

# Solaris 2.4 Introduction

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## *Preface*

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This manual describes those aspects of the Solaris™ 2.4 version of the System V Release 4 (SVR4) UNIX® that are of interest to users and system administrators.

To help you find additional information quickly, this manual directs you to other sources for details. Use this book primarily as an overview and a pointer.

### *How This Manual Is Organized*

This manual is organized into the following chapters:

- **Chapter 1, “Introduction to Solaris 2.4,”** provides a brief introduction to Solaris 2.4, lists new features in the release, and gives a brief overview of other Solaris topics.
- **Chapter 2, “Solaris 2.4 Enhancements,”** describes the enhancements made to Solaris 2.4, including XIL™ 1.2, Solaris PEX™ 2.2, XGL™ 3.1, Direct Xlib™ 3.1, and more.
- **Chapter 3, “Making the Transition to Solaris 2.4,”** describes issues for those making the transition from earlier Solaris releases to Solaris 2.4.
- **Chapter 4, “System Administration in Solaris 2.4,”** summarizes the process of administering SunOS™ 5.x systems and ONC™ networks in the Solaris 2.4 environment.
- **Chapter 5, “Solaris Documentation,”** describes available Solaris 2.4 printed and AnswerBook® on-line documentation and lists additional Solaris resource information.

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## *Related Books*

See the following manuals to get a broader overview of the Solaris 2.4 release:

- *SPARC: Installing Solaris Software*
- *x86: Installing Solaris Software*
- *Solaris 2.4 Open Issues and Late-Breaking News*
- *Solaris 1.x to Solaris 2.x Transition Guide*
- *Solaris User's Guide*

For additional information on hardware topics, see the following documents:

- *SPARC Hardware Compatibility List*
- *Solaris 2.4 x86 Hardware Compatibility List*
- *x86 Device Configuration Guide*

For additional information on system administration topics, see the following documents:

- *User Accounts, Printers, and Mail Administration*
- *Security, Performance, and Accounting Administration*
- *Peripherals Administration*
- *File System Administration*
- *Administration Application Reference Manual*
- *Common Administration Tasks*
- *Software and AnswerBook Packages Administration Guide*
- *SunSHIELD Basic Security Module Guide*
- *TCP/IP Network Administration Guide*
- *Name Services Administration Guide*
- *NFS Administration Guide*
- *SunDiag User's Guide*
- *Name Services Configuration Guide*
- *Direct Xlib User's Guide*

For additional information on software and driver development topics, see the following documents:

- *Software Developer Kit Introduction*
- *Software Developer Kit Open Issues and Late-Breaking News*
- *Driver Developer Kit Introduction*
- *Driver Developer Kit Open Issues and Late-Breaking News*

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## What Typographic Changes and Symbols Mean

Table P-1 describes the type changes and symbols used in this book.

Table P-1 Typographic Conventions

Typeface or Symbol	Meaning	Example
AaBbCc123	The names of commands, files, and directories; on-screen computer output	Edit your <code>.login</code> file. Use <code>ls -a</code> to list all files. system% You have mail.
<b>AaBbCc123</b>	What you type, contrasted with on-screen computer output	system% <b>su</b> Password:
<i>AaBbCc123</i>	Command-line placeholder: replace with a real name or value	To delete a file, type <code>rm filename</code> .
<i>AaBbCc123</i>	Book titles, new words or terms, or words to be emphasized	Read Chapter 6 in <i>User's Guide</i> . These are called <i>class</i> options. You <i>must</i> be root to do this.

Code samples are included in boxes and may display the following:

C shell prompt	system%
Superuser prompt, C shell	system#
Bourne and Korn shell prompt	\$
Superuser prompt, Bourne and Korn shells	#

## Platform-Specific Conventions

The following conventions are used to indicate that a section, note, bullet, table, or figure discussed in text applies only to a specific platform (that is, to either SPARC or x86, but not both).

### Section or Procedure Title

The following symbols are used to indicate that a section or procedure applies only to the named platform.

<u>SPARC</u>	Denotes a SPARC platform-specific section or procedure.
<u>x86</u>	Denotes an x86 platform-specific section or procedure.

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### *Notes*

The following notations are used to indicate that a section or procedure applies only to the named platform.

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**SPARC** – This note is specific to the SPARC platform.

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**x86** – This note is specific to the x86 platform.

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### *Bullet Items*

The following items are used to indicate that a bullet applies only to the named platform.

- **SPARC**: This bullet is specific to the SPARC platform.
- **x86**: This bullet is specific to the x86 platform.

### *Code Samples, Tables, and Figures*

The following notations are used to indicate that a code sample, table, or figure applies only to the named platform.

*Table 1-1* SPARC: Title Specific to SPARC Platform.

*Table 1-2* x86: Title Specific to x86 Platform.

# *Introduction to Solaris 2.4*

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This book provides an introduction to Solaris 2.4. It is meant to answer the general questions that users and system administrators may have about the features, enhancements, and latest changes to Solaris 2.4.

This manual briefly covers the following topics:

- New features in the Solaris 2.4 release
- Enhancements to previous Solaris features
- SPARC and x86 platforms, and how to install and support Solaris on both
- The transition from previous Solaris releases to Solaris 2.4
- System administration, including printing, electronic mail, file systems, networks, naming services, Administration Tool, and more
- Solaris documentation, including AnswerBook on-line documents and printed books

Solaris 2.4 is a robust and sophisticated software environment. There are many Solaris topics that cannot be touched upon or covered in this book. For more information on the Solaris documentation that covers these topics, and for information on additional resources, see Chapter 5, “Solaris Documentation.”

## *The Solaris 2.4 Software Environment*

The Solaris 2.4 software environment provides users and system administrators with the following:

- SPARC® and x86 cross-functional compatibility enabling the Solaris 2.4 operating system to run on SPARC as well as Intel 386, 486, and Pentium™ hardware
- 32-bit Solaris 2.4 operating system
- Industry standards: UNIX System V Release 4 (SVR4) and the ONC family of networking protocols
- OpenWindows™ 3.4 graphical user interface (GUI) in the OPEN LOOK® Window Manager and DeskSet™ environment for increased productivity
- OPEN LOOK Administration Tool as the base for object-oriented system administration

## *New Features in Solaris 2.4*

The Solaris 2.4 release includes some new features, as well as enhancements to previously provided Solaris features. For information about Solaris 2.4 enhancements, see Chapter 2, “Solaris 2.4 Enhancements.”

*Table 1-1* New Features in Solaris 2.4

<b>Solaris 2.4 New Features</b>	<b>Description</b>
AccessX™ enabling technology	Enabling technology to provide handicapped access with a variety of keyboard modifications.
OSF/Motif® Runtime Environment	A Runtime Environment used to run Motif applications.
Motif® installation GUI	A new graphical user interface (GUI)—provides step-by-step instructions for installing Solaris software.
Transparent Overlays	A graphics application programmer interface (API) allowing temporary graphical imagery in application windows.

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## *Differences Between SPARC and x86*

Solaris 2.4 runs on both SPARC and x86 platforms. In most cases the differences between these two environments are minimal. However, a few differences do exist. These are:

- x86 hard disks have standard PC fdisk partitioning as well as standard Sun label partitioning
- Many x86 peripherals require manual hardware and software configuration. In general, the variety of hardware is greater with x86
- x86 systems have more pointing devices and display devices available
- x86 keyboards do not have Meta or L-keys; key sequences are used to provide the same functions
- x86 systems require a boot diskette (in addition to a local or remote CD-ROM drive) to install
- x86 secondary boot (ufsboot, inetboot) has a shell-like interpreter interface

## *How Solaris is Packaged*

The Solaris 2.4 release is shipped on a single CD (compact disc) for SPARC systems. For x86 systems there is both a CD and a single boot diskette.

## *Installing Solaris Software*

Before installing Solaris software, you should have:

- Supported hardware—see *SPARC Hardware Compatibility List* or *Solaris 2.4 x86 Hardware Compatibility List*.
- Minimum required hardware—see *SPARC: Installing Solaris Software* and *x86: Installing Solaris Software*.

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**Note** – If you are making the transition to Solaris 2.4 from SunOS 4.x for SPARC or from Solaris 2.1 for x86, see Chapter 3, “Making the Transition to Solaris 2.4,” before installing Solaris software.

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For step-by-step instructions on installing Solaris software on systems using the JumpStart, interactive, or custom JumpStart methods, see:

- *SPARC: Installing Solaris Software*
- *x86: Installing Solaris Software*

To add or remove software packages after Solaris is installed, you can use:

- `pkgadd(1M)` and `pkgrm(1M)`—command-line utilities that are described in the *Software and AnswerBook Packages Administration Guide*.
- Software Manager `swmtool(1M)`—an OPEN LOOK graphical user interface that is described in *Software and AnswerBook Packages Administration Guide*.

