



Information Library for Solaris 2.6

SPARC™ Platform Edition

Solaris™





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Using Solaris Web Start	How to install the Solaris operating environment and additional software through a single browser interface
Upgrading Solaris	<ul style="list-style-type: none">■ Frequently asked questions■ Upgrading instructions■ What you should do after upgrading
Troubleshooting During Installation	Bugs, known problems, and workarounds from the time you boot the system until the Solaris operating environment is installed
Adding Software After Installation	How to add and remove software after the Solaris operating environment is installed

This Module...	Contains This Information...
Accessing Online Documentation	<ul style="list-style-type: none"> ■ List of AnswerBooks on the Solaris AnswerBook Online Documentation CD ■ How to install and start the AnswerBook Online viewer ■ How to use the AnswerBook Online product
Supported Hardware	<ul style="list-style-type: none"> ■ General requirements (memory, CPU, bus interface) ■ Supported systems ■ Supported devices ■ End-of-life hardware

Planning Your Installation

Planning Your Installation

This module describes how to plan and install the Solaris operating environment.

How to Plan Your Installation

1. **Make sure these instructions are for you.**

If You Are Installing Solaris From ...	Then Go To ...
A CD-ROM drive attached to your system	Step 2.
A remote CD-ROM drive on the network	<i>Solaris Advanced Installation Guide</i> in the Solaris server product box.

2. **Does your system already have a previous version of the Solaris operating environment installed?**

If yes, go to Upgrading Solaris in this book.

If no, go to step 3.

3. **Make sure your hardware is supported.**

See the module Supported Hardware in this book.

4. **If your system is attached to a network, gather system information.**

Use the following table to gather system information that you may be asked to supply during installation. Collecting this information now will save you time during installation.

If the system you're installing already has a previous version of the Solaris operating environment, you can find system information by using the commands shown.

If the system you're installing does not have the Solaris operating environment installed, the only way to get this information is to ask your system administrator or whoever has set up your network.

Network Information You May Need to Supply	Example	Command for Finding Information
System's name (host name)	crater	<code>/usr/bin/uname -u</code>
Primary network interface	le0	<code>ifconfig -a</code>
IP address	129.221.2.1	<code>ypmatch system_name host</code> or <code>nismatch system_name hosts.org_dir</code>
Domain name	chandy.West.Arp.COM	<code>usr/bin/domainname</code>
System part of a subnet?	yes	Check for existing subnet in <code>/etc/netmasks</code>
Netmask	255.255.255.0	<code>more /etc/netmasks</code>

5. Plan disk space.

Before installing the Solaris operating environment, use the following tables to determine your disk space needs beyond the required Solaris software group.

Space for Software	For More Information ...
Select a Solaris software group: ■ Entire Distribution Plus OEM: 616 Mbytes ■ Entire Distribution: 608 Mbytes ■ Developer System Support: 537 Mbytes ■ End User System Support: 281 Mbytes	See Table 1-1 for software descriptions.
Add co-packaged Solaris software	See the module Chapter 7 in this book.
Add vendor and third-party software	See appropriate documentation.
Add space for /home directory applications (for example, mail, personal files, application files)	n/a

TABLE 1-1 Software Group Contents and Total Sizes

Software Group	Size	What It Contains
End User System Support	281 Mbytes	<ul style="list-style-type: none"> ■ Windowing software <ul style="list-style-type: none"> ■ Common Desktop Environment (CDE) ■ OpenWindows[™] environment ■ Motif runtime libraries ■ Power Management[™] (energy saving software) ■ Basic networking support (telnet, rlogin, ftp) ■ Basic language and partial locale support ■ Removable media support (Volume Management) ■ Standard UNIX[®] utilities (sed, awk, nroff, troff, grep, pipes, ld, ldd, spell) ■ Basic printer support (lp, lpstat, lpr) ■ System support for audio playback and record ■ Java[™] Virtual Machine (ability to run Java applications) ■ Patch utilities ■ Additional hardware support for PCMCIA)

TABLE 1-1 Software Group Contents and Total Sizes (continued)

Software Group	Size	What It Contains
Developer System Support	537 Mbytes	<p>The End User software plus:</p> <ul style="list-style-type: none"> ■ Development support (ar command, graphic accelerator support, IPC) ■ CDE/Motif Developer software, runtime software, and manuals ■ Java Virtual Machine (ability to develop Java applications) ■ OS demo code ■ Power Management GUI tools ■ Online man pages ■ Solaris 1.x compatibility tools ■ Kernel probing support (TNF) ■ Extended language and partial locale support ■ Programming tools and libraries ■ Extended terminal support (terminfo) ■ Extended X support (XGLTM, XILTM, XCU4 libraries) ■ Graphics header (for graphic application development) ■ ISO-8859 required fonts
Entire Distribution	608 Mbytes	<p>The End User and Developer software plus:</p> <ul style="list-style-type: none"> ■ AnswerBook2TM (online documentation) ■ Full audio tools and demos ■ Enhanced security features (disk quotas, file/directory access monitoring, system accounting) ■ UUCP networking (UNIX-to-UNIX copy) ■ DHCP server (Dynamic Host Configuration Protocol) ■ Additional language and partial locale support (Eastern European) ■ Additional hardware support (Leo, SX/CG14, SunVideoTM, SunButtonsTM, SunDialsTM, TCX) ■ Enhanced networking support (NIS server, point-to-point protocol) ■ AdmintoolTM software ■ System recovery tools

TABLE 1-1 Software Group Contents and Total Sizes *(continued)*

Software Group	Size	What It Contains
		<ul style="list-style-type: none">■ Additional X features (complete fonts, PEX[™] software)■ ISO 8559 optional fonts
Entire Distribution Plus OEM System Support	616 Mybtes	<p>The End User, Developer, and Entire Distribution software plus extended hardware support, which includes:</p> <ul style="list-style-type: none">■ Voyager[™] drivers and modules■ sun4u (X server modules, VIS/XIL)■ SunFastEthernet[™] /FastWide SCSI adapter drivers■ PCI drivers■ M64 graphic accelerator■ A-10 (PFU) and Fujitsu device drivers and system support

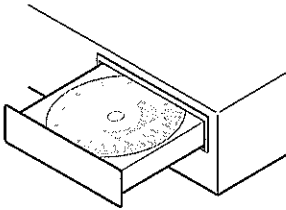
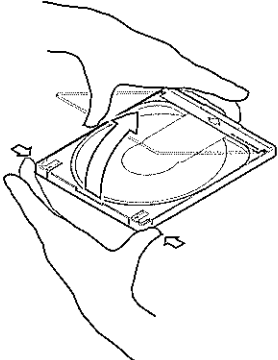
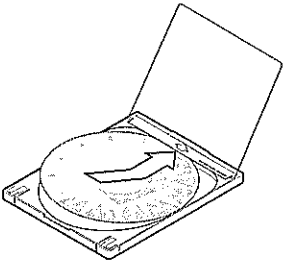
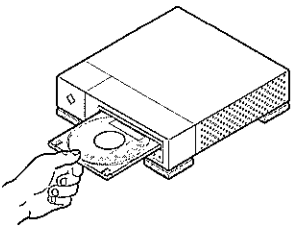
How to Install the Solaris Operating Environment

1. Decide which method to use for installing the software in your product box.

With This Method ...	You Can ...	You Can't ...
Solaris Web Start	<ul style="list-style-type: none"> ■ Install all the software in your product box (the Solaris operating environment and co-packaged software) at once from a single, browser-based tool ■ Install all the software with the default option, or pick only the software you want to install with the customize option ■ Install software on systems without graphic cards (headless systems). The headless system must have network access to another system with browser capabilities 	<ul style="list-style-type: none"> ■ Upgrade from a previous version of Solaris ■ Customize the software installations with choices at the lowest levels (for example, selecting/deselecting packages) ■ Use this method on systems with less than 48 Mbytes of system memory ■ Use this method on systems with less than a 1.05 Gbyte boot disk¹
Solaris Interactive Installation program, followed by other product installation programs	<ul style="list-style-type: none"> ■ Install the Solaris operating environment first, and then install the co-packaged software separately ■ Upgrade from a previous version of the Solaris operating environment ■ Customize the software installations at the lowest levels (for example, selecting/deselecting packages) ■ Install software on systems without graphic cards (headless systems) ■ Install on systems with the minimum hardware requirements specified for the Solaris software 	<ul style="list-style-type: none"> ■ Install all the software in your product box (Solaris operating environment) and co-packaged software) at once from a single tool

1. This restriction applies only to the size required to run Solaris Web Start; Solaris Web Start will determine whether your system has enough disk space to install the products you select.

2. Insert the Solaris CD into the system's CD-ROM drive.

CD-ROM Drive - Tray Version	CD-ROM Drive - Caddy Version
<p>1. Press the eject button on the front panel of the CD-ROM drive (a tray will slide out if you have this type of caddy).</p>  <p>2. Insert the Solaris CD (logo up) into the tray.</p> <p>3. Push the tray into the CD-ROM drive.</p>	<p>1. To open the caddy, pinch the corners while lifting the lid at the center.</p>  <p>2. Insert the Solaris CD (logo up) and close the caddy.</p>  <p>3. With the arrow on the caddy pointing toward the CD-ROM drive, insert the caddy.</p> 

3. Boot the system from the Solaris CD.

If Your System Is...	And You Want to Use...	Then...
New, out-of-the-box	Solaris Web Start or the Solaris Interactive Installation program	Turn on the system and follow the instructions on the screen.
Existing	Solaris Web Start	Get your system to the ok prompt and enter: <code>boot cdrom - browser</code>
	Solaris Interactive Installation program	Get your system to the ok prompt and enter: <code>boot cdrom</code>

Note - For older SPARC systems, use the following boot command:
`boot sd(0,6,2).`

Note - If you experience any problems from this point on, see the module Troubleshooting During Installation in this book.

4. Wait for booting to complete.

After you type the boot command, the system goes through a booting phase where hardware and system components are checked. This lasts for several minutes. The following screen provides an example of what you will see:

```
Type b (boot), c (continue), or n (new command mode)
>n
Type help for more information
ok boot cdrom
Booting from: sd(0,6,5)
SunOS Release x.x Version [UNIX(R) System V Release]
Copyright (c), Sun Microsystems, Inc.
WARNING: clock gained 35 days -- CHECK AND RESET THE
DATE!
Configuring devices
Starting OpenWindows...
```

5. Follow the on-screen instructions to install the Solaris operating environment.

You are now in the hands of the Solaris installation program. This menu-driven, interactive program guides you step-by-step through

installing the Solaris operating environment; it also has online help to answer your questions.

6. Now that you're done installing the Solaris operating environment, you can:

Task	Which Is Found in ...
Add vendor value-added software	Vendor Value-Added Software
Add other co-packaged software	Adding Software After Installation
Install Solaris online documentation	Accessing Online Documentation
Install patches to the Solaris operating environment	<i>Release Notes for Solaris 2.6 or Locale-Specific Release Notes</i>



What's New

What's New at a Glance

This document highlights new features of the Solaris™ 2.6 operating environment. Table 2-1 provides a list of new features in this release with short descriptions. For more extensive descriptions of these features, see Chapter 3.

- Table 2-1, "Solaris 2.6 Features at a Glance"
- "New Features in Previous Solaris Releases" on page 2-11
- Chapter 3

The Solaris operating environment is the foundation for web-based computing. It is scalable and has the capacity to run and grow businesses on the Internet. As reliable as the dial tone on your phone, Solaris software is the WebTone for the Internet. Reliable, solid, and multifaceted, Solaris software is built to provide capacity, security, interoperability, manageability, and global connectivity.

Why Upgrade to the Solaris 2.6 Release

These key features are the highlights of this release. The tables that follow describe all the new and exciting features in this release.

- Solaris Web Start is a browser-based utility that guides users through installation.
- Java™ Virtual Machine lays the foundation for deployment of Java applications on Solaris software.

- The HotJava™ browser is an easy-to-use, customizable, user interface for exploring the Internet and corporate intranets.
- Web technologies such as WebNFS™ software enable file systems to be quickly accessible through the Web using the NFS™ protocol.
- Support has been added for large files up to one Tbyte on UFS.
- Significant improvements have been achieved in web server and database performance. Existing levels of NFS server and time-share performance have been maintained.
- AnswerBook2 provides online documentation using a web browser interface.
- Conformance to the X/Open® UNIX® 95 standards continues the Sun™ commitment to open systems standards.
- Network management and system administration features provide a variety of improvements. Some of these are Network Time Protocol (NTP), Solstice™ Enterprise Agents™, Desktop Management Interface (DMI), dynamic host configuration protocol (DHCP), and variable length subnet masks (VLSM).
- Power Management™ for SPARC™ systems saves energy consumption when your system is idle by turning off the monitor (and optionally the system) according to preconfigured user choices.
- This release is year-2000 ready and follows X/Open guidelines where appropriate.
- Expanded language coverage is provided with the addition of 14 new locales, Unicode 2.0 support, TrueType fonts, and additional input methods for Asian languages.

TABLE 2-1 Solaris 2.6 Features at a Glance

Feature	Description
Java	
Java Virtual Machine	The Java Virtual Machine 1.1 integrates the Java platform for the Solaris operating environment. It includes the Java runtime environment and the basic tools needed to develop Java applets and applications.
HotJava Browser	The HotJava browser provides an easy-to-use, customizable user interface for exploring the Internet and corporate intranets. It can run executable content in the form of applets. (Applets are Java programs that can be included in an HTML page much like images can be included.)
Intranet/Internet Services	

TABLE 2-1 Solaris 2.6 Features at a Glance *(continued)*

Feature	Description
WebNFS Software	The WebNFS software enables file systems to be accessed through the Web using the NFS protocol. This protocol is very reliable and provides greater throughput under a heavy load.
Performance Improvements	
Database Performance	
UFS Direct I/O	For UFS files, direct I/O enables a program to read and write data directly from/to the disk, bypassing the virtual memory buffer cache. An example of a bulk I/O operation is downloading large amounts of satellite data to a file.
Raw I/O	Improvements were made to low-level I/O support routines that dramatically improved throughput for I/O to disk devices without a file system (raw devices). (Raw devices are often used for database files.) The driver for the SPARCstorage™ Array was rewritten to improve its throughput.
Network/Web Performance	
Kernel Sockets	The kernel sockets implementation provides improved compatibility with SunOS™ 4.x and BSD sockets and enables higher socket performance.
TCP Large Windows	TCP large windows provides the support described in RFC1323. It improves performance over high bandwidth networks such as ATM, or high delay networks such as satellite links, by using windows that exceed the normal 64-Kbyte limit.
Zero Copy TCP/Hardware Checksum	Zero copy TCP has been used to eliminate copying from user-space to kernel-space. Support for hardware checksum has been added as well. Performance is improved by avoiding software computation of the checksum, off-loading the work to a network adapter that supports it. This is currently only supported on the SunATM™ card.
Ease-of-Use and Management Improvements	
Installation	
Solaris Web Start Browser-based Installation	Solaris Web Start is a browser-based utility that guides users through selection and installation of both Solaris and bundled application software.
Installation Documentation	A documentation reorganization makes finding information on how to install Solaris software easier.

