

SGI ProPack 1.2 for Linux™ -230 Edition
Start Here

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About This Guide

This document provides information about the SGI ProPack 1.2 for Linux - 230 Edition release. It is divided into three chapters:

- Chapter 1, “Release Features,” describes the major features of this release.
- Chapter 2, “Software Overview,” describes the major features of earlier releases that are included in this release.
- Chapter 3, “Quick Configuration and Installation Instructions,” describes the procedures for configuring and installing the SGI ProPack 1.2 for Linux in various circumstances, including upgrading your system from an earlier SGI Linux Environment release.

The SGI ProPack 1.2 for Linux - 230 Edition is an overlay product that adds or enhances features in Linux base distributions from Red Hat (version 6.1) or SuSE (version 6.3). This 230 edition adds features for the Silicon Graphics 230 Visual Workstation.

Guides for installing and getting started with a base Linux distribution are included with the base Linux distribution release kit.

Reader Comments

If you have comments about the technical accuracy, content, or organization of this document, please tell us. 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 can be found on the back cover.)

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Release Features

This chapter provides a short introduction to the SGI ProPack 1.2 for Linux - 230 Edition and describes the features provided with this release. Chapter 2, "Software Overview," describes features supported in previous releases that enhance the features of your base Linux distribution.

SGI ProPack 1.2 for Linux - 230 Edition is a special edition of SGI ProPack 1.2 for Linux that supports the Silicon Graphics 230 Visual Workstation. This release includes all of the software components in SGI ProPack 1.2 for Linux, plus additional software components that are needed to enable the graphical features of the Silicon Graphics 230 Visual Workstation.

Caution: SGI ProPack 1.2 for Linux - 230 Edition has been tested only on the SG230 system, and it does not support any other system. Please do not attempt to install this software on any system other than SG230.

This Start Here document covers the non-graphics system-software components that are included in both SGI ProPack 1.2 for Linux and SGI ProPack 1.2 for Linux - 230 Editions. The 2.2.13-2SGI version of the Linux kernel includes a number of Open Source enhancements provided by SGI.

Please read the file *README.FIRST*, located on the software CD, before you install the software. This file contains information related to the software components that enable graphics features of the SG230. After the software installation, this file is located at */usr/doc/sgi/VisualWorkstation/README.FIRST*. **Do not install the software without reading this file first.**

The errata that describes issues which arose too late in the release cycle to be included in this document and provides help with all known problems is available at the following URL:

<http://support.sgi.com/linux>

Manuals for installing your base Linux distribution and getting started in using it are included with your base Linux distribution release kit. Use these manuals as a reference

for information not included in this guide. If you need to reinstall your base distribution, you must read “Configuring the X Windows System” on page 13.

Documentation for the SGI ProPack 1.2 for Linux - 230 Edition software and for Linux in general, including man pages, HOWTO guides, and other relevant documentation from the Linux Documentation Project, is available from the following URL:

<http://techpubs.sgi.com>

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

<http://oss.sgi.com>

Note: Packaged with the SGI ProPack 1.2 -230 Edition software is a separate sheet that contains the Software License Agreement. This software is provided to you solely under the terms and conditions of the Software License Agreement. Please take a few moments to review the Agreement.

Feature Overview

The SGI ProPack 1.2 for Linux- 230 Edition is an overlay product that adds to or enhances features in base Linux distributions from Red Hat (version 6.1) or SuSE (version 6.3).

The SGI ProPack software will most likely come preinstalled on your SGI platform. If you should need to install it, be aware that you must install one of the supported base Linux distributions using the base distributor’s installation tools and then install the SGI ProPack software using the ProPack installer. Installation and configuration is described in Chapter 3, “Quick Configuration and Installation Instructions.”