## *The OpenWindows 3.4 Environment*

The OpenWindows Version 3.4 environment provides the following features:

- The OPEN LOOK Window Manager (OLWM), a client to the OpenWindows server, manages the following:
  - Window placement
  - Workspace Programs menu
  - Window and icon opening and closing
  - Application starting and exiting
- Internationalization, which enables you to select the local language, time format, and numeric format for the workspace and the DeskSet applications.

If you have a localized version of the Solaris 2.4 release, you can install localization packages that provide support for European or Asian locales.

- The OpenWindows server, the platform of the OpenWindows environment for window applications.

The OpenWindows server is a program that is the foundation for the OpenWindows environment. It is the X11R5 sample server with a Display PostScript™ (DPS) imaging system extension and considerable SunSoft added value. The OpenWindows server also includes several X extensions and DPS font enhancements.

- Solaris 2.4 AnswerBook software, a document viewing system for on-line documentation.



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## AccessX

The Solaris AccessX software allows handicapped users to customize their keyboard behavior for easier access to the Solaris operating environment. It is fully described in *Solaris User's Guide*.

## Motif 1.2.3 Runtime Environment

You should install the Motif runtime environment (RTE) if users at your site run Motif applications that were developed and linked with Sun's version of OSF/Motif 1.2.3 dynamic libraries.

The Motif 1.2.3 runtime environment includes:

- The Motif widget library (`libXm`)
- The Motif resource manager library (`libMrm`)
- The Motif User Interface Language library (`libUil`)
- Header files for `Xm`, `uil`, `Mrm` and `bitmaps`
- Default key bindings for Motif on Sun
- An executable, `xmbind`, which allows you to change your keybindings without restarting `olwm`.

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**Note** – The Motif 1.2.3 RTE lets you run Motif applications and is delivered with Solaris software. To develop Motif 1.2.3 applications you need the Solaris Software Developer Kit (SDK), a Solaris option that must be purchased separately.

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The Motif 1.2.3 RTE package contents are listed in Table 1-2.

*Table 1-2* Motif 1.2.3 Runtime Environment Package

<b>Package Name</b>	<b>Package Contents</b>	<b>Default Installation Location</b>
SUNWmfrun	Motif dynamic libraries and Motif keybindings	/usr/dt/lib
	Header files for Motif libraries	/usr/dt/include
	xmbind	/usr/dt/bin
	Man page for xmbind	/usr/dt/man/man1

To install the Motif RTE, select the entire distribution software group, or select another software group and add the SUNWmfrun package.

For more information on using Motif in your environment, see *OSF Application Environment Specification (AES) User Environment Volume, Revision C*, (PTR Prentice Hall).

## Solaris 2.4 Enhancements



For the benefit of users and systems administrators updating from earlier Solaris releases, this chapter describes the features that were added or enhanced in Solaris software from releases 2.2 to 2.4.

### *The Solaris 2.4 Release*

Table 2-1 lists the features enhanced in Solaris 2.4.

*Table 2-1* Enhanced Features in Solaris 2.4

<b>Solaris 2.4 Features</b>	<b>Description</b>
XIL1.2 Imaging Library Runtime Environment	A foundation imaging library, suitable for libraries or applications requiring imaging or digital video, such as document imaging, color prepress, or digital video generation and playback.
SolarisPEX 2.2 Runtime Environment	An application programmer interface (API) that provides application portability across platforms and 3-D graphics rendering on local and remote displays.
XGL 3.1 Runtime Environment	A 2-D and 3-D immediate-mode application programmer interface (API) that provides portability across hardware platforms and optimal performance from graphics acceleration.

*Table 2-1* Enhanced Features in Solaris 2.4

<b>Solaris 2.4 Features</b>	<b>Description</b>
Direct Xlib 3.1	A graphics application that uses the new DGA Drawable Interface and supports systems with multiple frame buffers. It provides modified versions of the standard X11 libraries to accelerate Xlib rendering performance.
Expanded localization (OpenWindows 3.4)	The operating system is now available for desktop and workgroup server product configurations in four European languages and four Asian languages, as well as Latin American Spanish and U.S. English.
ImageTool enhancements	Functionality enhanced so the user can read Kodak images from a PhotoCD™ disc using Image Tool.
Enhanced hardware support	A wider range of new hardware configurations are supported: refer to <i>SPARC Hardware Compatibility List</i> or <i>Solaris 2.4 x86 Hardware Compatibility List</i> for specific details.

## *The Solaris 2.3 Release*

Table 2-2 lists the features that were added in the Solaris 2.3 release.

*Table 2-2* Features of Solaris 2.3

<b>Solaris 2.3 Features</b>	<b>Description</b>
Direct Xlib 3.0	The first release of Direct Xlib that utilized MIT DDX (device-dependent X) loadable modules to perform X11 graphics rendering.
Serial Port Manager	A tool that enables you to quickly setup and modify serial port software for terminals and modems.
Autofs	A new kernel virtual file system that supports automatic mounting of file systems.
PPP	An asynchronous implementation of the standard data link level Point-to-Point Protocol (PPP) included in the Internet protocol suite that enables communications links using modems and telephone lines.

*Table 2-2* Features of Solaris 2.3

<b>Solaris 2.3 Features</b>	<b>Description</b>
Cache File System (CacheFS)	A nonvolatile caching mechanism to improve performance of certain file systems by utilizing a small, fast, local disk.
NIS+	Three additional scripts to enable you to more easily set up an NIS+ domain.
SolarisPEX Runtime Environment (RTE)	An implementation of the MIT PEX specification that is an extension to the X Window System to support 3D graphics.

## *The Solaris 2.2 Release*

Table 2-3 lists the features that were added in the Solaris 2.2 release.

*Table 2-3* Features of Solaris 2.2

<b>Solaris 2.2 Features</b>	<b>Description</b>
XIL 1.0 Imaging Library Runtime Environment	Imaging library runtime environment to use with imaging and video applications developed with the XIL 1.0 Imaging Library Software Developer's kit.
Direct Xlib 2.0	The first release of Direct Xlib available for Solaris 2.x.
Volume Management	Software that automatically mounts and unmounts CDs and diskettes.
Multithreaded Library Interface	An interface that allows developers access to MIT applications.
User Installation Interfaces	User interfaces that make it easy to install and upgrade Solaris.
AnswerBook Improvements	New AnswerBook administrator's utility, <code>ab_admin(1)</code> , and Library-based user interface that allows easy access to AnswerBook sets located over networks.
Enhanced OpenWindows	OpenWindows enhancements include Image Tool, an improved Properties Tool, integrated international capabilities, and many ease-of-use improvements.

## *XIL 1.2 Runtime Environment*

The XIL 1.2 Runtime Environment is automatically installed if you select either of the following software groups:

- End user system support
- Developer system support
- Entire distribution

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**Note** – The Solaris installation program lets you edit the selection of packages; however, if you do not want the XIL 1.2 runtime environment (RTE), you must explicitly deselect it.

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You should install the XIL 1.2 RTE if users at your site run image-processing applications that were developed with XIL. For example, ImageTool, a DeskSet component, requires the XIL runtime environment.

The XIL 1.2 library includes several new features that were not available in the XIL 1.1 library. For example, it contains a new `XilDevice` object that can atomically initialize a device's attributes, and a new `XilInterpolationTable` object that permits vertical and horizontal kernel sampling on source-image pixels. XIL 1.2 applications that take advantage of these and other new XIL 1.2 features will not run in the XIL 1.1 RTE.

The XIL 1.2 RTE supports 1, 8, and 24 bit visuals.

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**Note** – The XIL 1.2 RTE lets you run XIL applications and is delivered with Solaris software. To develop XIL applications, you need the Solaris Software Developer Kit (SDK), which is a Solaris option that must be purchased separately.

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The XIL 1.2 RTE packages are listed in Table 2-4.

*Table 2-4* XIL 1.2 Runtime Environment Packages

<b>Package Name</b>	<b>Package Contents</b>	<b>Default Installation Location</b>
SUNWxildg	XIL Loadable Pipeline Libraries	/opt/SUNWits/Graphics-sw/xil
SUNWxiler	XIL English Localization	/opt/SUNWits/Graphics-sw/xil
SUNWxilrt	XIL Runtime Environment	/opt/SUNWits/Graphics-sw/xil
SUNWxilow	XIL Loadable Pipeline Libraries	/usr/openwin/SUNWits/Graphics-sw/xil

SUNWxilrt, SUNWxiler, SUNWxildg, and SUNWxilow make up the XIL runtime environment. SUNWxilrt contains the core XIL library and configuration files. SUNWxildg and SUNWxilow contain the XIL loadable pipelines, and SUNWxiler contains the XIL English language error messages. Applications built with the XIL library require these four packages to be installed; for example, ImageTool cannot run unless all four of these packages are installed.