TABLE 2-1 Solaris 2.6 Features at a Glance *(continued)*

Feature	Description
x86 Device Configuration	The Configuration Assistant interface is part of the new booting system for the Solaris (Intel Platform Edition) software. It determines which hardware devices are in the machine, accounts for the resources each device uses, and enables users to choose which device to boot from.
x86 Configuring Peripherals	The <code>kdmconfig</code> program is used to configure the mouse, graphics adapter, and monitor on an x86 system. If an <code>Owconfig</code> file already exists, <code>kdmconfig</code> will extract any usable information from it. In addition, this updated version of <code>kdmconfig</code> will also retrieve information left in the <code>devinfo</code> tree by the <code>devconf</code> program, and use that information to automatically identify devices.
Changed Solaris CD Layout	Slice 0 on the Solaris CD has been reorganized to make it more intuitive and extensible.
Upgrade with Disk Space Reallocation	The upgrade option provides an auto-layout feature to reallocate disk space if the current file systems don't have enough space for the upgrade.
Testing Upgrade Profiles	The <code>pfinstall</code> command is now available to test profiles that use the upgrade option.
Changing a System's Boot Device	A system's boot device is now changeable during installation.
Preconfiguring System Configuration Information	Using the <code>sysidcfg</code> file, you can now preconfigure system configuration information through a set of keywords. You can choose to provide one or more of the keywords to preconfigure varying levels of system information.
Optional 8-Bit Locales	The installation window in the English Solaris 2.6 CD offers several English language locales. To use 8-bit characters, users should install through one of the <code>en_XX</code> options. The locale used in the installation becomes the default system locale.
Documentation	
AnswerBook2 Documentation	Solaris online documentation can be accessed with any popular browser. The AnswerBook2 viewer is the Sun premier online documentation system. It uses a web browser-based interface that enables users to view and print a variety of Solaris information, including existing AnswerBook™ documents and man pages.
Desktop	

TABLE 2-1 Solaris 2.6 Features at a Glance *(continued)*

Feature	Description
Common Desktop Environment (CDE)	Solaris CDE is an advanced Motif-based desktop with an easy-to-use interface that provides a consistent look and feel across UNIX® platforms. With Solaris CDE you can run OpenWindows™ applications without modifications. In addition, CDE applications are integrated with the Web; for example, you can click on an HTTP address in a CDE Mailer message and a browser will open to the selected address.
Power Management for SPARC Desktops	Power Management software enables users to be more frugal with power consumption on desktop systems when they are not being used. By default, all UltraSPARC™ desktop systems power off when left alone for 30 minutes. Users can modify or turn off Power Management if needed.
OpenWindows Desktop	The OpenWindows 3.6 desktop and libraries have been updated with bug fixes and prepared for the year 2000.
New User Locales	Ten new locales added for Eastern European, Russian, Greek, and Baltic states.
Unicode 2.0 Support	Two locales which are Unicode 2.0 and ISO 10646 compliant have been added. These locales enable multiscrypt input and output and are the first locales provided in the Solaris environment with this capability. These locales support the CDE environment only, including the Motif and CDE libraries
Font Administration	<p>- Font Admin enables easy installation and usage of fonts for the X Window System. It supports TrueType, Type0, Type1, and CID fonts for multibyte languages, and provides comparative font preview capability. It is fully integrated into the CDE desktop.</p> <p>- TrueType fonts are supported through X and Display PostScript™. Font Admin allows for easy installation and integration of third party fonts into the Solaris environment.</p>
Asian Language Enhancements	Solaris 2.6 software has been re-architected to the historical dependency on the Extended UNIX Codeset (EUC). Additional codeset support and locales for popular Asian PC encoding standards, ShiftJIS (PCK) in Japan, Big5 in PRC, and Johap in Korea are also provided. These locales support the CDE environment only, including the Motif and CDE libraries.
Solaris User Registration	Users who register using Solaris electronic registration will receive information about new Solaris offerings and support.
Standards	
Year 2000 Compliance	The Solaris 2.6 operating environment is year 2000 ready. It uses unambiguous dates and follows the X/Open guidelines where appropriate.

TABLE 2-1 Solaris 2.6 Features at a Glance (continued)

Feature	Description
X/Open UNIX 95 (Spec 1170)	The previous release of the Solaris software was compliant with much of Spec 1170. The Solaris 2.6 release now meets all the requirements.
X/Open XFN 2.0	Federated Naming Service (FNS) is now compliant with the X/Open XFN 2.0 definition.
POSIX 1003.1b	POSIX real-time functionality is added. This includes full support for POSIX AIO (with the exception of the <code>-PRIORITIZED I/O</code> option) and some new extensions to support 64-bit files. (See "Large Files".)
ISO 10646	The ISO 10646 standard defines Unicode 2.0, including UCS-2 and UTF-8 (the standard UNIX implementation). All implementations specified in this standard are Unicode 2.0 compliant.
Robust Software Developer Environment	
Large Files	Large files are supported on UFS, NFS, and CacheFS™ file systems. The interfaces defined by the Large File Summit are supported.
Versioning/ Scoped Libraries	Developers of shared libraries can now have better control over the public interfaces that they offer. This helps to control the dependencies that applications have on these shared libraries. This means the applications are more portable and less affected by changes in the shared libraries, thus leading to higher quality products for both. In the Solaris 2.6 operating environment, the system libraries take advantage of this technology and have been both scoped and versioned.
Scheduler Activations	Scheduler activations provide additional kernel scheduling support for multithreaded applications.
Pre-emption Control	Pre-emption Control allows application control over kernel pre-emption.
/proc File System and Watchpoints	The previous flat /proc file system has been restructured into a directory hierarchy that contains additional subdirectories for state information and control functions. It also provides a watchpoint facility to monitor access to and modifications of data in the process address space. The <code>adb(1)</code> command uses this facility to provide watchpoints.
Federated Naming Service (FNS)	FNS is now compliant with the X/Open XFN 2.0 definition. FNS has also been enhanced to include support for Lightweight Directory Access Protocol (LDAP) as well as providing improved support for the files and NIS back ends.
Asynchronous I/O	Asynchronous I/O support for tapes provides an interface to improve performance on high-performance tape devices. With the ability to queue up I/O requests, this feature significantly improves the I/O throughput.

TABLE 2-1 Solaris 2.6 Features at a Glance *(continued)*

Feature	Description
Solaris Developer Kit (SDK)	The SDK software is now built into the Solaris operating environment and is no longer an unbundled product. All the information a developer needs to produce applications and graphics handlers for end-user Solaris runtime environments is now available in this Solaris release.
Graphics	
XGL™	The XGL 2-D and 3-D immediate-mode API provides portability across hardware platforms and optimal performance from graphics acceleration. The XGL API includes support for raster text, environment and vertex-level texture mapping, four-component texture mapping, DGA transparent overlay, and triangle list Gcache.
XIL™	<p>The XIL foundation imaging library is suitable for libraries or applications requiring imaging or digital video, such as document imaging, color prepress, or digital video generation and playback. The following features are new in the Solaris 2.6 release. The XIL 1.3 library:</p> <ul style="list-style-type: none"> - Is MT-hot - Supports the 32-bit, single-precision, floating-point data type - Supports temporary images - Supports the new XIL_GENERAL storage format - Includes Kodak Color Management System (KCMS) support - Supports the new XIL_BAND_SEQUENTIAL storage format for all data types - Saves on memory use with tiled storage
PEX™ 3.0.2 Runtime Environment	The PEX application programmer interface (API) provides application portability across platforms and 3-D graphics on local and remote displays.
KCMS Multithreaded Programming	KCMS now supports multithreaded programs: it is multithread safe (MT-safe). A KCMS application using multithreaded capabilities does not require locks around KCMS library calls.
X11R6 Base Window System	The X11R6 Base Windowing System includes the latest fixes and patches from the X Consortium.

TABLE 2-1 Solaris 2.6 Features at a Glance (continued)

Feature	Description
X11 Double Buffer Extension	The double buffer extension (DBE) provides a standard way to use double-buffering within the framework of the X Window System. Double-buffering uses two buffers, called "front" and "back," that hold images. The front buffer is visible to the user; the back buffer is not. A detailed specification is available via an Internet browser in ftp://ftp.x.org/pub/DOCS/DBE/
Large Files Support	
Large Files	Large files are supported on UFS, NFS, and CacheFS file systems. Applications can create and access files up to one Tbyte on UFS-mounted file systems and up to the limit of the NFS server for NFS- and CacheFS-mounted file systems. A new <code>-mount</code> option is available to disable the large-file support on UFS file systems. This <code>-mount</code> option gives the systems administrator a way to ensure that older applications that are not able to safely handle large files will not accidentally operate on large files.
64-bit AIO	The Solaris operating environment provides a new set of interfaces for developers who want to do asynchronous I/O to large files. These interfaces are integrated with KAIO in an implementation technique that optimizes I/O to raw files. They are automatically selected by either the Solaris AIO interfaces or the new POSIX AIO interfaces. KAIO is the optimized path for doing I/O to raw files. When using the interfaces with KAIO to raw files, there is a significant performance improvement.
Network Security	
NFS Kerberos	Kerberos authentication uses DES encryption to improve security over the network. The kernel implementations of NFS and RPC network services now support a new RPC authentication flavor that is based on the Generalized Security Services API (GSS-API). This support contains the hooks to add stronger security to the NFS environment.
RPCSEC_GSS	The user-level RPC implementation supports a new authentication flavor. This flavor is based on the GSS-API and provides the hooks to add stronger authentication, privacy, and integrity for RPC-based services.
Authentication Modules (PAM)	The PAM framework enables you to "plug in" new authentication technologies.
BIND Version 4.9.4-P1	Berkeley Internet Name Daemon (BIND), the most popular DNS implementation, has been upgraded to 4.9.4-P1. It addresses many of the security problems found in earlier versions of the implementation.
Network Management and System Administration	

TABLE 2-1 Solaris 2.6 Features at a Glance *(continued)*

Feature	Description
Network Time Protocol (NTP)	Solaris software now supports NTP, which provides both precise time and/or network clock synchronization for use in distributed computing environments. In the past, Solaris customers could use a publicly available version of NTP. The new support provides increased time precision.
Solstice Enterprise Agents	Solstice Enterprise Agents (SEA) is based on the new extensible agent technology or Master/subagent technology. SEA is for component developers and system and network managers who want to develop custom Simple Network Management Protocol (SNMP) or Desktop Management Interface (DMI) subagents to instrument different components, subsystems, and applications within a device to enable management from an SNMP management console.
DHCP	Dynamic Host Configuration Protocol (DHCP) enables a host to get an Internet protocol address and other system configuration parameters without preconfiguration by the administrator.
NFS Client Failover	Client failover provides a high level of availability of read-only file systems by enabling the client to automatically mount the file system from another server if the first server becomes unavailable.
Variable Length Subnet Mask (VLSM)	VLSM enables more efficient use of IP address space by enabling the TCP/IP administrator to use Classless Inter-Domain Routing (CIDR) to partition this space in a flexible manner.
Routing Sockets	Conformance with the de facto routing socket interface as implemented by 4.4 BSD, which allows use of CIDR-aware routing protocols such as OSPF, BGP-4, and RIPv2 is now included.
autofs	The new autofs automount daemon is now fully multithreaded. This enables concurrent servicing of multiple mount requests and increases reliability.
Processor Sets	Processor sets give the system administrator control over the allocation of processes to sets of processors.
NIS+ backup/ Fast restore	NIS+ backup and restore provide a quick and efficient method of backing up and restoring NIS+ namespaces.

TABLE 2-1 Solaris 2.6 Features at a Glance *(continued)*

Feature	Description
NIS+ Over a Wide Area Network (WAN)	Server-use customization enables NIS+ administrators to specify NIS+ server search order for clients that need naming services. Server use can be balanced among various clients by designating different servers for different clients as "preferred" (primary). If a client cannot obtain information from its preferred servers, the order in which the client seeks out other servers can be specified. This feature is particularly useful when a NIS+ domain spans a WAN link, because administrators can reduce network traffic over the WAN link by specifying that clients first try to obtain the naming service from servers on the client's side of the link.
NIS Server	Solaris software now natively supports the NIS server. In previous Solaris releases, the NIS server was supported under emulation mode by the NIS+ server or via an unbundled product named NSkit.
CFS Boot	CFS Boot enables AutoClient™ systems to boot more quickly with less network traffic by booting from a local CacheFS disk cache. The first system boot populates the cache. System boots that follow are satisfied from the cache.
Patch Tools	Patch tools, including <code>patchadd</code> and <code>patchrm</code> commands to add and remove patches, are now part of the Solaris software rather than shipping with each individual patch as <code>installpatch</code> and <code>backoutpatch</code> commands.
Isalist Utilities	Isalist is a set of utilities that enables users to find out which instruction sets are supported on their machines and also to determine which one performs best for them.
Printing	
Printing	<p>The Solaris 2.6 print software offers a better solution than the LP print software in previous Solaris releases. System administrators can easily set up and manage print clients using the NIS or NIS+ name services. This means print administration can be centralized for a network of systems and printers. New features include:</p> <ul style="list-style-type: none"> - Redesign of print packages - Print protocol adapter - SunSoft™ Print Client - Network printer support
Hardware Support	
PCMCIA PC Card	PCMCIA delivers a PCMCIA supplement into a Solaris Device Driver Kit to enable OEMs and third parties to develop PC Card device drivers that will be source-compatible across all Solaris platforms.

TABLE 2-1 Solaris 2.6 Features at a Glance *(continued)*

Feature	Description
Nomadic Support	
filesync	filesync ensures that data is moved automatically between a portable computer and a server.

New Features in Previous Solaris Releases

This section describes features introduced in previous Solaris releases.

Solaris 2.5.1 Release

Table 2-2 describes new and enhanced features of the Solaris 2.5.1 release, the previous release.