Some of the most significant features that SGI ProPack 1.2 for Linux- 230 Edition provides are as follows:

- Silicon Graphics VPro accelerated OpenGL implementation, which was developed in partnership with NVIDIA Corporation. The performance of this implementation equals or exceeds that of any other available Linux OpenGL implementation.
- IRIS Performer, a high-performance 3D rendering toolkit for developers of real-time, interactive graphics applications. IRIS Performer simplifies development of complex applications such as those for visual simulation, simulation-based

design, virtual reality, interactive entertainment, broadcast video, CAD, and architectural walk-through, while providing a high-performance portability path across the entire SGI product line.

IRIS Performer 2.3 for Linux is fully API-compatible with existing IRIS Performer applications and is a full distribution, including the core run-time libraries and file loaders, development header files, sample source code, and manual pages.

- SGI ProPack 1.2 for Linux - 230 Edition provides a kernel-level implementation of POSIX asynchronous I/O and the associated API library. This implementation works with raw devices as well as with file systems including pipes and sockets. For more information, see the */lib/libdba/README* file and “POSIX Asynchronous I/O” on page 9.
- A new configuration parameter, **CONFIG_NFSD_V3**, is set by default to configure the use of NFSD version 3. Customers can turn off this parameter and the **CONFIG_NFS_V3** parameter if they want to use NFS version 2 only. For information about how NFS is implemented in SGI ProPack 1.2 for Linux, see “NFS” on page 9.
- The *lcrash-1.0* RPM that was included in the SGI Linux Environment 1.1 with Red Hat 6.0 has been removed from the SGI ProPack 1.2 release, and the contents of the RPM have moved into the kernel RPM. For information about *lcrash*, see “Crash Functionality” on page 10.

Patches and Changes to Base Linux Distributions

This section provides an overview of changes the SGI ProPack 1.2 for Linux- 230 Edition software makes in your base Linux distribution.

- For information about the software that enables the graphical features of the SG230 system, see the file *README.FIRST* on the software CD. After installation, the file is also in */usr/doc/sgi/VisualWorkstation/README.FIRST*.
- The following packages were added by SGI:
 - kernprof 1.0 (kernel profiling tool to identify performance bottlenecks)
 - ktrace 1.0 (kernel trace tool)
 - libdba.so 1.0 (APIs to enhance database performance)
 - lockstat 1.0 (spinlock metering analysis)
 - sard 0.2 (disk activity statistics/analysis)

- sgi-logos 1.0.1-1 (SGI logos)
- sgi-extra-RedHat-1.2-1.noarch.rpm (manipulate system files for SGI value added features)
- sgi-extra-SuSE-1.2-1.noarch.rpm (manipulate system files for SGI value added features)
- sgi-initscripts-RedHat-1.0-1.noarch.rpm (manipulate init scripts for SGI value added features)
- sgi-initscripts-SuSE-1.0-1.noarch.rpm (manipulate init scripts for SGI value added features)
- sgi-release (SGI release identification)

Software Overview

This chapter describes features supported in previous releases that enhance the features of your base Linux distribution. For a description of new features, please read Chapter 1, “Release Features.”

The SGI ProPack 1.2 for Linux- 230 Edition provides the Linux kernel version 2.2.13. The ProPack software adds functionality to base Linux distributions that is specific to SGI hardware platforms.

Some of the most significant features that Linux provides are listed below:

- Typical commands you would expect to see on a UNIX-like system
- Typical configuration files you would expect to see on a UNIX-like system, along with an optional graphical front end
- Development tools such as compilers, debuggers, and libraries
- Internet applications such as web servers and browsers, news servers, network utilities, e-mail servers, and clients
- Everything needed for network file sharing with a wide variety of clients
- Desktop environments and graphical applications

Note: For information about the software components that enable the graphical features of the SG230 system, see the file *README.FIRST* on the software CD, which is also available as */usr/doc/sgi/VisualWorkstation/README.FIRST* after the software is installed.

The SGI ProPack 1.2 for Linux- 230 Edition software also provides optimization that enhances performance on database and other workloads. SGI has added a number of features to the Linux kernel and certain packages to provide increased performance and manageability for database workloads (such as Oracle 8i).

