts on Linux systems.

Providing extensive system accounting capabilities is often important for very large systems, especially when the system will be shared or made available for other organizations to use. CSA uses a Job Containers feature, which provides on Linux the notion of a job. A job is an inescapable container and a collection of processes that enables CSA to track resources for any point of entry to a machine (for example, interactive login, cron job, remote login, batched workload, and so on).

The Linux CSA application interface library allows software applications to manipulate and obtain status about Linux CSA accounting methods.

CSA on Linux is an SGI open source project, also available from the following location:

http://oss.sgi.com/projects/csa

For further documentation and details on CSA support, see the chapter titled "Comprehensive System Accounting" in the *Linux Resource Administration Guide*.

Partitioning

SGI provides the ability to divide a single SGI Altix system into a collection of smaller system partitions. Each partition runs its own copy of the operating system kernel and has its own system console, root filesystem, IP network address, and physical memory. All partitions in the system are connected via the SGI high-performance NUMAlink interconnect, just as they are when the system is not partitioned. Thus, a partitioned system can also be viewed as a cluster of nodes connected via NUMAlink.

Benefits of partitioning include fault containment and the ability to use the NUMAlink interconnect and global shared memory features of the SGI Altix to provide high-performance clusters.

For further documentation and details on partitioning, see the *Linux Configuration and Operations Guide.*

I/O Subsystems

Although some HPC workloads might be mostly CPU bound, others involve processing large amounts of data and require an I/O subsystem capable of moving data between memory and storage quickly, as well as having the ability to manage large storage farms effectively. The XFS filesystem, XVM volume manager, and data migration facilities were leveraged from IRIX and ported to provide a robust, high-performance, and stable storage I/O subsystem on Linux. This section covers the following topics:

- "Persistent IP Addressing of Ethernet Interfaces" on page 51
- "PCI Domain Support for SGI Altix 450 and 4700 Systems" on page 51
- "XSCSI Naming Systems on SGI ProPack Systems" on page 52
- "XFS Filesystem" on page 52
- "XVM Volume Manager" on page 52

Persistent IP Addressing of Ethernet Interfaces

An Ethernet interface can be given a persistent internet addresses by associating its permanent MAC address, such as 08:00:69:13:f1:aa, with an internet protocol (IP) address, for example 192.168.20.1. An interface with a persistent IP address will be given the same IP address each time the system is booted. For more information, see "Persistent Network Interface Names" in the *Linux Configuration and Operations Guide.*

PCI Domain Support for SGI Altix 450 and 4700 Systems

On an SGI Altix 450 and 4700 system, a *PCI domain* is a functional entity that includes a root bridge, subordinate buses under the root bridge, and the peripheral devices it controls. Separation, management, and protection of PCI domains is implemented and controlled by system software. For more information, see "PCI Domain Support for SGI Altix 450 and 4700 Systems" in the *Linux Configuration and Operations Guide.*

XSCSI Naming Systems on SGI ProPack Systems

The XSCSI subsystem on SGI ProPack 4 systems was an I/O infrastructure that leveraged technology from the IRIX operating system to provide more robust error handling, failover, and storage area network (SAN) infrastructure support, as well as long-term, large system performance tuning. This subsystem is not necessary for SGI ProPack 6 systems. However, XSCSI naming is available on SGI ProPack 6 systems. For more information, see "XSCSI Naming Systems on SGI ProPack Systems" in the *Linux Configuration and Operations Guide.*

XFS Filesystem

The SGI XFS filesystem provides a high-performance filesystem for Linux. XFS is an open-source, fast recovery, journaling filesystem that provides direct I/O support, space preallocation, access control lists, quotas, and other commercial file system features. Although other filesystems are available on Linux, performance tuning and improvements leveraged from IRIX make XFS particularly well suited for large data and I/O workloads commonly found in HPC environments.