TABLE 2-2 New Features in Solaris 2.5.1

Feature	Description
Security	
Large User IDs and Group ID	The limit on User ID and Group ID values has been raised to 2147483647, or the maximum value of a signed integer. The nobody user and group (60001) and the no access user and group (60002) retain the same UIDs and GIDs as previous Solaris 2.x releases.
System Administration	

TABLE 2-2 New Features in Solaris 2.5.1 (continued)

Feature	Description
System Administration for PowerPC™ Systems	Administering PowerPC systems differs in some ways from administering SPARC and x86 systems. Because the PowerPC system runs Open Firmware (OF) or Virtual Open Firmware (VOF), booting the system and adding a disk is different. The VOF has commands and configurable variables—similar to a SPARCsystem™ PROM monitor—that are used to either display or reset the way the system behaves before the operating system is loaded. Disk management is slightly different on a PowerPC system.
Graphics/Imaging	
KCMS Calibrator Tool	KCMS includes a loadable driver module for the X-Rite DTP92 Incident Colorimeter. The driver supports the X-Rite colorimeter, which connects to the serial port to obtain color measurement data. Includes new procedures for adding and removing color calibration modules to the system configuration file, <code>OWconfig</code> .

Solaris 2.5 Release

Table 2-3 describes new and enhanced features of the Solaris 2.5 release.

TABLE 2-3 New Features in Solaris 2.5

Features	Description
Standards	
XCU4 Conformance (for SPARC and Intel Systems)	Utilities conform to the XCU4 portion of the <i>X/Open Portability Guide, Issue 4</i> specification from X/Open.
POSIX.1c Conformance	Conforms to standards based on draft 10, which defines multithreading interfaces.
Networking	

TABLE 2-3 New Features in Solaris 2.5 *(continued)*

Features	Description
Network File System	Improves NFS version 2 and adds version 3. The following features were added: <ul style="list-style-type: none"> - Support Access Control Lists - NFS over TCP - Version 3 includes safe asynchronous writes on a server and has improved performance - NFS Lock Manager - Support for X/Open Federated Naming
Point-to-Point Protocol	PPP links computers and networks at separate locations using modems and telephone lines. New levels of security added.
telnet/telnetd	<ul style="list-style-type: none"> - Telnet client was upgraded to the 4.4 BSD version. - rlogind/telnetd, remote login capacity improved.
Name Service Cache Daemon	Improves responsiveness of name service requests.
Security	
NIS+ Security	Password aging enhances system security.
File Systems	
UFS Error Recovery	Improved error detection and soft failure modes.
UFS Filesystem Debugger	Changes to UFS improve operation of fsdb_ufs(1M).
UFS Access Control Lists	Provides a more precise way to manage file access permissions.
CacheFS Statistics	Improves NFS server performance and scalability by reducing server and network load.
Installation	
Service Setup for Clients	The installation program has changed and no longer sets up services for clients. To complete client and network setup, use the Solstice Host Manager.

TABLE 2-3 New Features in Solaris 2.5 (continued)

Features	Description
System Administration	
System Administration Tools	<ul style="list-style-type: none"> - Solstice AdminTools™ utility now used only for administering local systems. - Solstice AdminSuite™ product now used for managing systems in a network. (For SPARC and Intel systems)
/proc Tools	New process tools are available in /usr/proc/bin that display highly detailed information about the active processes stored in /proc, the process file system.
OpenWindows	
OpenWindows with Kodak Color Management System Calibrator Tool	The OpenWindows version 3.5 software includes the KCMS calibrator tool, which provides adjustments for accurate color representation to scanners, color monitors, and other output devices.
Graphics/Imaging	
PEX 3.0 Runtime Environment (for SPARC Systems)	The PEX application programmer interface (API) provides application portability across platforms and 3-D graphics on local and remote displays.
XGL 3.2 Runtime Environment	The XGL 2-D and 3-D immediate-mode API provides portability across hardware platforms and optimal performance from graphics acceleration. The XGL API includes support for raster text, environment and vertex-level texture mapping, four-component texture mapping, DGA transparent overlay, and triangle list Gcache.
XIL 1.2.1 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. Version 1.2.1 contains bug fixes and performance enhancements.
Hardware	
Enhanced Hardware Support	A wider range of new hardware configurations is supported.
St Driver	St driver supports tape drive models without waiting for new versions of the binary driver. Supports all tape positioning commands.

TABLE 2-3 New Features in Solaris 2.5 (continued)

Features	Description
Support for SPARCstorage Array (SPARC Systems)	Installation is improved.
Miscellaneous	
Sendmail	<ul style="list-style-type: none"> - Is now compatible with older sendmail files - Selects all hosts at a given priority through an MX randomizer - Support for ESMTP - Reduces duplicate mail if server fails
X/Open Federated Naming Service	FNS combines different naming systems that are regulated under a single interface.
Nologin	System administrators can warn users about impending down-time with /etc/nologin.
Font Support	<ul style="list-style-type: none"> - CID fonts provide improved performance for Display PostScript clients. - X11 clients can now access fonts rendered by the DPS extension through the XATM interface.
Compatibility	<ul style="list-style-type: none"> - More Solaris 1 binaries are now able to run on the Solaris 2.5 operating system. (For SPARC systems) - Some shell scripts from 4.x now work under 2.5.
Performance	
Time-sharing	Improved performance under time-sharing work loads.
KAIO	Improves the performance of asynchronous reads or writes for raw devices.

Solaris 2.4 Release

Table 2-4 describes new and enhanced features of the Solaris 2.4 release.

TABLE 2-4 New Features in Solaris 2.4

Features	Description
Installation	
Motif Installation GUI	A new GUI—used to install Solaris software.
OpenWindows	
Expanded Localization (OpenWindows 3.4)	Added to the operating system are four European languages and four Asian languages, as well as Latin American Spanish and U.S. English, for desktop and workgroup server product configurations.
Graphics	
Transparent Overlays	A graphics API that enables temporary graphical imagery in application windows.
XIL 1.2 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.
PEX 2.2 Runtime Environment	An 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 API that provides portability across hardware platforms and optimal performance from graphics acceleration.
Direct Xlib™ 3.1	A graphics application that uses the DGA Drawable Interface and supports systems with multiple frame buffers. Provides modified versions of the standard X11 libraries to accelerate Xlib rendering performance.
Hardware	
Enhanced Hardware Support	A wider range of new hardware configurations are supported.
Miscellaneous	
AccessX Enabling Technology	Provides people with disabilities with a variety of keyboard modifications.
OSF/Motif Runtime Environment	Used to run Motif applications.
Image Tool Enhancements	Functionality was enhanced so the user can read Kodak images from a PhotoCD disc using Image Tool.

Solaris 2.3 Release

Table 2-5 lists the features that were added in the Solaris 2.3 release.

TABLE 2-5 New Features in Solaris 2.3

Features	Description
Networking	
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.
NIS+	Three additional scripts to enable the user to more easily set up a NIS+ domain.
File Systems	
autofs	A new kernel virtual file system that supports automatic mounting of file systems.
Cache File System (CacheFS)	A nonvolatile caching mechanism to improve performance of certain file systems by using a small, fast, local disk.
System Administration	
Serial Port Manager	A tool that enables the user to quickly set up and modify serial port software for terminals and modems.
Graphics	
Direct Xlib 3.0	The first release of Direct Xlib to utilize MIT DDX (device-dependent X) loadable modules to perform X11 graphics rendering.
PEX Runtime Environment (RTE)	An implementation of the MIT PEX specification that is an extension of the X Window System to support 3-D graphics.
XGL Runtime Environment	A 2-D and 3-D immediate-mode API that provides portability across hardware platforms and optimal performance from graphics acceleration.

Solaris 2.2 Release

Table 2-6 lists the features that were added in the Solaris 2.2 release.

TABLE 2-6 New Features in Solaris 2.2

Features	Description
Installation	
User Installation Interfaces	User interfaces that make it easy to install and upgrade Solaris software.
System Administration	
Volume Management	Software that automatically mounts and unmounts CDs and diskettes.
OpenWindows	
Enhanced OpenWindows Environment	OpenWindows enhancements include Image Tool, an improved Properties Tool, integrated international capabilities, and many ease-of-use improvements.
Graphics	
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.
XGL Runtime Environment	A 2-D and 3-D immediate-mode API that provides portability across hardware platforms and optimal performance from graphics acceleration.
Miscellaneous	
Multithreaded Library Interface	An interface that provides developers with access to multithreaded applications.
AnswerBook Improvements	New AnswerBook administrator's utility, <code>ab_admin(1)</code> , a library-based user interface that enables easy access to AnswerBook sets located over networks.

What's New: A Closer Look

This chapter describes new features of the Solaris 2.6 release in detail. For a table listing features with brief descriptions, see Chapter 2.

The Solaris 2.6 operating environment includes advanced technologies for multithreading, symmetric multiprocessing, integrated TCP/IP-based networking, and centralized network administration tools. This Solaris release provides many new and exciting features that improve an already powerful, stable, operating environment.

Here are some of our new and exciting features:

- Solaris Web Start
- Java Virtual Machine
- HotJava browser
- Web technologies such as WebNFS
- Support for large files
- Network/Web server and database performance improvements
- AnswerBook2 online documentation system
- Conformance to X/Open UNIX 95 standards
- Network management and system administration such as NTP, SNMP, DMI, DHCP, and VLSM
- Power Management
- Year 2000 ready
- Expanded language coverage is provided

Java Features

The Solaris 2.6 operating environment lays the foundation for Java computing by bundling the Java Virtual Machine, the interpreter for the Java language, with the Solaris software. The HotJava browser is also conveniently bundled with Solaris. It is an easy-to-use Internet browser for exploring the World Wide Web and is recommended for viewing AnswerBook2 online documentation and installing by browser.

Java Virtual Machine

The Java Virtual Machine 1.1 provides access to the Java platform for the Solaris operating environment. It is compatible with the 1.1 Java Developer Kit™ from JavaSoft™. It includes the standard Java compiler (javac), the Java interpreter (java), the Java class file disassembler (javap), and the C-header and stub file generator (javah). The Solaris Java Virtual Machine also includes the just-in-time (JIT) compiler, improving performance.

The Java Virtual Machine uses Solaris native threads, which provides multiprocessor support for Java threads. Use of Solaris native threads also improves Java application scalability and integration with native methods.

Also included is the appletviewer, which enables you to run applets outside of the context of a World Wide Web browser.

javald(1), another enhancement used to manage Java applications, generates wrappers to execute Java programs. The wrapper ensures that a Java program executed with JAVA_HOME, CLASSPATH, and LD_LIBRARY_PATH environment variables set correctly for the program.

For more information, see *Network Interfaces Programmer's Guide*.

HotJava Browser

The HotJava browser provides an easy-to-use, customizable user interface for exploring the Internet. The HotJava browser provides:

- Java applet support

Applets are small programs that can be included on a web page, much like images can be included.

- Network security

The HotJava browser provides a secure environment for running applets. It supports signed applets, which enables you to fine-tune the desired level of security.

- Full HTML support

HTML is the language used to create web pages. The HotJava browser supports the latest HTML standard, which is currently HTML 3.2.

- HTML verification

Whenever you display a page with HTML errors, the HotJava HTML Errors button is activated. Click on this button for a list of the errors. This is useful if you are developing your own HTML page or if you are having trouble displaying a page.

- Multithreaded applications support

Because the HotJava browser is written in the Java multithreaded language several actions can take place simultaneously. For example, the browser can fetch multiple images at the same time, or it can clone HotJava pages, allowing you to have several HotJava windows open at one time.

- External viewer applications

There is a multitude of file types on the World Wide Web. When the HotJava browser encounters a file that it can't display in a web page, it starts up an appropriate external viewer application to display the file, based on its type. A graphical user interface is provided to enable you to specify your own content or application viewer.

- Fully configurable user interface

You can easily customize the HotJava browser to look and work the way you please. Much of this customization can be done without any programming.

- Extensible support for content and protocol handlers

The HotJava browser provides extensible support for new data types and protocols. A Java programmer can define new content and protocol handlers to use.

Intranet/Internet Servers

The Solaris operating environment is the intranet and Internet leader, and a powerful and reliable web platform. It is the premier operating environment

for building a robust web-based network infrastructure. As companies move toward using the Web both internally and externally, powerful Solaris features such as WebNFS that provide speedy access to web files become crucial.

WebNFS Software

WebNFS software enables file systems to be accessible through the Web using the NFS protocol. This protocol is very reliable and provides greater throughput under a heavy load. Also, files can be made publicly accessible without the overhead associated with an anonymous `ftp` site.

Additional information may be found in *NFS Administration Guide*.

Performance Improvements

Solaris 2.6 performance enhancements focused on improving database and web performance while maintaining the already high levels of file server and time-share performance seen in the Solaris 2.5.1 release.

Database Performance

Significant efforts were made to improve performance of the system for database engines. Work focused on two areas: virtual memory (VM) improvements and I/O throughput improvements.

VM changes focused on reducing overhead by using larger pages for the shared memory area used by database engines to share and store data. Instead of using the default system page size for pages in this area, a large page size of 4 Mbytes is used. This reduces the amount of internal work the system has to do when managing the descriptions attached to each process for pages the process is using. When coupled with existing mechanisms for sharing these descriptions, a performance increase of about 12% was achieved on various industry standard tests.

I/O throughput jumped as the result of low-level changes that minimized the overhead associated with processing large lists of pages for I/O. These modifications reduced the overhead associated with converting the virtual address used by the system to the physical address needed by the device drivers to execute I/O requests. With these improvements, the cost of doing I/O to physical devices dropped dramatically.

Throughput improvements have been demonstrated in a recent Informix TPC-C benchmark which

- produced 15,461 tpmC at \$134/tpmC
- with 13,000 users
- on an SMCC E4000 with 14 * 250 Mhz cpus and 5 Gbytes of memory.

This produced the highest Informix TPC-C number ever produced and reflects the best price/performance in the mid-range class.

TPC-C is a benchmark conducted under the auspices of the Transaction Performance Processing Council (TPC). It simulates a warehouse distribution system. Data is contained in nine tables and five transactions are executed against this data in prespecified mixes. The figure of merit is tpmC, which is shorthand for transactions per minute" in the TPC-C benchmark.

UFS Direct I/O

Many customers are interested in placing data directly on disk without buffering it in memory. The Solaris 2.6 release provides direct I/O to do this. Bulk I/O operations use large buffer sizes to transfer large files (files larger than physical memory). An example of a bulk I/O operation is downloading large amounts of satellite data to a file.

Direct I/O data is read or written into a process's address space without incurring the overhead of the operating system's page caching mechanism.