The performance enhancements include a kernel-level implementation of POSIX 1003.1-1996 asynchronous I/O, a low-overhead interprocess synchronization mechanism, low overhead and high-volume raw disk I/O, a fast *gettimeofday(3)* library function, and support for large amounts of physical memory.

The manageability and supportability improvements include kernel spinlock metering (for performance bottleneck analysis), kernel profiling enhancements, kernel memory dump capability with analysis tools, kernel *gdb* hooks. The SGI ProPack 1.2 for Linux- 230 Edition also includes version 0.6 of the kernel debugger *kdb*. The features of *kdb* releases are documented at the following URL:

<http://oss.sgi.com/projects/kdb>

The manageability of the release has been improved by integrating a number of publicly available kernel patches, such as the following:

- Stephen Tweedie’s Raw I/O patch, which forms the basis for the SGI raw disk I/O enhancements. This patch is described in “Raw I/O Path Changes.”
- The Device File System (**CONFIG_DEVFS_FS**) patch from Richard Gooch. This patch provides a more consistent naming scheme for hardware and software devices. Sites that expect to connect a large number of devices may find DEVFS very useful in helping to manage them. DEVFS can also provide the traditional Linux names for devices, for backward compatibility, and is otherwise very compatible with the rest of the Linux system.
- The *sard* utility and associated kernel metrics patch for disk traffic analysis. This patch provides additional disk I/O statistics, useful for tuning database layouts and queries.

Performance Improvements

The performance enhancements, enumerated in the preceding section, accelerate the performance of I/O intensive applications by streamlining the kernel code and data paths for disk I/O as well as providing larger shared memory segments and a low overhead interprocess synchronization mechanism.

Raw I/O Path Changes

Current file-system-based disk I/O requires fixed size I/O operations (typically 1024 bytes) into kernel buffers, then the data is moved from the kernel buffer to the user program address space. While this allows the file system to cache frequently accessed data, it also consumes excess system bus bandwidth when copying the data from the kernel buffer(s) into the user address space. Both the small size of the I/O (2 sectors) and

the copy operation greatly reduce the I/O subsystem throughput for database operations, where transactions and full-table scan operations operate more quickly with no operating system data intervention.

To help alleviate this problem, Stephen Tweedie of Red Hat developed a mechanism that allows disk I/O directly to a buffer in the application address space (historically known as raw (or unprocessed) I/O). This mechanism will lock the required pages of memory to prevent them from being paged out or swapped during the I/O operation. Applications required to perform this type of disk I/O would open the character special device `/dev/raw` and bind the disk device to a special raw device using a `ioctl(2)` system call.

This mechanism, however, is cumbersome to use and suffers from some deficiencies. The primary deficiency with the mechanism comes from its continued use of the file-system buffer-header data structures and associated device queueing routines. While use of the buffer headers is a straightforward mechanism, it implies that I/O operations will still need to be fragmented into 1024-bytes per operation, increasing the kernel overhead significantly. The binding mechanism used to bind an existing block device to a new raw device is also somewhat cumbersome and counterintuitive to Unix system administrators, who expect to find a relationship in the device namespace between a block device and its corresponding raw device.

To address these concerns, SGI has added additional capabilities to Stephen Tweedie's raw I/O patch that allow large I/O operations directly to the user address space and bypasses the bulk of the kernel I/O queueing code for SCSI and FiberChannel devices.

You can download a `dd` command that is capable of using the raw device features from the following FTP location:

`ftp://oss.sgi.com/projects/rawio/download/dd.raw`

This feature is off by default, but you can turn it on by setting the `CONFIG_RAW` kernel configuration parameter.

More information about raw I/O is available from the following URL:

`http://oss.sgi.com/projects/rawio/faq.html`

Fast Synchronization Mechanism

While the UNIX System V IPC semaphore facility does provide exceptional capability, its performance leaves much to be desired. Many Unix vendors have released a low-overhead inter-application synchronization primitive known as “post /wait.”