## *Solaris PEX 2.2 Runtime Environment*

Solaris PEX 2.2 RTE consists of a PEX client-side runtime library (PEXlib) and a PEX server-extension shared-object file (Solaris PEX server). PEXlib is an application programmer interface (API) to PEX protocol as Xlib is to core X protocol. PEXlib provides application portability across hardware platforms and enables 3D graphics rendering on local and remote displays. The OpenWindows Version 3.4 X11 server automatically loads the PEX shared-object extension when incoming PEX requests are sent from a PEX client.

The PEXlib implementation for Solaris 2.4 is based on *PEXlib - Specification and C Language Binding: Version 5.1*, available from the Massachusetts Institute of Technology (MIT). The PEX server extension is based on *PEX Protocol Specification, Version 5.1P*.

Solaris PEX 2.2 RTE is included in the Solaris 2.4 release for your convenience and should be installed if you are planning to:

- Run PEXlib-based graphics client applications
- Display any 3D graphics from client applications that perform rendering on remote displays through the PEX protocol

To install PEX, choose the entire distribution software group when installing Solaris 2.4.

### *Supported Devices and Features*

Solaris PEX 2.2 RTE supports all the devices that are supported in XGL 3.1 through Direct Graphics Access (DGA) and Xlib.

### *Installation Requirements*

Solaris PEX 2.2 RTE requires OpenWindows Version 3.4 and XGL 3.1 RTE packages. The PEX RTE packages are installed with the Entire Distribution option in Sun Install. If you want to use Custom Install in either Developer System Support or End User System Support, you need to select SunPEX Runtime Environment explicitly in install the PEX RTE packages.

The Solaris PEX 2.2 RTE packages are listed in Table 2-5.

*Table 2-5* Solaris PEX 2.2 RTE Packages

<b>Package Name</b>	<b>Package Content</b>	<b>Default Installation Location</b>
SUNWpexcl	PEX Runtime Client Libraries	/usr/openwin
SUNWpexsv	PEX Runtime Server Extension	/usr/openwin

## *XGL 3.1 Runtime Environment*

The Solaris 2.4 release includes the XGL 3.1 runtime environment (RTE). The XGL product is a 2-D and 3-D immediate-mode application programmer interface (API) that provides application portability across hardware platforms and enables graphics applications to get optimal performance from graphics accelerators.



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**Note** – The XGL 3.1 RTE lets you run XGL applications and is delivered with Solaris software. To develop XGL applications you need the Solaris Software Developer Kit (SDK), a Solaris option that must be purchased separately.

---

You should install XGL if users at your site are running a graphics application on a SPARCstation system, since the application may reference the XGL libraries. It is not always obvious whether an application requires the XGL RTE. Therefore, we recommend that you install the XGL RTE if you are installing OpenWindows Version 3.4 software on a color SPARCstation system.

Applications built with the XGL library require these four packages to be installed. The default installation location for these packages is `/opt/SUNWits/Graphics-sw/xgl`.

The XGL 3.1 RTE packages are listed in Table 2-6.

*Table 2-6* XGL 3.1 Runtime Packages

Package Name	Package Contents
SUNWxglrt	XGL runtime library and the Roman_M stroke font
SUNWxgler	Localized error message files for SUNWxglrt
SUNWxgldg	Loadable pipeline libraries for generic drivers with specific error message files when applicable. The generic drivers include <code>cg6</code> (GX, GXplus, TurboGX, and TurboGXplus), <code>cfb</code> (non-accelerated color frame buffers such as <code>cg3</code> and <code>cg8</code> ), <code>mem</code> (memory), <code>xpex</code> (combined Xlib and PEXlib pipelines), <code>swp</code> (software pipeline), and <code>cgm</code> (CGM Stream device). XGL loadable libraries for other devices are included in the packages distributed with each device.
SUNWxglft	XGL stroke fonts

The Solaris 2.4 XGL runtime library, `libxgl.so.3`, which is shipped as part of the SUNWxglrt package must be used with the Solaris 2.4 versions of the XGL reference pipelines in the SUNWxgldg package. Users cannot use Solaris 2.3 reference pipelines with the Solaris 2.4 version of `libxgl.so`. If users try to use a Solaris 2.3 or older version of the reference pipelines with the Solaris 2.4 `libxgl.so`, XGL will fail from within the runtime loader with unresolved external reference errors.

## SPARC *Supported Devices and Features*

Any graphics device supported by Solaris 2.4 is supported by the XGL RTE through Xlib or PEXlib.

---

**x86** – All x86 display adapters are supported through Xlib rendering.

---

The XGL 3.1 RTE provides support via Direct Graphics Access (DGA) for the following SBus graphics devices:

- GX, GXplus, TurboGX, TurboGXplus
- CG3, CG8 (TC)

The XGL 3.1 RTE uses PEX, the 3-D extension to X, whenever possible to render on remote displays. If the display doesn't support PEX, then Xlib is used for rendering. With this release, not all XGL primitives are accelerated through PEX. Those that aren't are rendered via Xlib.

---

**Note** – If a window raster is created on a remote server that supports PEX, but the PEXlib library, `libPEX5.so`, cannot be found on the local machine, XGL issues an error message and uses Xlib to communicate with the remote window raster. To eliminate the error, either install the PEXlib library or disable PEX on the remote server.

---

## *Installing the XGL RTE and Reference Pipelines*

The XGL RTE packages are automatically installed if you select any of the following software groups:

- Entire distribution
- Developer system support
- End user system support

Note that the XGL RTE is included in the End user system support package; it installs automatically when you choose the initial upgrade option.

The XGL packages are not deselected from the list of available software packages so the XGL RTE is installed unless you explicitly deselect it.

---

**Note** – If you installed the XGL libraries at a previous release and follow the normal upgrade procedure to install new packages for the current release, the new versions of the XGL packages are installed correctly. However, if you explicitly delete XGL packages, `pkgrm` may not remove all the files and directories that were created by other packages or by third party software. If you then add the `SUNWxglrt` package using `pkgadd`, the `SUNWxglrt` package will create a symbolic link on top of the existing directories, and the disk space for these directories will be lost. Therefore, if you want to use `pkgrm` and `pkgadd`, be sure to manually remove all remaining XGL files and directories before adding new packages with `pkgadd`.

---

## *Solaris Security and Accessing Direct Graphic Access (DGA)*

There is a security feature in Solaris that governs frame buffer access for processes started by anyone other than the first user of the window system. As a result, non-owners of the window system will not have access to DGA.

For example, if a user starts the window system and then another user sits at the workstation, changes to his own environment using `su`, and starts an XGL application, the application will not run via DGA even though the second user is running the application locally.

To give all local users access to DGA:

- 1. Change directory to the file `/etc/logindevperm`.**
- 2. Change permissions to `0666` in the lines shown below.**
- 3. Reboot.**

```
/dev/console 0666 /dev/mouse;      /dev/kbd
/dev/console 0666 /dev/sound/*    # audio devices
/dev/console 0666 /dev/fbs/*     # frame buffers
```

## SPARC *Direct Xlib 3.1*

Direct Xlib 3.1 is the fourth release of the OpenWindows product that transparently enhances graphics-rendering performance for graphics-intensive Xlib applications. Direct Xlib has been updated to utilize the new DGA Drawable Interface exported through `libdga`. In addition Direct Xlib now supports systems that have more than one frame buffer.

Direct Xlib benefits Xlib applications that are limited by X graphics performance. Performance improvement is dependent upon an application's use and mix of graphics primitives. Programs that are not graphics-intensive may not see a performance gain. The applications that may benefit are:

- Mechanical design
- Electronic design drafting
- Mapping
- Scientific visualization

---

**Note** – Direct Xlib 3.1 is only supported on the Solaris 2.4 and OpenWindows 3.4 platforms.

---

Direct Xlib 3.1 software accelerates rendering on the following devices:

- GX
- GXplus
- TurboGXplus
- SX

The Direct Xlib application is installed only if the entire Solaris distribution is installed. For those upgrading from Direct Xlib 2.0 to 3.1, there are some changes that may affect your use of Direct Xlib.