See the `directio(3C)` man page for more information.

Raw I/O

Improvements were made to low-level I/O support routines that dramatically improved throughput for I/O to disk devices without a file system (raw devices). (Raw devices are often used for database files.) The driver for the SPARCstorage Array was rewritten to improve its throughput.

Network/Web Server Performance

Previous efforts in improving network throughput had focused on improving throughput for long-lived connections. These efforts resulted in the highest NFS server performance numbers in the industry. The web server area represents an entirely different paradigm since it emphasizes short-lived

connections with little bandwidth demand during the connection. Some of the work for the Solaris 2.6 release to greatly improve that aspect of performance was packaged and released as the Solaris Internet Server Supplement (SISS) for the Solaris 2.5.1 release.

Web server performance improvements were achieved in several places, ranging from the socket interface layer, the TCP/IP protocol stack, and the STREAMS framework. The socket interface layer was redesigned as a file system (`sockfs`), thereby removing the need to duplicate socket code in the socket library as well as the STREAMS socket module. This significantly improved the performance for the short-lived connections that are common on the Web. The TCP/IP changes consist both of improvements to efficiently handle large numbers of connections as well as further improvements to the multithreading of the opening and closing of connections and sockets. Finally, the STREAMS framework has been restructured to allow more efficient opening and closing of TCP/IP sockets.

The Standard Performance Evaluation Corporation (SPEC) has released SPECweb96, a standardized benchmark for comparing web server performance. The benchmark is designed to provide comparable measures of how well systems can handle HTTP GET requests. SPEC based the work load on analysis of server logs from Web sites ranging from a small personal server up through some of the Internet's most-popular servers. Built upon the framework of the SPEC SFS benchmark, SPECweb96 can coordinate the driving of HTTP protocol requests from single- or multiple-client systems. For the latest Solaris 2.6 SPECweb96 submissions and more information on SPECweb96 benchmarks, please visit the SPEC web site:
<http://www.specbench.org>.

Kernel Sockets

The kernel sockets implementation provides improved compatibility with SunOS™ 4.x and BSD sockets, enabling higher socket performance.

TCP Large Windows

TCP large windows provides the support described in RFC1323. It is designed to improve performance over high bandwidth networks such as ATM, or high-delay networks such as satellite links, by expanding the amount of data that can be outstanding in a TCP session from 65535 bytes to approximately 1 Gbyte.

Zero Copy TCP/Hardware Checksum

Zero copy TCP/hardware checksum functionality can be used to increase TCP throughput in certain situations. It does so by avoiding the copying of data and by using hardware checksum logic in the network interface when available. Currently, the only network interface that contains the hardware checksum logic is the SunATM 622 interface.

For more information, see *Transport Interfaces Programming Guide*.

Ease-of-Use and Management Improvements

The Solaris operating environment is large and complex; its structure gives customers the flexibility to meet their needs. New features enable customers to easily install and manage the Solaris environment are

- Solaris Web Start, a web-browser installation tool
- An installation card to step customers through the installation
- A device Configuration Assistant for x86 machines
- A new, easy-to-use desktop

Installation

This section describes new features in the Solaris 2.6 software that affect installation.

Solaris Web Start Browser-based Installation

The Solaris software is the industry's first operating system that can be installed via a web browser. Solaris Web Start is a browser-based utility that guides users through the selection and installation of both Solaris and copackaged application software. Its graphical user interface also facilitates file system configuration.

The utility's built-in suite of online information answers questions about the product itself, the software it installs, and the hardware platforms it

supports. Use of the utility is optional: users can exit at any point and proceed with one of the more traditional Solaris installation methods.

For more information, see the module *Using Solaris Web Start in Information Library for Solaris 2.6 (Intel Platform Edition)* or *Information Library for Solaris 2.6 (SPARC Platform Edition)*.

New Installation Documentation

A documentation reorganization makes finding information on how to install Solaris software easier. The desktop product contains a small, step-by-step guide that describes installing the Solaris software from a local CD-ROM. The server product contains an advanced guide for setting up servers and clients, and a description of how to automate installations using custom JumpStart™ software.

Configuration Assistant and Booting Software for x86 Platforms

The Configuration Assistant interface is part of the new booting system for the Solaris (Intel Platform Edition) software. It determines which hardware devices are in the machine, accounts for the resources each device uses, and enables you to choose which device to boot from. The booting software, including the Configuration Assistant, is installed on the system's hard disk along with the Solaris operating environment. A file that contains the hardware configuration information for the system being installed is also installed on the hard disk. Each time the system is booted, the configuration information is passed to the Solaris kernel. The Configuration Assistant must be re-run any time the hardware configuration is changed.

For information on how to use the Configuration Assistant to help solve device configuration problems, see the modules (xref)*Configuring Devices* and the *Troubleshooting in Information Library for Solaris 2.6 (Intel Platform Edition)*.

Changed Solaris CD Layout

The Solaris CD layout has been changed in the Solaris 2.6 release. Slice 0 has been reorganized to make it more intuitive and extensible. It contains only control files and the `Solaris_2.6` directory at the top level. The control files at the top level on slice 0 are the same control files found on previous Solaris CDs. The control files are `.cdtoc`, `.slicemapfile`, and `.install_config`.

For more information, see *Solaris Advanced Installation Guide*.

Upgrade With Disk Space Reallocation

The upgrade option for the Solaris 2.6 release provides an auto-layout feature to reallocate disk space if the current file systems don't have enough space for the upgrade. This new feature is provided in the interactive Solaris installation program and by a new set of custom JumpStart profile keywords.

For more information, see *Solaris Advanced Installation Guide*.

Testing Upgrade Profiles

In previous Solaris releases, the system administrator could only test profiles that used the initial option. The Solaris 2.6 release now enables the `pfinstall` command to test profiles that use the upgrade option, so an administrator can see if a profile will do what is wanted before using it to upgrade a system. This is especially useful with the new disk-space reallocation feature.

To test an upgrade profile, you must run the `pfinstall -D` command on the system that you're going to upgrade (against the system's disk configuration). You cannot test an upgrade profile using a disk configuration file.

For more information, see *Solaris Advanced Installation Guide*.

Changing a System's Boot Device

The Solaris 2.6 release now enables you to change a system's boot device during the installation. A system's boot device is the disk slice where the root file system is installed and, consequently, where the installed system will boot from.

Also, the installation program can now update the system's EEPROM if you change the new boot device, so the system can automatically boot from it (SPARC systems only). In previous releases, changing the system's boot device during an installation meant that you had to manually change the system's EEPROM so it could automatically boot from the new boot device.

This new feature is provided in the interactive Solaris installation program and by the new custom JumpStart `boot_device` profile keyword.

For more information, see *Solaris Advanced Installation Guide*.

Preconfiguring System Configuration Information

In previous releases, the first part of the Solaris installation program tried to obtain system configuration information about a system (such as the system's peripheral devices, host name, IP address, name service) from the name service databases. The installation program prompted you if it couldn't find the information. If you didn't want to be prompted, you had to preconfigure the system configuration information in the name service.

Using the Solaris 2.6 `sysidcfg` file, you can now preconfigure system configuration information through a set of keywords. You can choose to provide one or more of the keywords to preconfigure varying levels of system configuration information.

The `sysidcfg` file can reside on a remote system or on a UFS or PCFS diskette in the system's local diskette drive. If you choose to put the `sysidcfg` file on a remote system, you have to use the `-p` option of the `add_install_client` command to specify where the system being installed can find the `sysidcfg` file.

When installing the base (English) Solaris 2.6 CD, you'll be prompted to select an English locale, because a new, 8-bit English local (`en_US`) has been added to Solaris 2.6. If you don't want to be prompted for the locale, you must preconfigure the locale information. For more information about the new `en_US` locale, see the "New Locales in the Base Installation."

For more information, see *Solaris Advanced Installation Guide*.

x86 Configuring Peripherals

The `kdmconfig` program is used to configure the mouse, graphics adapter, and monitor on an x86 system. If an `OWconfig` file already exists, `kdmconfig` will extract any usable information from it. In addition, this updated version of `kdmconfig` will also retrieve information left in the `devinfo` tree by the `devconf` program, and use that information to automatically identify devices. Any attribute values, such as manufacturer or model information, returned by probes for a given device (unless it is "Unknown") take precedence over the value received for the same attribute from the `OWconfig` file.

If all attribute values in the Confirm Configuration screen are obtained (none are "Unknown"), the default choice is Save and Exit Configuration. If information is needed, the program selects the first Unknown device as the default configuration selection. You can override the default selection by either selecting another device you want to configure or by selecting Save and Exit Configuration instead. When you exit, `kdmconfig` checks for Unknown devices and warns you about potential problems with the X Window System if values are missing. After reading the warnings, you can either continue with the configuration or exit the program and configure the devices later.

The changes regarding the sequence of screens for configuring individual devices are

- You can now choose one of the ports (COM1 to COM4, /dev/tty00 to /dev/tty03, respectively) when configuring a serial mouse.
- When configuring a Graphics Card/Monitor, users are now always presented with the choice of monitors following the selection of the graphics card, and the choices on other screens that follow (such as resolution and the like) depend on both card and monitor selections.

The program is similar to the previous version with regard to the character user interface and the function keys used to navigate within the program.

For addition information regarding the `kdmconfig` program, see the `kdmconfig(1M)` man page.

Optional 8-Bit Locales

The installation window in the English Solaris 2.6 CD offers several English language locales. To use 8-bit characters, install through one of the `en_XX` options. The locale used in the installation becomes the default system locale.

Note - The C locale was installed by default in the base English releases prior to this release.

TABLE 3-1 New Locales Offered in Installation

Locale Name	Language/Territory	Code Set
c	American English	7-bit
en_AU	Australian English	8-bit
en_CA	Canadian English	8-bit
en_UK	UK English	8-bit
en_US	American English	8-bit

For more detailed information on locale installation, see *Solaris 2.6 SPARC Platform Edition) Release Notes* or *Solaris 2.6 (Intel Platform Edition) Release Notes*.

Documentation

The AnswerBook2 documentation system uses a web browser-based interface that enables you to view and print a variety of Solaris information, including existing AnswerBook documents and man pages. The AnswerBook2 software provides a robust search engine that enables you to easily find information throughout the documentation library. You can install the AnswerBook2 document collections locally or on a centralized documentation server, and you can customize the AnswerBook2 documentation library.

For more information about the AnswerBook2 system, see the module *Accessing Online Documentation in Information Library for Solaris 2.6 (SPARC Platform Edition)* or *Information Library for Solaris 2.6 (Intel Platform Edition)*.

Desktop

The Solaris 2.6 release has the Common Desktop Environment (CDE) as the default desktop. It continues to support the OpenWindows desktop.

Common Desktop Environment

The Solaris Common Desktop Environment (CDE) is an advanced Motif-based desktop with an easy-to-use interface that provides a consistent look and feel across UNIX platforms. SunSoft, Hewlett-Packard Company, IBM Corporation, and Novell, Inc. each contributed technologies to establish a new cross-platform standard for user and application interfaces based on the X Window System and Motif.

While maintaining compliance with the CDE standards, Solaris CDE offers additional benefits to its users and developers, including performance improvements and significant defect fixes, thus providing a higher quality product. Existing OpenWindows utilities were integrated with CDE via a special folder in Application Manager. New features include a spell checker and an image viewer to display, rotate, scale, and convert graphic images and PostScript files.

With Solaris CDE you can run OpenWindows applications without modification, with drag-and-drop interaction from OpenWindows applications to CDE applications. All OpenWindows and OPEN LOOK applications run without any need for modification, recompilation, or unwieldy compatibility libraries. If you are used to the OpenWindows environment, you have access to the familiar backdrops, color palettes, and pop-up Workspace menu.

CDE User Environment

The CDE user environment includes the following features:

- Login Manager for logging into the desktop, which is available automatically as your workstation is booted. Choose from the Remote Login menu item Options menu to be able to run your desktop on any system on your network.
- An Integrated Motif environment that contains a Front Panel from which you can launch desktop applications. You can customize your desktop look by choosing such things as font size, color, and backdrop.
- The Workspace menu, which is a pop-up menu that contains items for managing the desktop workspace.
- An online Help information system that provides information on the various desktop applications.

CDE Development Environment

The CDE 1.2 Development Environment is included in optional packages for users who develop software in CDE. These packages contain:

- Utility applications, man pages, libraries, and header files to help you develop CDE applications
- Widgets to ease porting OPEN LOOK™ and Microsoft Windows applications to CDE, as well as terminal emulator, text editor, and file selection box widgets
- Application Builder, a tool for creating graphical user interfaces that use CDE application program interfaces (APIs)
- Desktop KornShell (dtksh), a scripting language
- Demonstration programs in source form for Motif, ToolTalk™ messaging, and other CDE services

Significant CDE Application Features

- Web- and Internet-aware features in File Manager and Enterprise Mailer
- Spell checker integrated into Text Editor and Enterprise Mailer
- Basic IMAP4 support in Enterprise Mailer
- Removable media support for CD-ROMs and diskettes
- Access Control List (ACL) support
- Multimedia image and audio support
- Auto lock screen
- Federated Naming Space (FNS) support in Calendar (for NIS+ only)

Power Management for SPARC Desktop Systems

Power Management software enables users to be more frugal with power consumption on desktop systems when they are not being used. By default, UltraSPARC desktop systems power off when not used for 30 minutes. The system can later be restored by Power Management software to the state it was in before it was powered off. Users can modify or turn off Power Management if needed.

For more information, see *Using Power Management*.

OpenWindows 3.6 Environment

The OpenWindows 3.6 desktop and libraries have been updated with bug fixes and prepared for the year 2000. The OpenWindows 3.6 environment provides the following features:

- The OPEN LOOK Window Manager, `olwm`, a client to the X server, which manages:
 - Window placement
 - Workspace Programs menu
 - Window and icon opening and closing
 - Application starting and exiting

For more information, see the `olwm(1)` man page.

- 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 2.6 release, you can install localization packages that provide support for European or Asian locales
- The X server, the platform of the OpenWindows environment for window applications

The X server is a program that is the foundation for the OpenWindows environment. It is the X11R6 sample server with a Display PostScript (DPS) imaging system extension. The X server also includes several X extensions, a font server 0 and DPS font enhancements:

- Default key bindings for Motif on Sun
- An executable, `xmbind`, that enables you to change your keybindings without restarting `olwm`

For more information, see the `Xsun(1)`, `Xserver(1)`, and `X11(7)` man pages.

New User Locales in the Solaris 2.6 CD

All localized versions of Solaris, including English, includes the new local support listed in Table 3-2.