For more information on the XFS filesystem, see *XFS for Linux Administration.*

XVM Volume Manager

The SGI XVM Volume Manager provides a logical organization to disk storage that enables an administrator to combine underlying physical disk storage into a single logical unit, known as a logical volume. Logical volumes behave like standard disk partitions and can be used as arguments anywhere a partition can be specified.

A logical volume allows a filesystem or raw device to be larger than the size of a physical disk. Using logical volumes can also increase disk I/O performance because a volume can be striped across more than one disk. Logical volumes can also be used to mirror data on different disks.

This release adds a new XVM multi-host failover feature. For more information on this new feature and XVM Volume Manager in general, see the *XVM Volume Manager Administrator's Guide.*

HPC Application Tools and Support

SGI has ported HPC libraries, tools, and software packages from IRIX to Linux to provide a powerful, standards-based system using Linux and Itanium 2-based solutions for HPC environments. The following sections describe some of these tools, libraries, and software.

Message Passing Toolkit

The SGI Message Passing Toolkit (MPT) provides industry-standard message passing libraries optimized for SGI computers. On Linux, MPT contains MPI and SHMEM APIs, which transparently utilize and exploit the low-level capabilities within SGI hardware, such as memory mapping within and between partitions for fast memory-to-memory transfers and the hardware memory controller's fetch operation (fetchop) support. Fetchops and other shared memory techniques enable ultra fast communication and synchronization between MPI processes in a parallel application.

MPI jobs can be launched, monitored, and controlled across a cluster or partitioned system using the SGI Array Services software. Array Services provides the notion of an array session, which is a set of processes that can be running on different cluster nodes or system partitions. Array Services is implemented using Process Aggregates (PAGGs), which is a kernel module that provides process containers. PAGGs has been open-sourced by SGI for Linux.

For more information on the Message Passing Toolkit, see the *Message Passing Toolkit (MPT) User's Guide.*

MVAPICH2 and OpenMPI

SGI no longer ships any open source MPI packages via the SGI Propack for Linux release. MVAPICH2 and OpenMPI RPMs are available as a courtesy, via the cool downloads section on Supportfolio.

These RPMs are IB interconnect, Intel compiler compiled versions of the open source products.

SGI MPT is provided with the SGI Propack 6 release and supports all SGI platforms.

Performance Co-Pilot

The SGI Performance Co-Pilot software was ported from IRIX to Linux to provide a collection of performance monitoring and performance management services targeted at large, complex systems. Integrated with the low-level performance hardware counters and with MPT, Performance Co-Pilot provides such services as CPU, I/O, and networking statistics; visualization tools; and monitoring tools.

For more information on Performance Co-Pilot, see the *Performance Co-Pilot for IA-64 Linux User's and Administrator's Guide.*

Reconfigurable Application-Specific Computing

The RASC program leverages more than 20 years of SGI experience accelerating algorithms in hardware. Rather than using relatively fixed implementations, such as graphics processing units (GPUs), RASC uses field programmable gate array (FPGA) technology to develop a full-featured reconfigurable computer. The RASC program also addresses the ease of use and performance issues present in typical reconfigurable computer environments.

To address performance issues, RASC connects FPGAs into the NUMAlink fabric making them a peer to the microprocessor and providing both high bandwidth and low latency. By attaching the FPGA devices to the NUMAlink interconnect, RASC places the FPGA resources inside the coherency domain of the computer system. This placement allows the FPGAs extremely high bandwidth (up to 6.4GB/s/FPGA), low latency, and hardware barriers. These features enable both extreme performance and scalability. The RASC product also provides system infrastructure to manage and reprogram the contents of the FPGA quickly for reuse of resources.

Both block DMA and stream DMA are supported. For more information, see Chapter 5, "Direct I/O" in the *Reconfigurable Application-Specific Computing User's Guide.*

RASC hardware implementation for SGI Altix 4700 systems is based on blade packaging. The new RASC blade has high-performance FPGAs with 200K logic cells and increased memory resources with 10 synchronous static RAM dual in-line memory modules (SSRAM DIMMs). For legacy systems, optional brick packaging is available for the latest blade-based RASC hardware.