1. The shared-font mechanism utilized by Direct Xlib has changed from Direct Xlib 2.0 to 3.1. If you used the `-sharedretainedpath` option to the OpenWindows server, then you should remove all files located within the directory specified with `-sharedretainedpath` before starting the server and using Direct Xlib 3.1.
2. Direct Xlib font-rendering performance has been significantly reduced in Direct Xlib 3.1. Performance for tools that are predominately text rendering may be unsatisfactory. Tools that mix graphics with text should not be dramatically affected.

3. Direct Xlib no longer supplies static versions of its libraries. Applications that use static linking will have to link dynamically to take advantage of Direct Xlib 3.1.

### *Upgrading from Direct Xlib 3.0 to 3.1*

If you explicitly set `LD_LIBRARY_PATH` in your environment to include the path to the Direct Xlib libraries, you are no longer required to add `$OPENWINHOME/server/lib` immediately after the path to the Direct Xlib libraries. Any references to this path should be removed since it may not be present in future OpenWindows releases. See the *Solaris Direct Xlib 3.1 User's Guide* for more information.

## *ImageTool Enhancements*

In Solaris 2.4, ImageTool can display images stored in Eastman Kodak Company's Photo CD format, which enables a computer to display images that were made from photographic negatives. Photo CD images are stored at multiple resolutions; below shows the resolutions ImageTool can display, and the names Kodak has given to those resolutions.

*Table 2-7* ImageTool Photo CD Formats

<b>Resolution</b>	<b>Name</b>
192 x 128	Base/16
384 x 256	Base/4
768 x 512	Base
1536 x 1024	4Base



## *Making the Transition to Solaris 2.4*

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This chapter briefly introduces the changes that users and system administrators can expect when making the transition from SunOS 4.x for SPARC systems and Solaris 2.1 for x86 systems.

---

**SPARC** – The Solaris 2.4 upgrade option is available if at least one disk attached to the system has a Solaris 2.1 or later root file system. The upgrade option is not available for systems with SunOS 4.1.

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**x86** – The Solaris upgrade option is not available from Solaris 2.1 to 2.4.

---

For more detailed information about the transition from SunOS 4.x to Solaris 2.4, and for information about the differences between these two software environments, see *Solaris 1.x to Solaris 2.x Transition Guide* and *Solaris Source Compatibility Guide*.

For a look at some of the changes between Solaris 2.4 and your previous version, see *Solaris 1.x to Solaris 2.x Transition Guide*.

## SPARC *Making the Transition From SunOS 4.x*

The Solaris 2.4 environment includes SunOS 5.x system software. The following sections present a brief description of the differences between SunOS 4.x and SunOS 5.x for both users and system administrators.

### SPARC *Changes Affecting SunOS 4.x Users*

Some of the more obvious differences between SunOS 4.x releases and the SunOS 5.x releases are:

- Many UNIX commands have changed. For a detailed list, see *Solaris 1.x to Solaris 2.x Transition Guide*.
- The printing subsystem has changed. For example:
  - `lp(1)` replaces `lpr`.
  - `lpstat(1)` replaces `lpq`.
  - `cancel(1)` replaces `lprm`.
  - `troff(1)` requires a printer name.
- The mail programs have changed. The SunOS 4.x mailboxes and folders are completely compatible with any of the three Solaris 2.3 mail programs:
  - `mailtool`, the DeskSet environment Multimedia Mail Tool
  - `mail(1)`, a command-line utility
  - `mailx(1)`, a command-line utility
- The location or name of some system files has changed. For example:
  - `/etc/vfstab` replaces `/etc/fstab`.
  - `/var/mail` replaces `/var/spool/mail`.
  - `/kernel/unix` replaces `/vmunix`.

For more information on the preceding topics, see *Solaris 1.x to Solaris 2.x Transition Guide*.

### SPARC *Changes Affecting SunOS 4.x System Administrators*

Some of the differences you will find in migrating to the SunOS 5.x environment from a SunOS 4.x environment are:

- Solaris 2.4 software can be installed on SPARC systems only from a local or remote CD-ROM drive or from a network.



- Solaris 2.4 software media is distributed in software groups, made up of *packages* and *clusters*. This facilitates installing the software to support typical environments for users or developers without requiring a custom installation. For the most up-to-date information on Solaris 2.4 packages use `pkginfo(1)` or `swmtool`.
- Device-naming conventions have changed; disks, for example, are now named as follows:

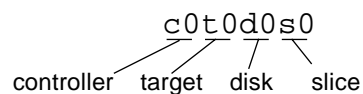


Figure 3-1 Device-naming Convention

Note that on some disks (*xy, xd*) there is no target component; such disks have names like `c0d0s0`.

- The file system directory structure has changed. For example:
  - The kernel, called `unix`, and its related modules are stored in the `/kernel` directory.
  - The `/opt` directory is a new directory. It is created during installation for storing or mounting optional software applications.
  - The `/devices` directory is a hierarchy of device files, with symbolic links into the `/dev` directory for compatibility with the SunOS 4.x device naming conventions.
  - The `/usr` directory has been restructured.
  - The `terminfo` database replaces `/etc/termcap`.
  - The `/etc/vfstab` file replaces `/etc/fstab`.
  - The `/var/mail` directory replaces `/var/spool/mail`.
  - The `/etc/lp` directory replaces `/etc/printcap`.
  - The Remote File Sharing service (RFS) as an optional software package has been discontinued since Solaris 2.2.
- The SunOS 5.x kernel is *dynamic*; you no longer rebuild or edit the kernel configuration file.
- The kernel can automatically load necessary drivers for new devices added to the system.

- The Solaris 2.4 startup and shutdown procedures have changed:
  - The `init(1M)` command uses different scripts for each run level.
  - The `shutdown` command does not support any of the options available in SunOS 4.1 systems.
  - The `fastboot(1B)` and `fasthalt(1b)` commands are only available using the SunOS/BSD Source Compatibility Package.
- Many commands have changed, as well as the output from commands. Scripts may need to be rewritten. For more information, see *Solaris 1.x to Solaris 2.x Transition Guide*.
- NIS+ replaces the NIS, the Network Information Service name service; however, NIS+ uses NIS data, which makes it easier to transition to NIS+.
- Administration Tool (`admintool`) has five OPEN LOOK tools:
  - Database Manager
  - Host Manager
  - Printer Manager
  - Serial Port Manager
  - User Account Manager
- The print management commands have changed. For a detailed list, see *Solaris 1.x to Solaris 2.x Transition Guide*.
- Terminals and modems are controlled through the Service Access Facility (SAF) and System Access Controller (SAC); the `/etc/ttytab` file is gone.

## SPARC *Compatibility with SunOS 4.x Releases for SPARC Systems*

The Solaris 2.4 environment provides two packages to ease the transition and migration to the SunOS 5.x system software for SPARC systems:

- The SunOS/BSD Source Compatibility Package
- The SunOS Binary Compatibility Package

If you use these packages, remember that they are a temporary transition aid only for

- Developers who want to compile SunOS 4.x application source code to run in the Solaris 2.4 environment.
- Users who want to run SunOS 4.x-based application binaries that have not yet been ported to run in a SVID-compliant environment such as the Solaris 2.4 environment.

---

### SPARC *The SunOS/BSD Source Compatibility Package*

If this software package is installed, it supports some of the SunOS/BSD commands that are not included in, or have changed in, the SunOS 5.x system software. Application source code that is compliant with the SunOS 4.x environment will compile and run under the Solaris 2.4 environment by using the SunOS/BSD Source Compatibility package.

For specific details, see *Solaris 2.4 Binary Compatibility Package Manual* and *Solaris 2.4 Source Compatibility Package Manual*.

### SPARC *The SunOS Binary Compatibility Package*

OpenWindows and other executable applications that are either dynamically linked or statically linked and written under SunOS 4.1.x<sup>1</sup> are supported in the Solaris 2.4 environment through the SunOS Binary Compatibility Package and the OpenWindows Binary Compatibility Package.

To use these packages, applications written under SunOS 4.x must:

- Not trap directly to the kernel
- Not write directly to system files
- Not use `/dev/kmem` or `libkvm` routines
- Not use unpublished SunOS interfaces
- Not rely on non-SunOS drivers

The SunOS/BSD Source Compatibility package must be installed to use the SunOS Binary Compatibility Package.

---

1. References to the "SunOS 4.1.x" release/environment include the SunOS 4.1 release and all subsequent 4.1 releases; 4.1.1, 4.1.1 RevB, 4.1.2, 4.1.3, and 4.1.3c.

## x86 *Making the Transition from Solaris 2.1 for x86*

Some differences exist for administrators moving to a Solaris 2.4 system environment from the Solaris 2.1 release. For example, installation procedures follow a different order, there are changes in the way disks are formatted, and printing commands are different.