SGI has included in this release a kernel level implementation of post/wait along with the library containing application API's. The post allows for a process to “wait” for an event. This event can either be a timeout or a “post” from another process. A group of cooperating processes can use these “post” and “wait” facilities to synchronize among themselves.

In order to use post/wait, the kernel must be compiled with the **CONFIG_PW** configuration variable, and you may optionally set an additional configuration variable, **CONFIG_PW_VMAX**. These variables are described in the configuration help. For a user program to use the post/wait facilities, it must link against *libdba.so*.

For more information on post/wait, please refer to the *postwait(3)* man page.

Fast *gettimeofday* Library Function

To correctly order operations in a database, the database must timestamp data and log entries frequently. Traditional *gettimeofday(3)* library functions are implemented as system calls, thus causing an address space switch (from user to kernel mode) each time a timestamp is required.

With this release, SGI has included a device driver that allows a read-only page of kernel memory, containing only the time value, to be mapped by an application (or on its behalf by a library function). *gettimeofday* is then implemented as a library function that simply reads the time value from the exported page in memory, thus avoiding a system call to obtain the time value.

In order to use the Fast *gettimeofday(3)* Library Function, the kernel must be compiled with **CONFIG_SYSDAT** and the user program must link against *libdba* in order to override the *libc* version of *gettimeofday(3)*.

POSIX Asynchronous I/O

The ability to overlap I/O and processing activities has always been important to high-performance applications. To allow this type of overlap in single-threaded applications, SGI has included a kernel-level implementation of POSIX asynchronous I/O and the associated API library.

The SGI ProPack 1.2 for Linux- 230 Edition works with raw devices as well as with file systems including pipes and sockets.

This facility is turned on by setting the **CONFIG_AIO** kernel option. User code can get access to the facility by linking with *libdba.so*. Further information can be found in the */lib/libdba/README* file.

NFS

The following NFS functionality has been added:

- NFS version 3 client and server support.
- Network Lock Manager (NLM) version 4 client and server support.
- Kernel level NFS and NLM implementation.

NFS and NFSD are configured as modules by default, but they can be configured to compile as part of the kernel by setting the **CONFIG_NFS_FS** and **CONFIG_NFSD** configuration parameters. The **CONFIG_NFS_V3** and **CONFIG_NFSD_V3** parameters are set by default and can be turned off if the user wants to use NFS version 2 only. The **CONFIG_NFSD** parameter needs to be configured for **LOCKD** to work, so if **CONFIG_LOCKD** is set, **CONFIG_NFSD** should be set also.

Kernel Spinlock Metering

The SGI ProPack 1.2 for Linux- 230 Edition includes a feature that allows developers to gather statistical information about the SMP kernel's use of spinlocks and mrlocks (multiple-reader single-writer spinlocks). This functionality is called *spinlock metering*, or *lockmetering*.

Spinlock metering is built into the kernel using the **CONFIG_LOCKMETER** configuration option (in the Kernel Hacking section of **make xconfig**). A kernel built with lockmetering will exhibit a small (roughly 1%) performance degradation relative to a kernel that is not configured for lockmetering. See the following URL for additional information:

<http://oss.sgi.com/projects/lockmetering>

Crash Functionality

The following changes have been made to the Linux crash utility, which are explained briefly below. General information about *lcrash* can be found in the *cmd/lcrash/README* file.

- Linux kernel crash dump enhancements. SGI ProPack 1.2 for Linux- 230 Edition provides a configuration option to allow kernel crash dumps to be available. This option is configured to be on by default, and the default dump space is the first swap partition found when booting. If you are building a new kernel, you can specify *Support kernel crash dump capabilities* in the Kernel Hacking section of **make xconfig**.

The crash dump capabilities in the kernel allow the system to create a crash dump when a failure occurs due to a *panic()* call or an exception. For more details on the dump method, compression used, and so on, please read the LKCD FAQ at the following URL:

<http://oss.sgi.com/projects/lkcd/faq.html>

Information about LKCD is also available in the file *cmd/lcrash/README.lkcd*.