RASC defines a set of APIs through the RASC Abstraction Layer (RASCAL). The abstraction layer can abstract the hardware to provide deep and wide scaling or direct and specific control over each hardware element in the system. In addition RASC provides a FPGA-aware version of GNU Debugger (GDB) that is based on the standard Linux version of GDB with extensions for managing multiple FPGAs. The RASC debug environment does not require learning new tool sets to quickly debug an accelerated application.

RASC supports the common hardware description languages (HDLs) for generating algorithms. RASC provides templates for Verilog- and VHDL-based algorithms. Several 3rd-party high-level language tool vendors are developing RASC interfaces and templates to use in place of traditional hardware design languages.

The "Getting Started with RASC Programming" section in chapter 1 or the *Reconfigurable Application-Specific Computing User's Guide* provides an overview of FPGA programming.

The RASC tutorial (see "Tutorial Overview" in Chapter 7) steps you through the entire RASC design flow: integrating the algorithm with core service; simulating behavior on the algorithm interfaces; synthesizing the algorithm code; generating a bitstream; transferring that bitstream and metadata to the Altix platform; executing an application; and using GDB to debug an application on the Altix system and FPGA simultaneously.

For detailed information on the SGI RASC program, see the *Reconfigurable Application-Specific Computing User's Guide.*

Extensible Firmware Interface (EFI)

The Extensible Firmware Interface (EFI), a supporting platform to provide input to the CPU and to handle its output, is provided by SLES10, the base Linux operating system for SGI Altix systems running SGI ProPack 6. EFI also controls the server's boot configuration, maintaining the boot menu in durable, non-volatile memory.

SLES10 uses `elilo` package which places the bootloader (`elilo.efi`) and configuration file (`elilo.conf`) in the `/boot/efi/efi/SuSE/` directory on SGI Altix systems.

Note: When booting from SLES10 CDs, use the `bootia64` command instead of `elilo`. Once the system is running SLES10, use `elilo` to boot from EFI.

> **Note:** If you have installed multiple kernel images and want to boot with one that is not currently the system default (`vmlinuz` in `/boot/efi/efi/SuSE`), simply copy the `vmlinuz` and `initrd` files for the kernel you wish to use from `/boot` to `/boot/efi/efi/SuSE`.

For a summary of EFI commands, see Table 3-2.

Table 3-2   EFI Commands

EFI Command	Description
alias [-bdv] [*sname*] [*value*]	Sets or gets alias settings
attrib [-b] [+/- *rhs*] [*file*]	Views or sets file attributes
bcfg	Configures boot driver and load options
cd [*path*]	Updates the current directory
cls [*background color*]	Clears screen
comp *file1 file2*	Compares two files
cp *file* [*file*] ... [*dest*]	Copies files or directories
date [*mm/dd/yyyy*]	Gets or sets date
dblk *device* [*Lba*] [*blocks*]	Performs hex dump of block I/O devices
dh [-b] [-p *prot_id*]	[*handle*]	Dumps handle information
dmpstore	Dumps variable store
echo [-on	-off]	[*text*]	Echoes text to stdout or toggles script echo
edit [*file name*]	Edits a file
endfor	Script only: Delimits loop construct
endif	Script-only: Delimits IF THEN construct
err [*level*]	Sets or displays error level
exit	Exits