There are differences in installation of Solaris 2.4 software on a networked x86 system:

- `kdmconfig` is called by `sysidconfig` and replaces `devconfig` during installation.
- When `bootparams` database server is queried, if the ethernet and hosts maps are set correctly, installation proceeds without questions. If there are discrepancies, or the system is standalone, a series of screens appear asking you to define the keyboard, mouse, and display attached to the system. See `kdmconfig(1M)`.

There is a change in the user interface of Solaris 2.4 on x86 systems:

- The Meta key is now mapped to the key sequence Ctrl-Alt on the x86 keyboard instead of to the right Control key.

There are differences in formatting SCSI and IDE disks for x86 systems.

- The `format(1M)` utility is now available to format, label, analyze, and repair SCSI disks. This utility is included in addition to the `addbadsec(1M)`, `diskscan(1M)`, `fdisk(1M)`, and `fmthard(1M)` commands available in the Solaris 2.1 for x86 release. To format IDE disks use the DOS format utility; however to label, analyze and repair IDE disks on x86 systems use the Solaris `format(1M)` utility.

There is a change in the support for parallel PostScript™ printers on x86 systems:

- The `lp` driver has been modified, so that setup for a parallel PostScript printer in x86 systems is now identical to the setup of a serial printer. The only difference is when you need to specify the device name of the port.

- The following files are no longer part of Solaris 2.4:

```
/etc/lp/fd/ppostio.fd
/etc/lp/fd/ppostior.fd
/usr/share/lib/terminfo/P/PPS
/usr/share/lib/terminfo/P/PPSR
```

- The x86 lp driver now takes advantage of added `ioctl`s in `postio`.

## x86 *Solaris 2.4 System Administration Tools*

System administration benefits of the Solaris 2.4 release are the result of enhancements to the Solaris system software and the ONC networking protocols and administration applications. For the benefit of x86 users who may not have seen intervening releases, these enhancements are described in the following sections.

### x86 *Since the Solaris 2.3 Release*

The following administration features have been enhanced since the release of Solaris 2.3:

- Keyboard, mouse, and display configurations are updated with `kdmconfig`
- `bootparams` names the keyboard, display, and mouse
- Booting sequence is different on x86 machines

### x86 *Since the Solaris 2.1 Release*

The following administration features have been enhanced since the release of Solaris 2.1:

- Administration Tool is enhanced to simplify terminal and modem setup.
- Automated Security Enhancement Tool (ASET) enables administrators to easily increase a system's security.
- Dynamic kernel and loadable modules simplify:
  - Kernel management for heterogeneous systems
  - Adding new devices to running systems
  - Adding device drivers without rebuilding the kernel
- NIS+ name service creates subdomains and assigns security to network resources.



## *System Administration in Solaris 2.4* **4**

---

The Solaris 2.4 system software and the ONC family of network protocols form the foundation for enabling distribution of applications and data across networks in the Solaris 2.4 environment. As a system administrator, you can manage users, data, programs, and resources across Solaris 2.4 networks.

### *Starting the OpenWindows Software*

For the Solaris 2.4 release, OpenWindows software is installed by default in `/usr/openwin`. Executing the `openwin` command accesses OpenWindows software; many applications such as Calendar Manager depend on finding OpenWindows software in `/usr/openwin`.

---

**Note** – If you installed OpenWindows software at a location other than `/usr/openwin`, you must create a symbolic link, `/usr/openwin`, that points to where the OpenWindows software is installed. This must be done before you start any OpenWindows software.

---

If you are mounting OpenWindows from a remote server, mount it on the directory `/usr/openwin`.

## *Shell and Command Tools*

There are three shells available in the Solaris 2.4 environment:

- The Bourne shell (`/bin/sh`) is the default UNIX-system command interpreter.
- The Korn shell (`/bin/ksh`) is an interactive command interpreter similar to the Bourne shell, but with additional history features.
- The C shell (`/bin/csh`) is an interactive command interpreter with a syntax similar to the C language and advanced features such as history listing, aliasing of commands, job control, enhanced file protection, and others.

You can run any of these shells in a Shell or Command Tool.

The *Solaris Advanced User's Guide* gives you information about changing shell parameters such as default position, size, and naming conventions. *User Accounts, Printers, and Mail Administration* describes defining a user's environment variables such as the default shell type.

## *Common Administration Tasks*

You can also use User Account Manager to add new users to your distributed computing environment with Administration Tool (`admintool`), using the User Account Manager to add entries to the network wide (NIS+) `passwd` and `auto_home` tables.

You use UNIX commands to allocate a home directory for the new user, copy skeleton initialization files into it, and make the home directory available to the new user from any machine on the network. These procedures are described in *User Accounts, Printers, and Mail Administration*.



---

## Setting Up Printers and Printing

*User Accounts, Printers, and Mail Administration* describes the `lp` print service software used to set up and administer printing and printers. The `lp` service consists of several *daemons*, or processes, that monitor system work, a hierarchy of configuration files in the `/etc/lp` directory, and a set of administrative commands such as those shown in Table 4-1.

Table 4-1 `lp` Administrative Commands

Command	Description
<code>lp -d</code>	Used to submit print requests
<code>lpstat -t</code>	Used to look at the <i>print queue</i> , or jobs waiting to print
<code>cancel</code>	Used to delete jobs from the print queue

*User Accounts, Printers, and Mail Administration* provides a complete description of printing topics such as:

- Print control forms, print wheels, and interface programs
- Setting up network print services
- Using a set of PostScript, device-independent fonts, and filters

---

**Note** – `lp` replaces the `lpr` commands and the `/etc/printcap` file. `TEX`, `pstat` (C/A/T), and raster image filters are not available in the Solaris 2.4 environment.

---

### *Print Spooler ( `lp` ) Feature Transition*

A new distributed print service to replace the SVR4 print spooler will be provided in place of the `lp` print spooler. The new print service will be based on the emerging ISO DPA 10175 and POSIX 1387.4 (formerly P1003.7.1) standards. SunSoft will continue to provide the existing print spooler until the new print service ships.

The new print service will continue to support the following commands:

- `lp(1)`
- `lpstat(1)`
- `cancel(1)`
- `lpr(1B)`

- `lpq(1B)`
- `lprm(1B)`
- `lptest(1B)`

The PostScript filters in `/usr/lib/lp/postscript` will continue to be provided.

The procedures for print administration, which are only used by system administrators, will be different. However, SunSoft will provide compatibility for the common options of the following administrative commands:

- `lpmove(1M)`
- `lpshut(1M)`
- `accept(1M)`
- `reject(1M)`
- `enable(1)`
- `disable(1M)`
- `lpc(1B)`

Because the administrative model is more powerful for an ISO DPA spooler, the following administrative commands will no longer be provided:

- `lpadmin(1M)`
- `lpssystem(1M)`
- `lpfilter(1M)`
- `lpforms(1M)`
- `lpusers(1M)`
- `lpsched(1M)`

For the same reason, compatibility will not be maintained for the configuration files used by the System V print spooler.

The mechanism for providing printer specific support by customizing the System V standard printer interface script will be changed. The SVR4 printing protocol will no longer be provided. Although the new print service will be based on the ISO DPA protocol, the Berkeley Software Distribution (BSD) printing protocol (RFC 1179) will be used to provide operability with existing Solaris and other UNIX-based systems.

---

### ***The BSD Printing Protocol***

To simplify the transition, users are strongly advised to configure print clients to use the BSD protocol. This can be done when adding a remote printer by using the default value for Print Server OS in the `admintool(1M)` Printer Manager or by specifying `-t bsd` to the `lpsystem(1M)` command in a command line interface.

---

**Note** – Configuring to use the BSD protocol now will allow print clients and servers to be upgraded to future versions of Solaris without breaking print operability. The `lpsystem(1M)` command has been enhanced to report a warning when an administrator configures a print client to use the System V protocol.

---

## ***Setting Up Mail***

A mail configuration requires three elements that can be combined on the same system or provided by separate systems:

- At least one mail server
- A mail host
- Mail clients

When you want users to communicate with networks outside your subnet, you must also have a relay host or a gateway.

In addition to explaining how the `sendmail(1M)` mail service works and defining all of the mail concepts, *User Accounts, Printers, and Mail Administration* provides step-by-step instructions for setting up:

- Relay hosts
- Gateways
- Mail hosts
- Mail servers
- Mail clients

## ***ToolTalk Service***

The ToolTalk® service, an interprocess-message service used by developers, is automatically installed (the Core System Support cluster must always be installed). *ToolTalk User's Guide* describes the ToolTalk service and provides instructions for tasks such as administering the service and its databases, files, and objects that are referenced by the ToolTalk messages.