- Boot up process changes. As the system boots up, the */sbin/vmdump* script will be run out of */etc/rc.d/rc.sysinit*. This script saves crash dumps and reads sysconfig variables to open the dump device and configure the system for crash dumps.
- Crash dump configuration options. There are a number of configurable options to save system crash dumps. Please read */etc/sysconfig/vmdump* for more details on the options available. The following list describes what the options allow you to do:
 - Determine if you want to implement crash dumps in the kernel
 - Choose whether to save crash dumps to disk or not
 - Change the location to which the crash dumps are saved

- Specify any block dump device you want
- Compress (or not compress) the crash dumps
- Configure the system to reset (or not reset) after a failure
- The *lcrash* utility now uses the new *librl* library for command line input.

Patches, Configuration Options, Commands, and Libraries

The following list describes patches implemented and enhancements to configuration options, commands, and libraries:

- *librl* library. This new library supplies command line editing and command history functionality. See the */cmd/lcrash/lib/librl/README* file for information on how to use this library. The *lcrash* command uses this library.
- Remote debugging over a serial line. There is a new configuration option, **CONFIG_GDB**, which is used to enable *gdb* debugging. To force a kernel that has been compiled with **CONFIG_GDB** to pause during the boot process and wait for a connection from *gdb*, the parameter **gdb** should be passed to the kernel. This can be done by typing **gdb** after the name of the kernel on the LILO command line. The patch defaults to use *ttyS1* at a baud rate of 38400. These parameters can be changed by using **gdbttyS=port number** and **gdbbaud=baud rate** on the command line.
- *rlimits* patch. In the Linux 2.2.13 kernel, faulty *rlimit* checking will not allow a process to have more than 2 GB total address space, stack size, or locked memory. This release has fixed the *rlimit* checking, so (subject to other accounting limitations), the kernel honors **RLIM_INFINITY** settings on these resources.
- SMP PTE patch. In stock Linux, the page stealing code that is used under high memory load has a bug that might cause it to steal a page from a process without writing out the contents to swap if the page has been modified by the process. This bug is only present in a multiprocessor machine. SGI ProPack 1.2 for Linux- 230 Edition provides a fix for this bug.

Quick Configuration and Installation Instructions

Your SGI machine comes with a base Linux distribution and the SGI ProPack 1.2 for Linux - 230 Edition overlay software preinstalled. This chapter describes how to install the software from the CD if at some time you need to reinstall it.

Caution: The SGI ProPack 1.2 for Linux - 230 Edition software supports only two base Linux distributions:

- Red Hat version 6.1
- SuSE version 6.3.

Do **not** attempt to install SGI ProPack 1.2 for Linux - 230 Edition over any other base Linux distribution.

If you do need to install software, be aware that you must install a base Linux distribution using the base distributor's installation tools and then install the SGI ProPack 1.2 for Linux - 230 Edition software using its installer as described in this chapter.

You should configure the base Linux distribution as described in the installation manual for the base distribution.

Before you install or configure your system, please read Chapter 1, "Release Features," and Chapter 2, "Software Overview," so that you understand the features of SGI ProPack 1.2 for Linux - 230 Edition and how to configure them. Also read the file *README.FIRST*, located on the software CD, and the SGI ProPack 1.2 for Linux - 230 Edition Errata, located at <http://support.sgi.com/linux>.

Configuring the X Windows System

The Red Hat Linux 6.1 and SuSE Linux 6.3 distributions both include version 3.3.5 of the XFree86 implementation of the X Window System. This implementation does not contain software drivers for the Silicon Graphics VPro graphics subsystem in the SG230.

When installing Red Hat Linux 6.1 or SuSE Linux 6.3 on a SG230 system, you should configure the system **not** to start the X Window System, and run instead in text console mode. You can then run the SGI ProPack for Linux - 230 Edition INSTALL script in text console mode.