TABLE 3-2 New User Locales Included in Solaris 2.6

Country	Locale-Name	ISO Code Set
Austria	de_AT (German Partial Locale)	8859-1
Estonia	et	8859-1
Czech	cz	8859-2
Hungary	hu	8859-2
Poland	pl	8859-2
Latvia	lv	8859-4
Lithuania	lt	8859-4

TABLE 3-2 New User Locales Included in Solaris 2.6 (continued)

Country	Locale-Name	ISO Code Set
Russia	ru	8859-5
Greece	el	8859-7
Turkey	tr	8859-9

These locales are supported through the SUNWploc1, SUNWplow1, and SUNWpldte packages, which are part of the Entire cluster.

Two locales, Greek and Russian, are based on non-Latin scripts and require an optional SMCC keyboard for text input.

Unicode 2.0 Support

Two locals, which are Unicode 2.0 and ISO 10646 compliant, have been added. These locales enable multiscrypt input and output and are the first locales provided in the Solaris environment with this capability. These locales support the CDE environment only, including the Motif and CDE libraries.

Font Administration

Font Admin enables easy installation and usage of fonts for the X Window System. It supports TrueType, Type0, Type1, and CID fonts for multibyte languages, and provides comparative font preview capability. It is fully integrated into the CDE desktop.

TrueType fonts are supported through X and DPS. Font Admin allows for easy installation and integration of third party fonts into the Solaris environment.

For more information, see the X/Open web site at <http://www.xopen.org>.

Asian Language Enhancements

Solaris 2.6 software has been re-architected to the historical dependency on the Extended UNIX Codeset (EUC). Additional codeset support and locales for popular Asian PC encoding standards, ShiftJIS (PCK) in Japan, Big5 in

PRC, and Johap in Korea are also provided. These locales support the CDE environment only, including the Motif and CDE libraries.

Solaris User Registration

Solaris User Registration is a registration mechanism invoked when the user first brings up the Solaris 2.6 desktop environment. By registering, customers can take advantage of Sun's commitment to providing superior service and support. Registered users will be regularly informed about new Solaris releases, upgrade offers, and promotions that they can use to enhance their systems.

Standards

Many customers rely on the Solaris operating environment as the foundation for mission critical applications. New standards in the Solaris operating environment show Sun's continuing involvement in providing a stable operating environment. Continuous improvements in support for standards are shown in these new features.

Year 2000 Ready

Sun's Solaris 2.6 operating environment is year 2000 ready. The Solaris 2.6 release uses unambiguous dates and follows the X/Open guidelines where appropriate. For further information, including the definition of year-2000 compliance, see the Year 2000 web page at <http://www.sun.com/y2000>.

X/Open UNIX 95 (Spec 1170)

The previous release of Solaris was compliant with much of Spec 1170. Solaris 2.6 software now meets all the requirements.

Areas changed in the Solaris 2.6 release to meet the Spec 1170 requirements:

- System interfaces and headers

System headers were updated to bring them up to compliance with Spec 1170.

- X/Open curses

A new library has been added to support the interfaces defined by this specification. Significant support for internationalized curses capabilities, pads, terminfo database access, and color manipulation has been added.

- Networking services

- New X/Open standardized socket and IP address resolution interfaces are available.
- The X/Open Transport Interface (XTI) is an evolution and standardization of the set of interfaces that were supported by the Transport Layer Interface (TLI) in SVR4. TLI continues to be available for compatibility, but new development should use XTI.

For more information, see *Transport Interfaces Programming Guide*.

X/Open XFN 2.0

Federated Naming Service (FNS) is now compliant with the X/Open XFN 2.0 definition.

POSIX 1003.1b

POSIX 1003.1b support is completed. The Solaris software has provided all of the interfaces for POSIX 1003.1b since the Solaris 2.3 release. A subset of those interfaces was functional in that they provided services instead of returning "Not Supported." This release finishes support for POSIX 1003.1b (with the exception of the `-PRIORITIZED IO` option).

This standards feature is of interest to developers interested in writing portable, standards-compliant code. It is also of interest to developers interested in higher performance message passing or semaphore code who otherwise would use System V messages or semaphores and who can accept the more limited functionality offered by POSIX.

As of the Solaris 2.6 release, POSIX 1003.1b support is provided for the following:

- Asynchronous I/O (except prioritized I/O)
- Mapped files
- Memory locking
- Memory protection

- Message passing
- Priority scheduling
- Realtime signals
- Semaphores
- File synchronization
- Shared memory objects
- Synchronized I/O
- Timers

Support for many of these features has been available in the Solaris operating environment for several releases in a non-standards-conformant way.

ISO 10646

The ISO 10646 standard defines Unicode 2.0, including UCS-2 and UTF-8 (the standard UNIX implementation). All implementations specified in this standard are Unicode 2.0 compliant.

Robust Software Developer Environment

The Solaris operating environment provides developers with the documentation, development software libraries, productivity tools, sample code, and testing tools needed to develop software applications for the Solaris runtime environments. This section describes new features to help developers dealing with large files (over 2 Gbytes), multithreaded applications, and X servers and libraries.

Large Files

The large files project supports files that are larger than or equal to 2 Gbytes. Large-file semantics are supported on UFS, NFS, and CacheFS file systems. Applications will be able to create and access files up to

- One Tbyte on UFS-mounted file systems

- The limit of the NFS server for NFS- and CacheFS-mounted file systems

Existing file I/O interfaces have been modified to detect the error when they are used with a large file. New data types (most with suffixes of 64 or 64_t) and new interfaces (most with suffixes of 64) are provided to operate on large files.

An existing application running on Solaris 2.x software should be checked for the following points:

- To make the application large-file compatible (for example, "large-file safe in Solaris 2.6"), examine the application's source code to ensure that use of existing interfaces is appropriate and has the correct error-handling characteristics when a large file is encountered.
- For your application to work with large files (for example, "large-file aware"), you must examine and modify your source code. Examples for areas to modify include:
 - Output and in-memory formatting strings such as %ld to %ll
 - Any variable for temporary storage of sizes or offset information must be correctly sized to avoid truncation
 - Function parameters and return values should be checked and corrected if necessary.

For more information, see *NFS Administration Guide* and *System Administration Guide*.

Versioning and Scoped Libraries

Versioning and scoping are related enhancements to the link editor in the Solaris operating environment. Developers of dynamic objects can use these technologies to define sequential versions of a dynamic object's binary interface within the object and reduce global symbols to local scope. These capabilities provide the means to control interface evolution across software releases, inherit global symbols from previous versions, record version dependencies, and describe internal implementation changes.

Versioning and scoping enable developers to provide stable interfaces for program development, achieve standards compliance, and protect implementation changes (such as bug fixes) from the object's public interface. An added benefit can be reduced object size and runtime relocation cost, which can improve an application's runtime performance.

For the Solaris 2.6 operating environment, the system libraries take advantage of this technology and have been both scoped and versioned.

For more information, see *Linker and Libraries Guide*.

Scheduler Activation

Scheduler activations provide additional kernel scheduling support for multithreaded applications. This is implemented as a private interface between the kernel and the libthread library (or libpthread), without changing the libthread (libpthread) interface. Among other things, this enables the thread library to implement adaptive mutex locks. Adaptive mutex locks is where a thread trying to acquire a lock spins if the thread holding the lock is currently running on a processor, and blocks otherwise.

See the `libsched(3X)` man page for more information.

Pre-emption Control

Pre-emption control allows applications to give scheduling hints to the kernel to prevent preemption for short periods of time. This can improve the performance of some classes of applications such as database servers.

/proc File System and Watchpoints

The previous flat /proc file system has been restructured into a directory hierarchy that contains additional subdirectories for state information and control functions. It also provides a watchpoint facility to monitor access to, and modification of, data in the process address space. The new /proc file structure provides complete binary compatibility with the old /proc interface.

The `adb(1)` command has been modified to use the new /proc watchpoint facility. It now provides data breakpoints to cause the subject processes to stop on access to specified variables.

For more information, see the `adb(1)` man page.

Federated Naming Service (FNS)

FNS is now compliant with the X/Open XFN 2.0 definition. FNS has also been enhanced to include support for Lightweight Directory Access Protocol (LDAP). It also provides improved support for the files and NIS back ends.

For more information, see *Federated Naming Service Programming Guide*, *Solaris Naming Administration Guide*, and *Solaris Naming Setup and Configuration Guide*.

Asynchronous I/O for Tape Drives

Asynchronous I/O support for tapes provides an interface to improve performance on the high performance tape devices. With the ability to queue up to requests, this feature significantly improves the I/O throughput.

Solaris Developer Kit (SDK)

The SDK software is now built into the Solaris environment and is no longer an unbundled product. All the information a developer needs to produce applications and graphics handlers for end-user Solaris runtime environments is now available in the Solaris software.

Graphics

The Solaris VISUAL™ software includes several graphics and multimedia software foundation libraries. Foundation libraries are the lowest-level device-independent layer of the Solaris software. This level of interface is designed to support a wide variety of common functions. You can build higher-level libraries on top of the foundation libraries, or the foundation libraries can be used directly by a software application. These foundation libraries create applications that incorporate 2-D and 3-D graphics, imaging, and digital video. The libraries are the XGL graphics library (which serves as a foundation library for the Solaris PEX software) and XIL imaging library.

PEX 3.0.2 Runtime Environment

The Solaris PEX 3.0.2 RTE consists of a PEX client-side runtime library (PEXlib) and a PEX server-extension shared-object file (Solaris PEX server). PEXlib is an API to PEX protocol as Xlib is to core X protocol. PEXlib provides application portability across hardware platforms and enables 3-D graphics rendering on local and remote displays. The OpenWindows Version 3.6 X11 server automatically loads the PEX shared-object extension when it receives a PEX request from a PEX client.

The PEXlib implementation for the Solaris 2.6 release is based on *PEXlib - Specification and C Language Binding: Version 5.1*, available from the

Massachusetts Institution of Technology. The PEX server extension is based on *PEX Protocol Specification, Version 5.1*.

Solaris PEX 3.0.2 RTE is included in the Solaris 2.6 release and should be installed if you are planning to

- Run PEXlib-based graphics client applications
- Display any 3-D 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 the Solaris 2.6 software.

For more information on PEX, see:

- *Solaris PEX Implementation Specification*
- *Solaris PEXlib Reference Manual*
- *CGE PEX 5.1 Portability Guide*

Also, the following books are available at bookstores:

- *PEXlib Programming Manual*, O'Reilly and Associates, Inc.
- *PEXlib Reference Manual*, O'Reilly and Associates, Inc.

XGL 3.3 Runtime Environment

The XGL library is a 2-D and 3-D immediate-mode API that provides application portability across hardware platforms and enables graphics applications to get optimal performance from graphics accelerators. The XGL version 3.3 library enables applications to determine transparency support level and includes a new attribute to enable user control over edge offset.

The XGL 3.3 runtime environment (RTE) is included with the Solaris 2.6 release and should be installed if users at your site are running graphics applications. It is not always obvious whether an application requires the XGL RTE; therefore, you should install the XGL RTE if you are installing CDE or OpenWindows software, since an application may reference the XGL libraries.

For more information on XGL, see *XGL Programmer's Guide* or *XGL Reference Manual*.

XIL 1.3 Runtime Environment

The XIL library is an imaging API that provides a basic set of functions for imaging and video applications. The library provides a strategy for low-level

software interfaces (foundation libraries) and enables APIs and API developers to port their code to these foundation libraries.

The XIL 1.3 runtime environment (RTE) is included with the Solaris 2.6 release and should be installed if users at your site are running imaging applications. It is not always obvious whether an application requires the XIL RTE; therefore, you should install the XIL RTE if you are installing either OpenWindows or CDE software, since an application may reference the XIL libraries.

Backward Compatibility

The XIL 1.3 library API is fully backwards compatible. This means that existing applications can be run without modification or recompilation.

MT-Hot

The XIL 1.3 library is MT-hot. Developers can write multithreaded applications without putting locks around XIL functions. Multiple threads from the API will execute correctly as long as they do not require data from the same image. The library itself also is MT-hot. It takes advantage of multiprocessor systems without applications having to be rewritten.

Tiled Storage

The XIL 1.3 library stores very large images in buffers of memory called tiles. If a region of an image within a tile boundary is needed, only that tile is loaded into memory, thereby increasing performance.

The library also includes a new storage object, which supports conventional contiguous storage as well as tiled or stripped storage for XIL images. The storage object serves as a container for the image's attributes, such as its scanline and pixel stride, and its data pointer. Storage is not allocated for the image until you export the image and modify it directly. This saves on memory use.

New Data Type

The XIL 1.3 library now supports the 32-bit single-precision, IEEE floating-point data type. Using this data type enables you to develop highly sophisticated scientific imaging applications.

Temporary Images

The XIL 1.3 library supports temporary images, which are images used as an intermediate step in creating a subsequent image. They may only be written to, and read from, once. Temporary images are particularly advantageous for large images, because XIL can release the storage associated with them when it's no longer needed.

XIL_GENERAL Storage Format

The XIL 1.3 library supports the new XIL_GENERAL storage format. This format provides the flexibility of specifying each band of a multiband image as a separate memory buffer. Furthermore, each band can have its own scanline and pixel stride.

XIL_BAND_SEQUENTIAL Storage Format

The XIL 1.3 library now supports the XIL_BAND_SEQUENTIAL format for all data types, not just XIL_BIT images.

KCMS Integration

The XIL 1.3 library includes Kodak Color Management System (KCMS) support. You can achieve very close color matching between a display image and the actual stored image.

KCMS Multithreaded Programming

The Kodak Color Management System (KCMS) software product is a color management solution that ensures color consistency from input devices to output devices. It is technology licensed from Eastman Kodak that was developed in conjunction with SunSoft.

KCMS now supports multithreaded programs: it is multithread safe (MT-safe). If your KCMS application uses multithread capabilities, you do not need to put locks around KCMS library calls.

For more information, see *KCMS Application Developer's Guide*.

X11R6 Base Window System

The X11R6 Base Windowing System includes the latest fixes and patches from the X Consortium.

For more information, see the X/Open web site at <http://www.xopen.org>.

X11 Double Buffer Extension

The Double Buffer Extension (DBE) provides a standard way to use double-buffering within the framework of the X Window System. Double-buffering uses two buffers, called "front" and "back," that hold images. The front buffer is visible to the user; the back buffer is not. A detailed specification is available via an internet browser in <ftp://ftp.x.org/pub/DOCS/DBE/>.

For more information, see the X/Open web site at <http://www.xopen.org>.