## *Administering Realtime Applications*

The greatest improvement in performance for realtime applications comes as a result of the implementation of a new scheduler. The standard UNIX scheduler is not suitable for realtime applications. Realtime applications require a scheduler in which process priorities are never changed and are taken as absolute. *System Services Guide* provides information on the SunOS 5.x process scheduler and tells you about administering workstations that run realtime applications.

## *Administering Files and File Systems*

This section introduces Solaris 2.4 file system management technology and resource sharing. Solaris 2.4 resource sharing products are distributed file systems. This means that a computer can distribute its file systems on the network, allowing client computers to use the file systems as if they were local. The sharing resources products offered by the Solaris 2.4 environment are:

- NFS® for sharing files across a network. NFS was developed by Sun Microsystems and adopted by SVR4. You can read and write NFS files anywhere on the network (provided you have permission to do so).
- The Autofs is a network service that allows a user to read and write network file systems by automatically mounting them, eliminating the need to issue a `mount` command.
- The System V file system pertains specifically to x86 systems.

## Setting Up File Systems

During the installation of Solaris software, the SunOS 5.x file system is installed onto the disk. Table 4-2 lists the default set of directories; your system may have a combination of these defaults. For more information about the directory hierarchies and the file systems mounted on each directory, see *File System Administration*.

Table 4-2 Default Directories and Mount Points

Name	Description
/	The root, or base, directory to all file systems and directories
/etc	The directory containing system-specific files and databases
/usr	The mount point for the sharable /usr file system
/export/ home	The default mount point for a file system containing user's home directories
/var	A directory containing system files and directories likely to change or grow over the life of the local system
/kernel	The directory containing UNIX and its related modules and drivers
/opt	The directory where you install optional software applications
/tmp	A temporary directory that is cleared each time the system boots
/proc	The directory containing a list of active system processes, by number

### Understanding File System Types

*File system types* support different media and storage devices, such as different hard disks, remote file systems, and compact discs. Data is stored on these devices by the operating system to maximize the retrieval of the data. A file system is a grouping of files stored in a particular file system type. For a complete list of file systems arranged by file system type, see *File System Administration*.

The Solaris 2.4 environment supports three file system types:

- Disk-based
- Distributed (network)
- Pseudo

---

**x86** – The SVR4 `u5` file system type is not a supported file system for SPARC systems, but is supported on x86 systems. For information about file systems and compatibility, see *Administration Supplement for Solaris Platforms*.

---

### ***Disk-based File Systems***

Disk-based file systems are file systems structured for a particular hard-disk format.

There are three disk-based file systems:

- The UNIX file system (UFS) is the default file system for local hard disks. The UFS combines the BSD Fast File System (BSD FFS) and the 4.3 Tahoe Fast file system features to provide the following:
  - File system locking
  - Data blocks as large as 8 Kbytes
  - Support for new-generation hard disks by de-referencing variable-length list structures
  - Unlimited inodes and cylinders per cylinder group for disks
- The High Sierra File System (`hfs`) is a file system for compact disc (CD-ROM) drives. It supports the High Sierra CD-ROM file formats and the ISO 9660-88 CD-ROM file formats using the Rock Ridge extension. (The Rock Ridge extension now supports multisession CD-ROM.)
- The PC file system (`pcfs`) is a file system for accessing data written for personal computers running versions of the DOS operating system.

### ***Pseudo File Systems***

Pseudo file systems are virtual or memory-based file systems. These file systems are primarily used for storing system level information and are rarely accessed directly by users, but rather by a UNIX command that returns system information.

The most commonly used of these pseudo file systems for system administration are:

- The temporary file system, `tmpfs(7)`, which improves system performance by storing, or *caching*, local and network disk access in memory. `tmpfs` information is temporary; it is lost when the power is turned off to the system or when you restart the system.

- The process file system, `proc(4)`, which contains information about executing kernel processes. Standard system call interfaces are used to access the `/proc` files: `open(2)`, `close(2)`, `read(2)`, `write(2)`, and `ioctl(2)`.
- The loopback file system, `lofs(4s)`, which enables virtual file systems to be created, providing convenient paths to files through mounted directories using alternate path names.
- The Cache File System (CacheFS) which can be used to improve performance from remote file systems or slow data devices such as CDs. When a file system is cached, the data read from the remote file system or CD is stored on the local system for future use. See *Administering File System* for more information on CacheFS.

### ***Distributed File Systems***

Distributed file systems are actually network services for sharing files and resources across a network. *NFS Administration Guide* describes distributed file systems in detail.

### ***Virtual File Systems***

Virtual File System/virtual node (VFS/vnode) file management is implemented in the operating system and network environment. VFS is a set of interfaces that can access different file systems. A vnode is any file, belonging to any file system type, that is accessed by the kernel.

## ***Administering Systems and Networks***

Once you have the Solaris 2.4 release installed, you can take advantage of the SunOS 5.x system software features that simplify system administration and provide a greater control for specific applications and installations. This section is an overview of the features.

### ***Dynamic Kernel***

In the Solaris 2.4 environment the kernel is *dynamic*. It loads drivers or other modules into memory when devices are accessed. You no longer need to manually rebuild or reconfigure the kernel after installation or to add and delete drivers. This is called *autoconfiguration*.

Autoconfiguration provides the following enhancements:

- Makes it unnecessary to rebuild kernels when adding new devices to the system
- Eliminates the need to reboot a machine each time a new driver is loaded
- Improves performance by removing unneeded code bound to the kernel for infrequently used devices

### *Adding Devices or Kernel Modules During Boot*

At boot time, the system does a self-test and checks for all devices that are attached to it. When you add a new device to the system, you reconfigure the kernel by entering:

- `boot -r` (SPARC systems)
- `b -r` (x86 systems)

When you boot, a reconfiguration script loads all the device drivers listed in the modules directories and creates the corresponding hardware nodes. See the `kernel(1M)` man page for more information.

To interactively add drivers or modules to the system, you can also use one of the following:

- `boot -a` (SPARC systems)
- `b -a` (x86 systems)

You should be aware that for whatever boot specification you use you will be asked to provide a number of other boot parameters, including what to boot, where your root file system is, and similar questions.

Paths to the system files and kernel modules are stored in `/etc/system`. When the system boots, it reads the information in `/etc/system` to determine which modules to load. You can specify a different path by using the `MODDIR` syntax of the `system(4)` file or by using `boot -a`.

For more information about booting, see *Administration Supplement for Solaris Platforms* and *Solaris 1.x to Solaris 2.x Transition Guide*. For more information on adding devices and drivers, see *Peripherals Administration*.



## Volume Management

Volume Management is a layer of software that manages CD and diskette devices. This software automatically mounts and unmounts CDs and diskettes. If your CD or diskette contains a file system, it will be automatically mounted to the location listed in Table 4-3.

Table 4-3 Location of CD and a Diskette With a File System

Media	Location
CD-ROM	<code>/cdrom/<i>cdrom_name</i></code>
Diskette	<code>/floppy/<i>diskette_name</i></code>

If your CD or diskette does not contain a file system, it will be mounted as shown in Table 4-4.

Table 4-4 Location of a CD and a Diskette Without a File System

Media	Location
CD-ROM	<code>/vol/dev/aliases/cdrom0</code>
Diskette	<code>/vol/dev/aliases/floppy0</code>

For more information on configuring Volume Management, see *Peripherals Administration*. For information on how to use and administer diskettes and CD-ROMs, see *File System Administration*.

In OpenWindows, File Manager uses Volume Management to provide immediate access to CDs and diskettes with file systems. For more information on File Manager features, see *Solaris User's Guide*.

Manual pages for Volume Management components are also available in Solaris 2.4. See `rmmount(1M)`, `rmmount.conf(4)`, `volcancel(1)`, `volcheck(1)`, `vold(1M)`, `vold.conf(4)`, `volfs(7)`, and `volmissing(1)`.

Volume Management now controls these CD paths:

```
/dev/dsk/c0t6d0s0
/dev/rdisk/c0t6d0s0
```

And these diskette paths:

```
/dev/diskette  
/dev/rdiskette
```

Attempts to mount or access a CD or diskette using these paths results in an error message.

### *Displaying System Definitions*

When a system boots, configuration information is written to a file that can be examined by using the `sysdef(1M)` command. It lists all hardware devices as well as pseudo devices, system devices, loadable modules, and the values of certain kernel-tunable parameters. See the `sysdef(1M)` man page for more information.

### *Initializing and Changing Run Levels*

The kernel has eight *run levels* (also called init states). Run levels are software configurations that invoke a selected group of processes. The default run level for the SunOS 5.x system software is level 3. The levels are briefly described in Table 4-5; for more information, see *Common Administration Tasks*.