The Silicon Graphics VPro accelerated OpenGL implementation that is included in SGI ProPack 1.2 for Linux - 230 Edition requires XFree86 version 4.0. The SGI ProPack 1.2 for Linux - 230 Edition INSTALL script removes XFree86 3.3.5, and then installs and configures XFree86 4.0.

If you install Red Hat 6.1 on an SG230 system, choose “Skip X configuration” when the Red Hat installer prompts you to configure XFree86 3.3.5. When the installation is complete, the system should reboot into text console mode.

If you install SuSE 6.3 on an SG230 system, choose “No” when the SuSE Linux 6.3 installer prompts you to start “fine” to configure XFree86 3.3.5.

At the end of a SuSE 6.3 installation on a SG230 system, the software might fail in an attempt to start XFree86 3.3.5, resulting in an unintelligible video image. If this happens, simply press the hardware Reset button on the SG230 front panel, and the system should reboot into text console mode.

Installing SGI ProPack 1.2 for Linux - 230 Edition from a CD

Should you need to install SGI ProPack 1.2 for Linux - 230 Edition from CD, first ensure that either Red Hat 6.1 or SuSE 6.3 is installed, and then use the procedure in this section.

The installation procedure has buttons that will allow you to go back to the previous screen or to quit the installation. To use these buttons, press the **Tab** key to highlight the one you want to use and press **Enter**.

1. Log in as root.
2. Mount the SGI ProPack 1.2 for Linux - 230 Edition CD by executing one of the following commands:

For Red Hat 6.1 - *mount -t iso9660 /dev/cdrom /mnt/cdrom*

For SuSE 6.3 - *mount -t iso9660 /dev/cdrom /cdrom*
3. Change directories to the root directory for the mounted CD. On Red Hat 6.1, this is, */mnt/cdrom*. On SuSE 6.3, it is */cdrom*.

4. At this point, you can access *README.FIRST*. This file contains information you must read before proceeding with the installation.
5. Execute *./INSTALL*
6. Select the language you want to use for the installation procedure. The default is English. Use the up and down arrow keys to select your language of choice and press the **Tab** key to highlight *OK* and press **Enter**.
7. The Welcome screen appears. Highlight *OK* and press **Enter**.
8. The Package Group Selection screen appears. This screen allows you to select the type of package you want to install. You select a package by using the up and down arrow keys and pressing the Space bar to select the one you want. When you select a package, RPMs for that package will be installed after you press the **Tab** key to highlight *OK* and press **Enter**.

You may also choose "Select individual packages," which lets you choose the specific RPMs that you want to install.
9. You may see the Package Dependencies screen, which tells you if there are additional packages required beyond those you selected. Review the packages. If you want to install them (you should install them unless there is some important reason not to do so), press the **Tab** key to highlight *OK* and press **Enter**.
10. The Installation to Begin screen appears. It tells you that a log of the installation will be placed in */tmp/install.log*. Press the **Tab** key to highlight *OK* and press **Enter**.
11. The installation begins. You will see the Package Installation screen, which tells you which packages are being installed and logs the time it takes to install them.
12. After all non-graphics software components have been installed, the *INSTALL* program will prompt you to press **y** or **Enter** to begin the installation of the Visual Workstation graphics software components.
13. After all software components have been installed, the *INSTALL* program will prompt you to press **y** or **Enter** to reboot the system.

Recreating Your Preinstalled System

Should you need to recreate your system, install your base distribution of the Red Hat 6.1 or SuSE 6.3 operating system as described in the distributor's installation instructions and then install the SGI ProPack 1.2 for Linux - 230 Edition from the CD as described in this section.

Before you install or configure your system, please read Chapter 1, “Release Features,” and Chapter 2, “Software Overview,” so that you understand the features of SGI ProPack 1.2 for Linux - 230 Edition and how to configure them. Also read the file *README.FIRST*, located on the software CD, and the SGI ProPack 1.2 for Linux - 230 Edition Errata, located at <http://support.sgi.com/linux>.