Large Files Support

The Solaris operating environment now supports files larger than approximately 2 Gbytes. New interfaces are provided to operate on large files for developers who want to do asynchronous I/O to large files.

Large Files

The large files project supports files that are larger than or equal to 2 Gbytes. Large file semantics are supported on UFS, NFS, and CacheFS file systems. Applications are able to create and access files up to

- One Tbyte on UFS mounted file systems
- The limit of the NFS server for NFS and CacheFS mounted file systems.

Existing file I/O interfaces have been modified to detect an error when they are used with a large file. New data types (most with suffixes of 64 or 64_t) and new interfaces (most with suffixes of 64) are provided to operate on large files.

New mount Option

A new mount option is available to disable the large-file support on UFS file systems. This gives the system administrator a way to ensure that older

applications that are not able to safely handle large files will continue to work.

The default mount option is `largefiles`. The `largefiles` option means that a file system mounted with this option allows creation of files larger than or equal to 2 Gbytes.

A file system mounted with this option does not have to contain files larger than 2 Gbytes.

Once a file system has been mounted with the `largefiles` option, if a large file has been created in that file system, it cannot be remounted with the `nolargefiles` option until the `fsck` command is run to confirm the absence of large files.

Large Files and Applications

An existing application running on Solaris 2.x software should be checked for the following points:

- To make the application large-file compatible (for example, “large-file safe in Solaris 2.6”), examine the application’s source code to ensure that use of existing interfaces is appropriate and ensure the correct error-handling characteristics when a large file is encountered.
- For your application to work with large files (for example, “large-file aware”), you must examine and modify your source code. Examples of areas to modify include:
 - Output and in-memory formatting strings such as `%ld` to `%lld`
 - Any variable used for temporary storage of sizes or offset information must be correctly sized to avoid truncation.
 - Function parameters and return values should be checked and corrected if necessary.

For more information, see *NFS Administration Guide* and *System Administration Guide*.

64-Bit AIO

The Solaris operating environment provides a new set of interfaces for developers who want to do asynchronous I/O to large files. The following interfaces accept 64-bit AIO:

- aio_read64
- aio_write64
- lio_listio64
- aio_suspend64
- aio_error64
- aio_return64

The following interfaces exist, but are not supported:

- aio_fsync64
- aio_cancel64

These interfaces also work with KAIO. KAIO is the optimized path for doing I/O to raw files. When using the interfaces with KAIO to raw files, there is a significant performance improvement.

The Solaris operating environment supports another set of AIO interfaces that pre-dates POSIX. These interfaces have also been updated for large file support:

- aioread64
- aiowrite64

Network Security

The Solaris operating environment provides a sophisticated security system that controls the way users access files, protect system databases, and use system resources. Solaris security is network-wide security, providing security over several different systems, not just one. The Solaris security system is designed to accommodate different security models, giving users the flexibility to choose the model that best fits their needs now and in the future. There are a number of new features that add to the Solaris security system in the areas of access control, encryption, and authentication.

NFS Kerberos

Kerberos authentication uses DES encryption to improve security over the network. The kernel implementations of NFS and RPC network services have been modified to add support for a new RPC authentication flavor that is based on the Generalized Security Services API (GSS-API). This support contains the hooks to add stronger security to the NFS environment.

The `share` and `mount` commands have been altered to provide NFS support for Kerberos. Also, the `share` command now allows for multiple authentication flavors from different clients.

For more information, refer to *NFS Administration Guide*.

RPCSEC_GSS

The user-level RPC implementation has been modified to add support for a new authentication flavor. This flavor is based on the GSS-API and provides the hooks to add stronger authentication, privacy, and integrity for RPC-based services.

Pluggable Authentication Modules (PAM) Framework

The PAM framework enables you to “plug in” new authentication technologies without changing the `login`, `ftp`, or `telnet` commands. You can also use PAM to integrate UNIX login with other security mechanisms like DCE or Kerberos.

Mechanisms for account, session, and password management can also be plugged in using this framework.

Some of the benefits PAM provides are

- Flexible configuration policy
- Ease of use for the end user
- The ability to pass optional parameters to the user authentication services

For more information, see *System Administration Guide*.

Bind 4.9.4-P1

The Solaris operating environment now supports and includes Domain Name System (DNS) Berkeley Internet Name Daemon (BIND) version 4.9.4 patch level 1. BIND is the most popular implementation of DNS. BIND is critical for Internet connectivity because it provides an Internet naming service that stores host (IP) addresses, mail information, and similar data for lookup purposes. BIND always includes a number of programs and the

resolver library. The main program is named, the daemon that provides DNS information. Applications such as `telnet` communicate with `named` via the resolver library.

BIND 4.9.4-P1 provides new security over the Internet. The older version of BIND did little to prevent DNS spoofing. Intruders could cause BIND to provide incorrect name data. Services that use this (some of which do not verify data) could be tricked into allowing remote access to unauthorized users. The 4.9.4 version fixes many holes in security.

For more information, see *Solaris Naming Administration Guide*.

Network Management and System Administration

The Solaris operating environment provides a stable and reliable networking environment. New network management and system administration features in this release expand tools for managing this environment.

Network Time Protocol (NTP)

This Solaris release supports NTP, which provides both precise time and/or network clock synchronization for use in distributed computing environments. In the past, Solaris customers could use a publicly available version of NTP. The new support provides increased time precision.

Solstice Enterprise Agents (SEA)

Based on the new extensible agent technology or Master/subagent technology, SunSoft provides the solution Solstice Enterprise Agents (SEA). The agents consist of a Master Agent and subagents. The Master Agent receives and responds to Simple Network Management Protocol (SNMP) or Desktop Management Interface (DMI) requests. The responses are sent after retrieving the appropriate values from the respective subagents. The subagents manage information bases (MIBs or MIFs) designed for specific components and applications. Enterprise Agents also enable users to integrate and use SNMP-based Legacy Agents.

SEA is for both component developers and system and network managers who want to develop custom SNMP or DMI subagents to instrument

different components, subsystems, and applications within a device to enable management from an SNMP management console.

DHCP

Dynamic Host Configuration Protocol (DHCP) enables a host to get an Internet protocol (IP) address and other system configuration parameters preconfigured by the administrator on the DHCP server. DHCP also enables the host to give up this address when it is no longer required, or when the designated period for its use ends. This protocol improves on the traditional IP address allocation where the system administrator must assign or change each IP address individually. Both DHCP server and client-side support are provided.

For more information, see *TCP/IP Network Administration Guide*.

NFS Client Failover

Client failover provides for a high level of availability of read-only file systems by allowing the client to mount files from another server as needed. The failover is transparent to the client, so work is not disturbed if one server has problems as long as there is a replica available.

More information about NFS client failover can be found in *NFS Administration Guide*.

Variable Length Subnet Mask (VLSM)

Previously, the Solaris operating environment supported the use of a single netmask for each network number in use on a network. The netmask determines which bits of an IP network number represent the subnet, and which represent the host number. Using variable-length subnet masks (VLSM) enables more efficient use of IP addresses in large networks. With VLSM, the TCP/IP administrator can now use multiple netmasks for a given network number, tailoring each mask according to the size of each individual subnetwork. When deciding how to route an IP packet, Solaris automatically uses the longest matching netmask.

For example, in prior releases an administrator could subdivide the network 192.168.1.0 into eight subnets by using a netmask of 255.255.255.224. By using VLSM, this network number can instead be broken into

- Two subnets with a netmask of 255.255.255.192, and
- Four subnets with a netmask of 255.255.255.224

In addition, the use of VLSM allows supernetting or aggregation of network numbers, which can result in substantial savings in the sizes of routing tables carried by network routers. These two techniques make it possible to implement Classless Inter-Domain Routing (CIDR) as described in RFC1519.

To fully utilize VLSM in a network, CIDR-aware protocols such as OSPF, BGP-4, or RIPv2 must be used.

For more information, see *TCP/IP and Data Communications Administration Guide*.

Routing Sockets

The Solaris operating environment now conforms to the de facto routing socket interface as implemented by 4.4 BSD. This interface enables netmask information to be shared between routing protocol implementations and the kernel. It can also be used by implementations of CIDR-aware routing protocols.

Although the Solaris software does not deliver a routing daemon that implements these protocols, TCP/IP administrators are advised to contact the Merit GateD Consortium (<http://www.gated.org/>) for information on Gated. Gated is a program that implements these and other routing protocols and uses the routing socket interface.

Processor Sets

Processor sets allow a group of processors to be allocated for the exclusive use of one or more applications. The `/usr/sbin/psrset` command gives a system administrator control over the creation, management, and binding of processes into processor sets.

See the `psrset(1M)` man page for more information.

autofs

`autofs` is a file system that automatically mounts file systems as needed and unmounts them when they are not being used. The new automount daemon

is now fully multithreaded. This enables concurrent servicing of multiple mount requests. The new functionality makes the service more reliable.

The autofs service now supports browsability of indirect autofs maps. All mountable entries under an autofs mount point can be visible without the overhead of mounting them first. By default the /home and /net autofs mount points will have browsing disabled, but all other indirect mount points will be browsable. The ability to browse can be administered at the host level with the automount command and at a name-space level through the autofs maps.

In addition, better on-demand mounting of hierarchically related file systems is included. Previous releases automounted an entire set of file systems if they were hierarchically related, even if only one file system was referenced. Now, the file system that is referenced is dynamically mounted without the other file systems in the hierarchy.

For more information, see *NFS Administration Guide*.

NIS+ backup and Fast restore

NIS+ backup and restore provide a quick and efficient method of backing up and restoring NIS+ namespaces.

For more information, see *Solaris Naming Administration Guide*.

NIS+ Over a Wide Area Network (WAN)

NIS+ administrators can now specify NIS+ server search order for clients that need naming services. Server use can be balanced among various clients by designating different servers for different clients as "preferred" (primary). The order in which the client seeks out other servers when it cannot obtain information from its preferred server can be specified. This feature is particularly useful when a NIS+ domain spans a Wide Area Network (WAN) link. Administrators can reduce network traffic over the WAN link by specifying that clients first try to obtain the naming service from servers on the client's side of the link. NIS+ administrators can also specify what a client does when no preferred server is available.

For more information, see *Solaris Naming Administration Guide*.

NIS Server

The Solaris operating environment now natively supports the NIS server. In previous Solaris releases, the NIS server was supported under emulation mode by the NIS+ server or by an unbundled product named NSkit. Bundling the NIS server is intended to aid the transition from the SunOS 4.x to the Solaris 2.6.

CFS Boot

CFS boot enables AutoClient systems to boot more quickly with less network traffic by booting from a local CacheFS disk cache. The first system boot populates the cache, and system boots that follow are satisfied from the cache.

For more information, see *System Administration Guide*.

Patch Tools

In previous releases, patch installation and removal tools and their corresponding documentation were delivered as part of each patch shipped. These tools are now part of the Solaris software, which provides the following benefits:

- There is less wasted space on user systems. (Tools are installed once instead of with each patch.)
- Multiple patch handling is easier.

New Patch Commands

The `patchadd` and `patchrm` commands are used to add and remove patches from a Solaris 2.x system. They cannot be used to manage patches on a Solaris 1.x system.

You can add one or more patches to a system, client, service, or a net install image.

A patch is added to the local system by typing, for example:

```
# patchadd /var/spool/patch/104946-02
```

A patch is added to a client by specifying the client's root directory on a server, for example:

```
server# patchadd -R /export/root/client1 /var/spool/patch/104946-02
```

A patch is added to a service area (a `usr` file system, from any Solaris release setup on a server that is usually mounted as read only by the clients the server serves) by specifying the service area on the server, for example:

```
server# patchadd -S Solaris_2.3 /var/spool/patch/104946-02
```

If a patch contains both `root` and `usr` packages in the patch, the `patchadd` command must be issued twice: once with the `-R` option to apply the patch's `root` package, and once with the `-S` option to apply the patch's `usr` package.

See the `patchadd(1M)` and `patchrm(1M)` man pages and *System Administration Guide* for more information.

Isalist

`Isalist` is a set of utilities for SPARC systems that enables users to find out which instruction sets are supported on their machines and also to determine which one will perform the best for them. The set of utilities include:

- The `isalist` command, which prints out an ordered list of supported instruction set
- The `optisa` command, which prints out the best instruction set out of this list
- A pragmatic interface, which is the equivalent of using the `sysinfo` system call

Currently there are many variations of the SPARC processor, some of which can be treated as separate instruction sets. An application binary that is compiled for one variation may not run, or may run with performance degradation, or may run normally on a machine implementing a different variation. The `Isalist` utilities provide a standard interface so users can choose their application binary correctly to obtain maximum performance. For example, a system administrator can write a wrapper script and use the output of `isalist` and `optisa` to choose the appropriate binary for a given application.

Printing

The Solaris 2.6 print software offers a better solution than the LP print software in previous Solaris releases. System administrators can easily set up and manage print clients using the NIS or NIS+ name services. This means you can centralize print administration for a network of systems and printers.

Solaris 2.6 print software features include:

- Redesign of print packages
- Print protocol adapter
- SunSoft Print Client
- Network printer support

Redesign of Print Packages

The Solaris 2.6 print packages have been redesigned to provide greater flexibility and modularity of print software installation and to allow installation of a smaller client footprint.

Redesign features include:

- The ability, with a custom installation, to install only the client software on the print client, allowing for a smaller client footprint.

All packages, client and server, are installed by default on all machines. You can choose to install client software only on print client machines by customizing your installation.

- PostScript filter software contained in the print package SUNWpsf.

The new set of print packages is:

SUNWpcr	- SunSoft Print - Client (root)
SUNWpcu	- SunSoft Print - Client (usr)
SUNWpsr	- SunSoft Print - LP Server (root)
SUNWpsu	- SunSoft Print - LP Server (usr)
SUNWpsf	- PostScript Filters (usr)
SUNWscplp	- SunSoft Print - Source Compatibility (usr)

The removed print packages are:

SUNWlpr	- LP Print Service (root)
SUNWlpu	- LP Print Service - Client (usr)
SUNWlps	- LP Print Service - Server (usr)

Print commands contained in SUNWscpu have been moved and placed into SUNWsc1plp (SunSoft Print - Source Compatibility).

Print Protocol Adapter

The Solaris 2.6 print protocol adapter replaces the Service Access Facility (SAF), the network listener, and lpNet on the inbound side of the LP spooler with a more modular, modern design.

This replacement provides the following features:

- Complete BSD print protocol implementation plus extended Solaris functionality
- Allows multiple spooling systems to coexist on the same host and have access to the BSD print protocol
- Can be extended by third-party application developers to support other printing protocols such as Apple, Novell, and so on.