*Table 4-5* Run Levels

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<b>Level</b>	<b>Description</b>
0	Power-down state
1	System-administrator state (single-user)
2	Multiuser state (resources not shared)
3	Multiuser state; the default state (resources shared)
4	Alternative multiuser state (currently unused)
5	Software reboot state (unused)
6	Reboot
S or s	Single-user state

---

---

## *Administration Tool (admintool)*

The Solaris 2.4 environment contains graphical user interface tools for performing system administration. Administration Tool (admintool), which runs under the OpenWindows environment, includes:

- Database Manager
- Host Manager
- Printer Manager
- Serial Port Manager
- User Account Manager

---

**Note** - The `sysadmin` group (group ID=14) is created by default in Solaris 2.4. To enable a user to access Administration Tool applications, the only task a system administrator has to perform is to add that user to group 14. If a system is upgraded to Solaris 2.4 that already has a group 14 not named `sysadmin`, a warning message is displayed.

---

### *Database Manager*

Database Manager is an interface to the NIS+ databases. Each database has a File, View, and Edit menu. You can list all entries in the databases and search for or display lists of entries that match a value. For information about using the Database Manager, see *User Accounts, Printers, and Mail Administration* and *Administration Application Reference*.

### *Host Manager*

Host Manager is a graphical user interface for managing network client information. You can use Host Manager to add support for the following networked system types:

- Standalone systems
- Diskless clients
- Dataless clients

Host Manager is primarily used on a local server to manage support for diskless and dataless clients that need remote file resources and disk storage space. Host Manager can also be used to manage client information from a remote system with the appropriate access privileges.

For more information about using Host Manager, see *Administration Application Reference*.

For additional information about configuring systems on your network, see *Common Administration Tasks*. See *Name Services Configuration Guide* for information on how to configure an NIS+ root master server, and the server compatibility modes:

- NIS+ server answering NIS and NIS+ client requests
- NIS+ server answering NIS+ client requests

### *Printer Manager*

Printer Manager is an OPEN LOOK printer server and print client installation and configuration application for the bundled SVR4 `lp` print subsystem. Printer Manager simplifies connecting your workstation to an existing network printer and creating a new print server. Connections to 4.x BSD printer servers are made by choosing from a menu in the tool.

By registering the printer server and printer name with NIS+, any Solaris 2.4 client can browse the available printers from a list, so you no longer have to know the printer name and server name in advance. See *User Accounts, Printers, and Mail Administration* for details about Printer Manager. Also see *Setting Up Printers and Printing* on page 29 and *Administration Application Reference*.

### *Serial Port Manager*

Serial Port Manager enables you to quickly set up and modify serial port software for terminals and modems. It provides templates for common terminal and modem configurations and multiple port setup, modification, or deletion. To learn more about using Serial Port Manager, see *Peripherals Administration* and *Administration Application Reference*.

### *User Account Manager*

User Account Manager enables you to add new user accounts to a network. If you have several user accounts to add, User Account Manager lets you introduce them all from a single workstation at the same time. To learn more about using User Account Manager, see *User Accounts, Printers, and Mail Administration*, and *Administration Application Reference*.

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## *Securing Systems and Networks*

Security is an important part of administering a single system or a large network. To preserve the integrity of data and programs and to ensure that only certain users can access sensitive information, the Solaris 2.4 environment provides several security features. This section tells you what is available and where to look to learn how to implement the level of security appropriate for your system.

### *Administration Tool Security*

Administration Tool (`admintool`) uses secure RPC to control access to its services and administrative tools. You can use either System (UNIX) authentication or DES authentication to verify user identities. All users can run `admintool` to retrieve administration information. You can determine which users can update the information by adding them to the `sysadmin` group (group ID 14 by default) in the group database. For more information about setting up Administration Tool security, see *Security, Performance, and Accounting Administration*.

### *The Shadow Password File*

You secure access to your system by using the `shadow(4)` password file, `/etc/shadow`. The shadow password file improves security through password aging and login controls. The file may only be accessed by root. For more information, see *Security, Performance, and Accounting Administration* and *User Accounts, Printers, and Mail Administration*.

### *Automated Security Enhancement Tool (ASET)*

ASET is a utility that improves security by enabling you to check system file settings, including:

- Permissions
- Ownership
- File contents

ASET warns you about potential security problems and, when appropriate, sets the system files permissions automatically, according to the security level specified. For more information, see *Security, Performance, and Accounting Administration*.

## *Setting Up Network Communication Services*

The Internet Protocol suite (IP) is a set of formal rules governing the transmission communication of hardware and software in a network environment. *TCP/IP Network Administration Guide* manual provides the conceptual framework for the use of IP in the ONC networking environment. Complete instructions for setting up and administering TCP/IP-based networks are presented.

## *Administering Name Services*

*Name Services Configuration Guide* and *Name Services Administration Guide* discuss NIS+, the network information service for Solaris networks. NIS data can be shared with NIS+ and the services are partially interoperable.

All commands and functions that use NIS are prefixed by the letters *yp*, as in `ypmatch(1)`, `ypcat(1)`, and `ypclnt(3N)`. Commands and functions that use the NIS+ version are prefixed by the letters *nis*, as in `nismatch(1)`, `nischown(1)`, and `nis_tables(3N)`.

Some of the advantages of using the NIS+ name service are:

- NIS+ shares data with the NIS environments, making migration smooth.
- Domains, or groups of systems, are hierarchical; you can create subdomains.
- You can use the name service switch (`/etc/nsswitch.conf`) to set which name service the system tries to use first—NIS+, NIS, or DNS.
- You can use the Database Manager to make changes to the NIS+ tables by:
  - Adding information
  - Modifying information
  - Deleting information
  - Searching for information

## *NIS+ Network Security*

The NIS+ service provides a flexible security model for name service entries. You can assign UNIX-style permissions (read, write, execute) for every item in the NIS+ table. For information about NIS+ security, see *Name Services Administration Guide*.

The SunSoft Solaris Desktop Box is the base box you receive when you purchase the Solaris 2.4 Operating System product. It contains the Solaris CD and two kinds of documents. The Solaris 2.4 documentation comes as a printed manual set and as AnswerBook on-line documentation. Everything you need to install the Solaris product for either SPARC or x86 systems is contained in the appropriate Solaris Desktop Box.

The documentation in the Solaris Desktop Box is aimed primarily at end users. The Solaris Operating System, and the documentation, can be extended by adding other product boxes, CDs, and documentation to your system.

### *About AnswerBook On-Line Documentation*

An AnswerBook set is a collection of documentation that can be viewed on-line. The *Solaris 2.4 User AnswerBook* contains basic manuals for all Solaris users and is included on the Solaris 2.4 CD with the system software. If you choose the entire distribution software group during installation, this documentation is automatically installed.

AnswerBook sets can be shared by users across a network through a Library-based user interface. This on-line “Library” that users see is supported by centralized administrative procedures using a utility called `ab_admin(1)`. Properly configured, AnswerBooks on a network are for users like books in a library that they can browse, search, bookmark, and print.

To support the new Library feature, an AnswerBook start-up script, delivered as part of the OpenWindows package, replaces all AnswerBook start-up scripts from previous releases. In addition, installers and administrators of

AnswerBook sets must take some administrative steps to make AnswerBook sets—new and old—available to users. These procedures are discussed in detail in *Software and AnswerBook Packages Administration Guide*.

### *Other Solaris AnswerBooks*

Other AnswerBook documentation is available to Solaris users. For example, system administration documents can be viewed in the *Solaris 2.4 System Administrator AnswerBook* and Solaris command reference pages in the *Solaris 2.4 Reference Manual AnswerBook*. Both AnswerBooks are on the Solaris 2.4 System CD in the Workgroup Box. For more information, see “Additional AnswerBook Documentation.”

For information on Software and Driver Developer AnswerBooks, see “Software and Driver Developer Documentation.”

### *Printed Documents*

The following printed documents are provided to the Solaris Desktop Box audience:

- *Solaris Roadmap*  
Provides a brief overview of the contents of the Solaris Desktop Box and helps you walk through the included documentation.
- *Solaris 2.4 Introduction*  
Describes the Solaris computing environment and details new features for users.
- *Solaris 2.4 Open Issues and Late-Breaking News*  
Describes open bugs that a user needs to know, as well as fixed bugs that have been documented in previous Solaris 2.x release notes.
- *SPARC: Installing Solaris Software* or *x86: Installing Solaris Software*  
Provides step-by-step instructions for booting and installing Solaris software on networked and on-networked systems.
- *Software and AnswerBook Packages Administration Guide*  
Explains how to install Solaris software packages, including AnswerBook packages, from a CD-ROM onto a system or server. Includes instructions for the administrator on how to make AnswerBook on-line documentation available to users on a network.