Table 3-2   EFI Commands **(continued)**

EFI Command	Description
flash *filename*	Flashes PROM on C-brick
for var in *set*	Script-only: Indicates loop construct
getmtc	Gets next monotonic count
goto *label*	Script-only: Jumps to label location in script
guid [-b] [*sname*]	Dumps known guid IDs
help [-b] [*internal command*]	Displays this help
if [not] *condition* then	Script-only: Indicates IF THEN construct
load *driver_name*	Loads a driver
ls [-b] [*dir*] [*dir*] ...	Obtains directory listing
map [-bdvr] [*sname*[:]] [*handle*]	Maps shortname to device path
mem [*address*] [*size*] [;*MMIO*]	Dumps memory or memory mapped I/O
memmap [-b]	Dumps memory map
mkdir *dir* [*dir*] ...	Makes directory
mm *address* [*width*] [;*type*]	Modifies memory: Mem, MMIO, IO, PCI
mode [*col row*]	Sets or gets current text mode
mount *BlkDevice* [*sname*[:]]	Mounts a filesytem on a block device
mv *sfile dfile*	Moves files
pause	Script-only: Prompts to quit or continue
pci [*bus dev*] [*func*]	Displays PCI device(s) info
reset [cold/warm] [*reset string*]	Indicates cold or warm reset
rm *file/dir* [*file/dir*]	Removes file or directories
set [-bdv] [*sname*] [*value*]	Sets or gets environment variable
setsize *newsize fname*	Sets the files size

Table 3-2   EFI Commands **(continued)**

EFI Command	Description
stall *microseconds*	Delays for *x* microseconds
time [*hh*:*mm*:*ss*]	Gets or sets time
touch [*filename*]	Views or sets file attributes
type [-a] [-u] [-b] *file*	Types file
ver	Displays version information
vol *fs* [*volume label*]	Sets or displays volume label

SGIconsole

SGIconsole is a combination of hardware and software that provides console management and allows monitoring of multiple SGI servers running the IRIX operating system and SGI ProPack for Linux. These servers include SGI partitioned systems and large, single-system-image servers, including SGI Altix 350 and 450 systems and the SGI Altix 3000 and 4000 family of servers and superclusters.

SGIconsole consists of an 1U rackmountable SGI server based on the Intel Pentium processor, a serial multiplexer or Ethernet hub, and a software suite that includes the Console Manager package and Performance Co-Pilot, which provides access to common remote management tools for hardware and software.

Console Manager is a graphical user interface for the SGIconsole management and monitoring tool used to control multiple SGI servers. SGIconsole also has a command line interface. For more information on SGIconsole, see the *SGIconsole Start Here.*

NUMA Data Placement Tools

This section describes the commands that are currently provided with the collection of NUMA related data placement tools that can help you with tuning applications on your system.

Note: Performance tuning information for single processor and multiprocessor programs resides in *Linux Application Tuning Guide*.

`dlook` Command

The `dlook`(1) command displays the memory map and CPU use for a specified process. The following information is printed for each page in the virtual address space of the process:

- The object that owns the page (file, `SYSV` shared memory, device driver, and so on)
- Type of page (`RAM`, `FETCHOP`, `IOSPACE`, and so on)
- If RAM memory, the following information is supplied:
  - Memory attributes (`SHARED`, `DIRTY`, and so on)
  - Node on which that the page is located
  - Physical address of page (optional)

Optionally, the amount of elapsed CPU time that the process has executed on each physical CPU in the system is also printed.

`dplace` Command

The `dplace`(1) command binds a related set of processes to specific CPUs or nodes to prevent process migrations. In some cases, this tool improves performance because of the occurrence of a higher percentage of memory accesses to the local node.

`taskset` Command

The `taskset`(1) command is used to set or retrieve the CPU affinity of a running process given its PID or to launch a new command with a given CPU affinity. CPU affinity is a scheduler property that "bonds" a process to a given set of CPUs on the system. The Linux scheduler will honor the given CPU affinity and the process will not run on any other CPUs. Note that the Linux scheduler also supports natural CPU affinity; the scheduler attempts to keep processes on the same CPU as long as practical for

performance reasons. Therefore, forcing a specific CPU affinity is useful only in certain applications.

For more information on NUMA tools, see Chapter 5, "Data Placement Tools" in the *Linux Application Tuning Guide.*

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