The new print protocol adapter is compatible with print clients set up in previous Solaris 2.x releases if the BSD protocol was used to configure these clients. If not, you have to modify the previous Solaris 2.x print client configuration to the BSD protocol using the Solstice AdminTools utility, Solstice AdminSuite Printer Manager, or the `lpsystem` command.

SunSoft Print Client

The SunSoft Print Client software was previously released as an unbundled product. It was available on the Solaris Migration CD and as part of the Solstice AdminSuite 2.x suite of administration products. It is now bundled with the Solaris 2.6 release.

The SunSoft Print Client software is

- Substantially smaller (183 Kbytes total) than the previous Solaris release.
- Interoperable with BSD protocol as described in RFC-1179. This includes SunOS 4.x, Solaris 2.x, HP-UX, and other operating environments.

The SunSoft Print Client software uses a NIS map, NIS+ table, or a single file to provide centralized client administration in the Solaris 2.6 release.

- On client systems, the `/etc/lp` directory structure is replaced with a configuration database that can be stored in a:
 - Printer not in the client database (`server:printer`)
 - User file (`$HOME/.printers`)
 - System file (`/etc/printers.conf`)
 - NIS map (`printers.conf.byname`)
 - NIS+ FNS context
- The client software uses a more streamlined implementation, thus providing reduced client overhead and generally quicker and more accurate responses to print status requests.
- The `printers.conf` file is administered like a standard NIS map or NIS+ table.

The `lpset (1M)` command is used to create the `printers.conf` file.

The print client software packages are `SUNWpcr` and `SUNWpcu`.

Enhanced Network Printer Support

The Solaris 2.6 print software provides base-level support for network-attached printers. This is achieved with the following features:

- A new interface script, `/usr/lib/lp/model/netstandard`, is specifically designed to support network printers. This script collects the spooler and print database information needed to perform network printing and passes it to the print output module.
- A new print output module, `netpr`, is called from the `netstandard` interface script to print the print job by opening a network connection to the printer, creating the correct protocol instructions, and sending the data to the printer.

The `netpr` binary currently supports two protocols: BSD print protocol and TCP pass-through.

See *(Solaris) System Administration Guide* and *Solstice AdminSuite 2.3 Administration Guide* for more information.

Hardware Support

The Solaris operating environment continues to provide the software needed to support new hardware.

PCMCIA PC Card

The PC Card Standard defines a 68-pin interface between a credit-card sized peripheral and the PC Card socket in the computer. It also defines a software architecture that enables the computer's operating system to configure and control the PC Card peripheral dynamically, upon insertion.

The Solaris 2.6 release provides a UNIX implementation of the PC Card Standard, bundled with a number of drivers for common PC Cards. The Solaris Card Services provide PC Card driver interfaces with ANSI C language bindings, enabling drivers to be written that are independent of the particular platform and host architecture.

For more information, see *Writing PCMCIA Device Drivers* which is available on Sun's external web page on the Device Driver Kit Web site.

Nomadic Support/File Synchronization

The new `filesync` feature ensures that data is moved automatically between the portable computer and the server. `filesync` is primarily intended for use on nomadic systems, although it may also be useful for backup and file replication on more permanently connected systems. Its purpose is to keep copies of files in sync between multiple systems, typically a server and a portable computer.

`filesync` can be used to maintain lists of files and directories to be kept in sync between multiple systems. Each time it is invoked, it examines all the files on both systems, determines which files have changed, and propagates the changes (creations, deletions, edits). It can deal with changes in both directions, and with conflicting changes.



Using Solaris Web Start

This module of the *Information Library* explains how to use the Solaris™ Web Start installation utility, including advanced techniques.

For instructions on *tasks* you can perform, turn to:

- "How to Run Solaris Web Start in Local Mode" on page 4-8
- "How to Run Solaris Web Start in Client-Server Mode" on page 4-8
- "How to Install Over a Previous Installation" on page 4-10

For *background* and *reference information*, turn to:

- "What Is Solaris Web Start?" on page 4-1
- "About Solaris Web Start's Defaults and Limitations" on page 4-3
- "About Client-Server Installation Mode" on page 4-4
- "About Using Solaris Web Start With An Install Server" on page 4-6
- "About Manual File System Layout" on page 4-7

Before using Solaris Web Start, be sure to refer to the *Solaris Release Notes* document to find out if there are limitations of this installation method for your system.

For general instructions on planning installations or choosing an installation method, refer to the *Installation Instructions* document. (This is the installation card with the message "Start Here.")

What Is Solaris Web Start?

Solaris Web Start is Sun's web browser-based "virtual assistant" for installing software.

Through Solaris Web Start, you can easily select and install all the software your machine requires, including the Solaris software group, Solstice™ utilities, and other co-packaged software.

Use Solaris Web Start to select exactly the software combination to suit your needs, or just click the Default Installation... button to install the default software selections immediately.

How Does Solaris Web Start Work?

Solaris Web Start lets you choose the product box software you want to install on your machine and creates a profile that reflects your software selections (or the default selections).

Solaris Web Start uses the Solaris JumpStart™ utility to read the profile automatically, thus installing the Solaris software and the other selected software products with minimal intervention.

Solaris Web Start runs in a portable, web browser-based environment. This means you can run Solaris Web Start from a web browser on any desktop platform networked to your server.

If you're setting up a machine that includes a frame buffer, keyboard, and monitor, you can run Solaris Web Start directly from that machine.

Modes of Operation

There are two ways to use Solaris Web Start:

- Local Mode
- Client-Server Mode

Local Mode – If you run Solaris Web Start from the machine you're setting up, Solaris Web Start writes the profile to disk and uses that profile information when you select and confirm the Install Now option. Your computer system must include a CD-ROM drive, frame buffer, keyboard, and monitor if you are to use this mode.

Client-Server Mode – In this mode, Solaris Web Start still runs on the machine being configured, but Java™ applets in Solaris Web Start interact with you on your desktop web-browser. Client-server mode is useful for installing software on a so-called "headless server," which does not include a frame buffer for bitmapped graphics.

About Solaris Web Start's Defaults and Limitations

Table 4-1 summarizes what Solaris Web Start does and does not let you do, as well as what it does by default.

TABLE 4-1 Solaris Web Start's Defaults and Limitations

Does by Default...	Lets You...	Doesn't Let You...
Creates root and swap partitions on the system disk	Change the size of partitions	—
Sets up the system disk	Set up other disks using Lay Out File Systems in the Customized Installation option	—
Creates an /opt partition for co-packaged software	Create additional partitions and file systems	Store co-packaged software in a partition other than /opt
Installs English versions of Solaris	Choose additionally to install localized Solaris versions	Omit installation of the English version of Solaris

Solaris Web Start “decides” dynamically what products to install by default. This decision is based on:

- Which product box you purchased
- Whether you're installing a server or a desktop system
- What Solaris language you're installing
- How large your computer's boot disk is

The Solaris Web Start interface always reflects the appropriate defaults for your situation. These defaults are summarized in tabular form when you select the Default Installation... option.

Product-Specific Defaults

Some default decisions are made by Solaris Web Start on a per-product basis. For Solaris 2.6 Documentation, Solaris Web Start installs both the server and data packages. If you want only one of these packages, install it manually after running Solaris Web Start.

Limitations of Default Installation on Multiple Disk Systems

If you are installing software on a system that has multiple disks, you should be aware that the Default Installation option sets up only the system disk. Other disks will not be recognized by the operating system unless you manually set up file systems on them, mount the file systems, and create entries for them in `/etc/vfstab`. For details, see the “Managing File Systems” chapter of *System Administration Guide*, as well as the reference manual page for `format`.

If you want Solaris Web Start to set up *all* the disks in your system, use the Customized Installation option and select all those disks using Lay Out File Systems.

About Client-Server Installation Mode

Solaris Web Start’s client-server mode lets you take advantage of the ease and convenience of a browser-based installation, even when the machine on which you’re loading the software doesn’t support a graphical user interface.

What Happens in Client-Server Mode

Figure 4-1 shows what happens when you start up Solaris Web Start by the usual means (see “How to Run Solaris Web Start in Client-Server Mode” on page 4-8).

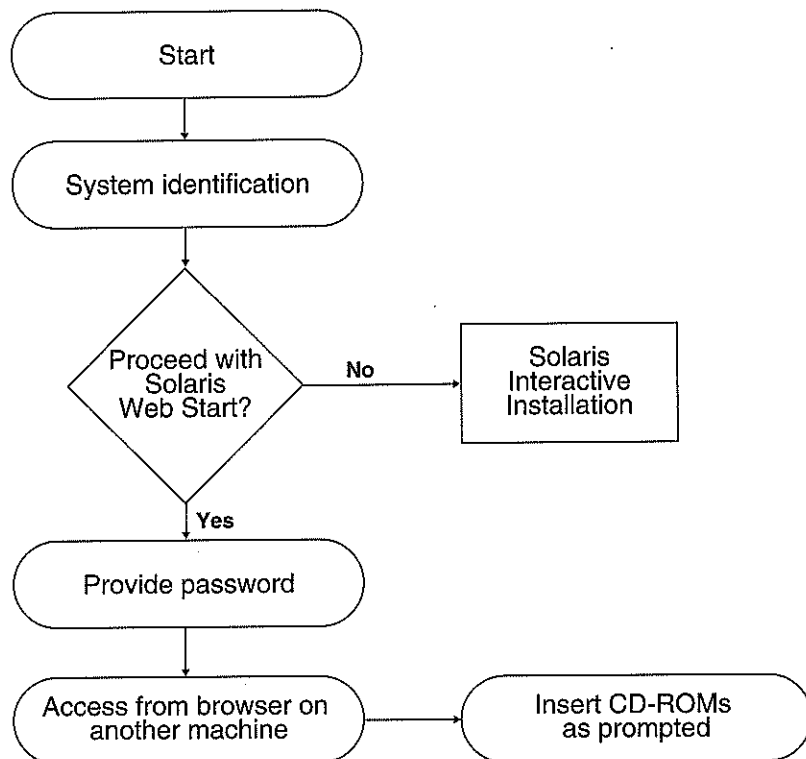


Figure 4-1 Client-Server Mode Task Flow

A system identification tool asks you to supply system and network information about the machine you're adding to the network. This is a standard part of Sun's installation process.

Once you've completed entering system identification information, Solaris Web Start "figures out" that your machine lacks graphical support.

You cannot run Solaris Web Start on this system - it requires a bitmapped graphics display.

At this point, you can choose to exit from Solaris Web Start and use the standard Solaris Interactive Installation program, or you can choose to proceed with Solaris Web Start's client-server mode.

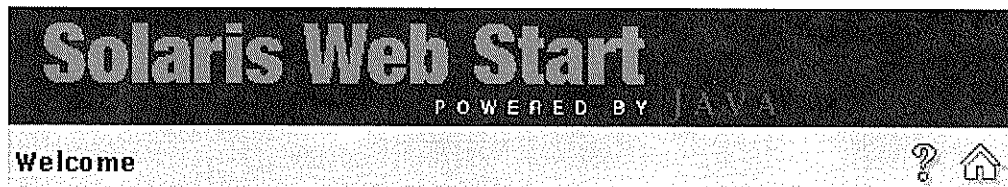
You have two options:

- [1] Continue running Solaris Web Start using a browser window on another machine connected over the network.
- [2] Run a standard Solaris interactive installation.

If you choose to proceed, Solaris Web Start instructs you to provide a password. This authentication password is distinct from any others you might have: it restricts who can use Solaris Web Start to install software over the network on your machine.

Solaris Web Start next explains how you can run your installation over the network by going to another machine and pointing your web browser program at a special Uniform Resource Locator (URL).

If you follow these instructions, you'll soon see Solaris Web Start's graphical user interface appear in your web browser: you're on your way to an easy installation.



About Using Solaris Web Start With An Install Server

The typical way to install Solaris software on a computer is through the system's CD-ROM drive. However, you can install Solaris over the network instead of from the system's CD-ROM drive.

Doing this involves setting up an *install server*: a machine on which an image of Solaris software exists. This image can be transferred over the network to other computers, so you can easily perform replicated installations.

The details of setting up an install server and performing network-based installations are beyond the scope of this document (see *Solaris Advanced Installation Guide*). However, having set up an install server with a Solaris 2.6 image, you can use Solaris Web Start in conjunction with it.

Getting Started

On the client side, instead of typing `boot net` to start the network-based installation, type:

```
# boot net - browser
```

Note that there are spaces both before and after the hyphen. This command displays Solaris Web Start.

Solaris Web Start Install Server Process

Use Solaris Web Start in the usual way, selecting the desired software and configurations, or accepting the defaults.

Solaris Web Start checks your selections against the image on the install server. If the software you request exists on the install server, it is transferred over the network and installed on the client. If a particular program you requested does not exist on the install server, Solaris Web Start prompts you to supply the appropriate CD-ROM.

About Manual File System Layout

Solaris Web Start lays out file systems for you automatically. It does this in a way that mirrors what the Solaris Interactive Installation program does.

The file system configurations that Solaris Web Start automatically provides will be adequate for virtually any situation. However, you might consider laying out file systems manually if:

- There are other products, not included in your product box, that you need to install, and these products must share the same file systems (`root`, `/usr`, and `/swap`) used by the co-packaged software in the product box.
- Your experience has been that the file systems provided by Solaris Interactive Installation do not work for your situation.

If you do need to lay out file systems manually, Solaris Web Start gives you the tools to do so easily. A series of simple screens break down the job of setting up file systems into manageable chunks in which you:

- Select which disks you want

- Select which file systems you want .
- Create, rename, move, delete, expand, or shrink file systems
- View a summary of your choices and confirm them

Note - Editing file systems requires advanced system administrator's knowledge. You should not alter file system layouts unless you are experienced in this area.

How to Run Solaris Web Start in Local Mode

How you run Solaris Web Start depends on what mode you use. For a description of the modes, see "Modes of Operation" on page 4-2.

Before You Begin

This procedure applies to new, out-of-the-box machines. For machines that are already running, see "How to Install Over a Previous Installation" on page 4-10.

The machine should be taken out of its packaging and set up according to the instructions accompanying the hardware.

▼ To Run in Local Mode

1. Insert the Solaris CD into the CD-ROM drive.
2. Turn on power to the system.
3. Follow the instructions that appear on your computer's screen.

How to Run Solaris Web Start in Client-Server Mode

How you run Solaris Web Start depends on what mode you use. For a description of the modes, see "Modes of Operation" on page 4-2.