- *Solaris 2.4 SPARC Hardware Platform Guide* (SPARC Only)  
Describes the specifics of installing Solaris for individual OEM platforms.
- *x86 Device Configuration Guide* (x86 Only)  
Describes the parameters of x86 devices and encourages methodical planning and recording of specific device information. Provides a strategy for setting component parameters to prevent conflicts.
- *Solaris 2.4 x86 Hardware Compatibility List* (x86 Only)  
Provides information about general x86 hardware requirements, supported x86 hardware, and tested x86 system platforms.
- *Solaris Quickstart Guide*  
Describes how to perform common tasks using Calendar Manager, File Manager, Mail Tool, and Text Editor. Also includes information on using these tools together.

## *User AnswerBook*

The following AnswerBook on-line documents are provided to the Solaris Desktop Box audience in the *Solaris 2.4 User AnswerBook*:

- *Solaris 2.4 Introduction*  
Describes the Solaris computing environment and details new features for users.
- *Solaris User's Guide*  
Provides a detailed description of the applications that constitute the DeskSet environment: File Manager, Mail Tool, Calendar Manager, Text Editor, Workspace Properties, Shell Tool, Command Tool, Console, Clock, Calculator, Performance Meter, Print Tool, Tape Tool, Snapshot, AudioTool, ImageTool, Icon Editor, and Binder.
- *Solaris Advanced User's Guide*  
Explains how to carry out command-line operations useful to Solaris users, such as using basic SunOS commands, using the `vi` editor, using printers and `mailx`, and customizing your work environment.
- *Solaris Help Handbooks* (on-line only)  
Describes how to carry out basic tasks using DeskSet applications. To view the handbooks, choose Help from the OpenWindows Workspace menu.

## *Additional AnswerBook Documentation*

The Solaris Workgroup Box contains documentation and licensing for wide network use. The documentation for this audience includes system administrator on-line documentation and printed books.

The following AnswerBook on-line documentation is provided to the Solaris Workgroup system administrator audience:

- *Solaris System Administrator AnswerBook*
- *Solaris Reference Manual AnswerBook*

System administrator on-line documentation is provided on the Solaris System AnswerBook CD.

## *System Administrator AnswerBook Documents*

The following System Administrator AnswerBook on-line documents are provided to the Solaris system administrator audience:

- *SPARC: Installing Solaris Software* and *x86: Installing Solaris Software*  
Provides step-by-step instructions for booting and installing Solaris software on networked and on-networked systems.
- *User Accounts, Printers, and Mail Administration*  
Describes how to set up and administer user and group accounts, user environments, printers, and electronic mail services.
- *Security, Performance, and Accounting Administration*  
Describes how to set up system and user security, optimize system performance, and track system use through accounting.
- *Peripherals Administration*  
Describes how to add and configure modems, terminals, disks, CD-ROMs, and diskettes. Also describes how to add device drivers and provides reference material on the Service Access Facility and format utility.
- *File System Administration*  
Covers administration of file systems, including creating file systems, archiving files, backup and restore procedures, disk management, and troubleshooting.

- *Administration Application Reference Manual*  
Provides reference information about the suite of graphical user interfaces used to perform system administration tasks.
- *Common Administration Tasks*  
Contains information about system administration tasks that are performed on a regular basis. Includes information on using Software Manager (a graphical user interface used to add and remove software packages).
- *Software and AnswerBook Packages Administration Guide*  
Explains how to install Solaris software packages, including AnswerBook packages, from a CD-ROM onto a system or server. Includes instructions for the administrator on how to make AnswerBook on-line documentation available to users on a network.
- *SunSHIELD Basic Security Module Guide*  
Gives installation and administration instructions for the Solaris SHIELD™ Basic Security Module (BSM). The BSM provides security auditing and a device allocation mechanism defined as C2 Class in the Trusted Computer System Evaluation Criteria.
- *TCP/IP Network Administration Guide*  
Contains procedures and conceptual information for network administration using the Solaris implementation of the TCP/IP protocol suite. Explains how to set up a local area network, administer its activities, expand an internetwork using point-to-point protocol (PPP) or routers, and transfer files across distant networks using UUCP.
- *Name Services Administration Guide*  
Presents tasks for setting up and administering the Network Information Service Plus (NIS+) and the Domain Name Service (DNS).
- *NFS Administration Guide*  
Describes how to administer resource-sharing products to share files and peripherals among a number of systems on the network. Also explains how to administer NFS systems, and how to use the automounter.
- *SunDiag User's Guide*  
Describes the SunDiag™ system exerciser, which runs diagnostic tests for most hardware systems running the Solaris system. Also explains how to create and develop your own tests for use within the SunDiag environment.

- *Solaris 1.x to Solaris 2.x Transition Guide*  
Describes what has changed in the Solaris environment for users, system administrators, and developers familiar with the SunOS 4.x release. Also evaluates the availability of all SunOS 4.x interfaces and describes corresponding Solaris features.
- *Name Services Configuration Guide*  
Describes how to use the Network Information Service Plus (NIS+) scripts to quickly set up an NIS+ domain.
- *Direct Xlib User's Guide*  
Describes the installation and use of the Direct Xlib end-user product. The Direct Xlib product provides enhanced graphics performance for graphics-intensive Xlib applications.

### *Reference Manual AnswerBook Documents*

The following Solaris Reference Manual AnswerBook on-line documents are provided to the system administrator audience:

- *SunOS Reference Manual* contains SunOS manual pages, organized by section:
  - *man Pages(1): User Commands*
  - *man Pages(1M): System Administration Commands*
  - *man Pages(2): System Calls*
  - *man Pages(3): Library Routines*
  - *man Pages(4): File Formats*
  - *man Pages(5): Headers, Tables and Macros*
  - *man Pages(6): Demos*
  - *man Pages(7): Special Files*
  - *man Pages(9): DDI and DKI Overview*
  - *man Pages(9E): DDI and DKI Driver Entry Points*
  - *man Pages(9F): DDI and DKI Kernel Functions*
  - *man Pages(9S): DDI and DKI Data Structures*

- *OpenWindows Reference Manual* contains OpenWindows 3.3 manual pages, organized by section:
  - *man Pages(1): User Commands*
  - *man Pages(1M): System Administration commands*
  - *man Pages(4): File Formats*
  - *man Pages(5): Headers, Tables and Macros*
  - *man Pages(7): Special Files*

## *Software and Driver Developer Documentation*

Software and driver developers can extend the Solaris product for their needs by purchasing additional Solaris product boxes, CDs, and documentation.

For more detailed information about Solaris software developers, see *Software Developer Kit Introduction*. For more detailed information about Solaris driver developers, see *Driver Developer Kit Introduction*.

### *Software Developers*

The following AnswerBook on-line documentation is provided to the software developer audience:

- *Solaris 2.4 Software Developer AnswerBook*
- *Solaris XIL 1.2 AnswerBook*
- *Solaris XGL 3.1 AnswerBook*
- *Solaris 2.4 Reference Manual AnswerBook*
- *Solaris 2.4 Supplemental Developer AnswerBook*
- *OpenWindows Developer Guide AnswerBook*

Software developers also receive the Motif Developer Set, which contains on-line PostScript files.

Software developer on-line documentation is provided on the Solaris Software Developer Kit CD.

## *Driver Developers*

The following AnswerBook on-line documentation is provided to the driver developer audience:

- *Solaris 2.4 Driver Developer AnswerBook*
- *Solaris 2.4 Reference Manual AnswerBook*
- *Solaris 2.4 Supplemental Developer AnswerBook*

Driver developer on-line documentation is provided on the Solaris Driver Developer Kit CD.

## *Additional Information*

Additional sources of information about Solaris 2.4 are available. The following is a brief list of places to look for assistance, information, and support in working with Solaris 2.4:

- SunSoft™ Press—Publishes 3rd party books about Solaris topics.
- SunExpress®—A quick-delivery customer distribution channel for SMI software, peripherals, documentation, hardware accessories, and (some) third party software.
- SunSoft Customer Support—Internal SunSoft group set up to help customers with their Solaris needs.
- SunSoft Customer Education—Internal SunSoft group that provides Solaris and application training to SunSoft customers and users.
- SMI (Sun Microsystems, Inc.) Customer Education—Internal SMI group that provides Solaris and application training to SMI customers and users.
- SunSolve™—A SunSoft database provided to customers on CD-ROM that answers many of the common questions about Solaris, including a variety of troubleshooting solutions.