Before You Begin

This procedure applies to new, out-of-the-box machines. For machines that are already running, see "How to Install Over a Previous Installation" on page 4-10.

The machine should be taken out of its packaging and set up according to the instructions accompanying the hardware. You'll need to attach an alphanumeric terminal or `tip` line to the computer's serial port in order to view console messages and supply system identification information.

▼ To Run in Client-Server Mode

1. **Insert the Solaris CD into the CD-ROM drive.**
2. **Turn on power to the system.**
3. **Provide system identification information as requested.**

A system identification tool asks you to supply system and network information about the machine you're adding to the network.

Eventually, Solaris Web Start "figures out" that your machine lacks graphical support.

```
You cannot run Solaris Web Start on this system - it
requires a bitmapped graphics display.
You have two options:
-----
```

- ```
[1] Continue running Solaris Web Start using a browser window on
 another machine connected over the network.
[2] Run a standard Solaris interactive installation.
```

4. **Confirm you want to proceed with Solaris Web Start.**

Type the appropriate option number and then press the Return or Enter key.

5. **Supply a Solaris Web Start authentication password.**

This password is needed to prevent someone else from performing an installation on your system. Remember this password—you'll need it to access your server from the client machine's browser.

6. **Follow the instructions that appear on your terminal.**

You'll be informed how to access Solaris Web Start by pointing your web-browser program at the proper location.

---

## How to Install Over a Previous Installation

Solaris Web Start does not install Solaris upgrades. However, you can take a running system and install a newer release of Solaris on top of it.



---

**Caution** - Installing a Solaris release over a previous installation wipes out all the software and data that was previously stored on the system disk. Depending on the size of the system disk and on what software you choose to install, Solaris Web Start may also wipe out existing data on other disks.

---

1. **Insert the Solaris CD into the CD-ROM drive.**

2. **Get your system to the ok prompt.**

On SPARC™ systems, you can do this by holding down the L1 or Stop key while pressing the key labelled "a."

3. **Type `boot cdrom - browser`**

Note that there are spaces both before and after the hyphen.

4. **Confirm that you want to install over existing software.**

When Solaris Web Start detects that operating system software already exists on your machine, then Solaris Web Start will ask you to confirm that you want to install new software over it.

[1] Reinstall everything using Solaris Web Start.  
[2] Upgrade software using Solaris Interactive Installation.

(Continued)

Type 1 or 2, then press the Return key=>

**5. Proceed as follows, depending on which mode you're using.**

- *Local mode*– Skip to Step 8 on page @-11.
- *Client-server mode* – Continue with Step 6 on page @-10.

**6. Provide system identification information as requested.**

A system identification tool asks you to supply system and network information about the machine you're adding to the network.

Eventually, Solaris Web Start "figures out" that your machine lacks graphical support.

You cannot run Solaris Web Start on this system - it requires a bitmapped graphics display.

You have two options:

- [1] Continue running Solaris Web Start using a browser window on another machine connected over the network.
- [2] Run a standard Solaris interactive installation.

**7. Confirm you want to proceed with Solaris Web Start.**

Type the appropriate option number and then press the Return or Enter key.

**8. Follow the on-screen instructions.**

If you're running Solaris Web Start in client-server mode, you'll be prompted to supply an authentication password, and then informed how to access Solaris Web Start by pointing your web-browser program at the proper location.

If you're running Solaris Web Start in local mode, a browser window appears on your computer's screen.







## Upgrading a System

---

This module describes how to upgrade an existing Solaris system. Topics include:

- “Frequently Asked Questions About Using the Upgrade Option” on page 5-2
- “Upgrade Instructions” on page 5-3
- “What to Do After Upgrading” on page 5-7

---

## Ways to Upgrade a System

When you install a new version of Solaris software on an existing Solaris system, the installation program lets you choose one of the following options to copy the Solaris operating environment to disk:

- *Upgrade* – This option merges the new version of the Solaris operating environment with the existing files on the system’s disks. It saves as many modifications as possible that you have made to the previous version of the Solaris operating environment.
- *Initial* – This option overwrites the system’s disk with the new version of the Solaris operating environment. You must back up any local modifications that you have made to the previous version of the Solaris operating environment before you begin the installation and restore the local modifications after the installation completes.

---

## Frequently Asked Questions About Using the Upgrade Option

**Q:** Will I be able to use the upgrade option on my system?

You can use the upgrade option if you are running Solaris 2.4 or later.

To see what version of the Solaris operating environment the system is running, type:

```
$ uname -a
```

**Q:** Do I have to back out patches before I use the upgrade option?

No.

**Q:** What if the Solaris installation program doesn't provide the upgrade option, but the system should be upgradeable?

See the module Troubleshooting During Installing in this book.

**Q:** What if the system's file systems don't have enough space for the upgrade?

The upgrade option in the Solaris Interactive Installation program lets you reallocate disk space if the current file systems don't have enough space for the upgrade. By default, an auto-layout feature tries to determine how to reallocate the disk space so the upgrade can succeed. If auto-layout can't determine how to reallocate disk space, you must specify which file systems can be moved or changed and run auto-layout again based on your input.

## Q: Can I automatically upgrade to another software group?

No. For example, if you previously installed the end user software group on your system, you cannot use the upgrade option to upgrade to the developer software group. However, you can always add software to the system during the upgrade that is not part of the currently installed software group.

## Q: Where does the installation program log local modifications that the upgrade couldn't preserve?

- Before the system reboots –  
    /a/var/sadm/system/data/upgrade\_cleanup
- After system reboots – /var/sadm/system/data/upgrade\_cleanup

## Q: Where does the installation program log what happened during the upgrade?

- Before the system reboots – /a/var/sadm/system/logs/upgrade\_log
- After system reboots – /var/sadm/system/logs/upgrade\_log

---

## Upgrade Instructions

1. Consider the following information before you upgrade an existing system to a new version of the Solaris operating environment.

- Check the section *Software Features No Longer Supported* in the *Solaris release notes* and your vendor release notes to see if there is any software that you use that is no longer provided in the new release.
- See the module *What's New* in this book and your vendor release notes to see if any of the changes or enhancements to the Solaris operating environment will affect anything that you currently do.
- See the module *Supported Hardware* in this book to make sure your system and devices are supported by the new release.
- Check other software documentation.



**Caution** - To avoid loss of data during upgrade, check the following table for known problems. This list is not complete. Always check co-packaged, vendor, and third-party software documentation for upgrading instructions.

**TABLE 5-1** Software That Requires Changes Before Upgrading

| Software                                               | Problem Summary                                                                                                                                                                                                                               |
|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Solstice <sup>TM</sup> Online: DiskSuite <sup>TM</sup> | Metadevices cannot be upgraded. You must comment out metadevices entries ( <code>/dev/md</code> ) in the <code>/etc/vfstab</code> file before starting the upgrade option. See the Solstice Online: DiskSuite documentation for instructions. |
| Prestoserve                                            | If you start the upgrade process by shutting down the system using <code>init 0</code> , you can lose data. See the Prestoserve documentation for shutdown instructions.                                                                      |

- Check for all the available patches that you may need. The most updated patch list is provided by SunSolve on the internet (<http://sunsolve.sun.com/>).
2. **Back up your system.** See "How to Back Up a System" on page 5-6 for detailed instructions.

Always back up existing file system before using the upgrade option and installing a new version of the Solaris operating environment. Backing up file systems means copying file systems to removable media (such as tape) to safeguard your data against loss, damage, or corruption. If you do not have a backup procedure in place, use the following procedure to perform a full backup of file systems. For information on setting up

scheduled backups and using other backup commands, see *System Administration Guide* in the Solaris server product.

**3. Insert the Solaris CD into the CD-ROM drive.**

**4. Boot the system from the Solaris CD.**

Get your system to the ok prompt and type: `boot cdrom`.

---

**Note** - For older SPARC based systems, use the following boot command:  
`boot sd(0,6,2)`

---

---

**Note** - If you experience any problems from this point on, see the module *Troubleshooting During Installation* in this book.

---

**5. Wait for booting to complete.**

After you type the boot command, the system will go through a booting phase where various hardware and system components are checked. This lasts for several minutes. The following table provides examples of what you should see when the system is booting.

```
ok boot cdrom
Booting from: sd(0,6,2)
SunOS Release x.x Version [UNIX(R) System V Release]
Copyright (c), Sun Microsystems, Inc.
WARNING: clock gained 35 days -- CHECK AND RESET THE DATE!
Configuring devices
Starting OpenWindows...
```

**6. Follow the on-screen instructions to install the Solaris operating environment.**

You are now in the hands of the Solaris installation program. This menu-driven, interactive program guides you step-by-step through installing the Solaris operating environment; it also has online help to answer your questions.

**7. Wait as the Solaris operating environment is installed on the system.**

A log of the installation (how the system was installed) is saved to the following files:

- Before the system reboots –  
/a/var/sadm/system/logs/upgrade\_log
- After system reboots – /var/sadm/system/logs/upgrade\_log

## ▼ How to Back Up a System

1. Become superuser.
2. Shut down the system.

```
init 0
```

3. Bring the system to run level S (single-user mode).

```
ok boot -s
```

4. (Optional) Check the file system for consistency with the **fsck** command.

Running the **fsck** command using the **-m** option checks for consistency for file systems. For example, power failure can leave files in an inconsistent state.

```
fsck -m /dev/rdisk/device-name
```

5. If you will be backing up file systems onto a remote tape drive:
  - a. Add the following entry to the **./rhosts** file of the system that is initiating the backup:

```
host root
```

- b. Verify that the host name added to the **./rhosts** file above is accessible via the local **/etc/inet/hosts** file or available NIS or NIS+ name sever.
6. Identify the device name of the tape drive.  
The default tape drive is **/dev/rmt/0**.
7. Insert a tape that is not write protected into the tape drive.
8. Back up file systems using one of the **ufsdump** commands listed in Table 5-2.



TABLE 5-2 Full Backup Commands

| To Do Full Backups To...    | Use This Command...                                    |
|-----------------------------|--------------------------------------------------------|
| Local diskette              | <code>ufsdump9ucf /vol/dev/ files_to_backup</code>     |
| Local cartridge tape drive  | <code>ufsdump9ucf /dev/rmt files_to_backup</code>      |
| Remote cartridge tape drive | <code>ufsdump0ucf remote_host:/ files_to_backup</code> |

9. When prompted, remove the tape and replace it with the next volume.
10. Label each tape with the volume number, level, date, system name, and file system.
11. Bring the system back to run level 3 by pressing Control-d.
12. Verify the backup was successful by using the `ufsrestore` command to display the tape contents.

## What to Do After Upgrading

After the system finishes upgrading, the installation program leaves it at the superuser prompt in single-user mode.

### 1. Clean up the system if necessary.

When you use the upgrade option, the Solaris installation program merges local software modifications of the existing system with the new software; however, in some cases, the merge is not possible. See the following file to see if you need to fix any of the local modifications that the upgrade could not preserve:

`/a/var/sadm/system/data/upgrade_cleanup`



**Caution** - Make sure you look at all the information in the `upgrade_cleanup` file. Your system may not boot if you fail to fix the unpreserved local modifications.

**2. Reboot the system.**

```
reboot
```



# Troubleshooting

---

This module provides a list of specific error messages and generic problems that you may encounter when installing the Solaris software. Start by using the following list to identify where in the installation process the problem is occurring.

- "Booting a System" on page 6-1
- "Installing Solaris (Upgrade)" on page 6-3

---

## Booting a System

### Error Messages

le0: No carrier - transceiver cable problem

| Problem                                     | How to Fix the Problem                                                                                                                      |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| The system is not connected to the network. | If this is a non-networked system, ignore this message. If this is a networked system, make sure the Ethernet cabling is attached securely. |

The file just loaded does not appear to be executable

#### Problem

The system cannot find the proper media for booting.

#### How to Fix the Problem

Verify that the system has been set up properly to install over the network from an install server. For example, make sure you specified the right platform group for the system when you set it up. Also, if you did not copy the Solaris CD, make sure the Solaris CD on the install server is mounted and accessible.

boot: cannot open /kernel/unix

#### Problem

SPARC based systems only.

#### How to Fix the Problem

Reset the boot file in the PROM to " " (blank).

This error occurs when you override the boot file location by explicitly setting it to /kernel/unix. In the Solaris 2.6 release, the kernel no longer resides in /kernel/unix, but in /platform/<arch>/kernel/unix.

Can't boot from file/device

#### Problem

The installation program can't find the Solaris CD in the system's CDROM drive.

#### How to Fix the Problem

Make sure:

- The CD-ROM drive is installed properly or is turned on
- The Solaris CD is inserted into the CD-ROM drive

WARNING: clock gained xxx days -- CHECK AND RESET DATE!

**Problem**

SPARC based systems only.  
This is an informational message.

**How to Fix the Problem**

Ignore the message and continue with the installation.

---

## Installing Solaris (Upgrade)

### Error Messages

No upgradeable disks

**Problem**

Bug ID: 1191792  
A swap entry in the `/etc/vfstab` file is causing the upgrade to fail.

**How to Fix the Problem**

Comment out the following lines in the `/etc/vfstab` file:

- All swap files and slices on disks not being upgraded
- Swap files that are no longer present
- Any unused swap slices

---

## General Problems

**Problem**

The upgrade fails because the Solaris installation program could not mount metadevices on the system.

**How to Fix the Problem**

Comment out all metadevices in the system's `/etc/vfstab` file. The upgrade option does not support metadevices.

| Problem                                                                                                                                                                                                                                                                                                                                         | How to Fix the Problem                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Bug ID: 1170953</p> <p>The upgrade option is not presented even though there is a version of Solaris software that's upgradable on the system.</p> <p><i>Reason 1:</i> The /var/sadm directory is a symlink or it is mounted from another file system.</p> <p><i>Reason 2:</i> The /var/sadm/softinfo/INST_RELEASE file is missing.</p>      | <p><i>Solution for Reason 1:</i> Move the /var/sadm directory into the root (/) or /var file system.</p> <p><i>Solution for Reason 2:</i> Create a new INST_RELEASE file by using the following template:</p> <pre>OS=Solaris VERSION=2.x REV=0</pre> <p>where <i>x</i> is the version of Solaris software on the system.</p>                                                                                           |
| Problem                                                                                                                                                                                                                                                                                                                                         | How to Fix the Problem                                                                                                                                                                                                                                                                                                                                                                                                  |
| <p>The upgrade fails for reasons beyond your control, such as a power failure or a network connection failure, and the system is left in an unbootable state.</p>                                                                                                                                                                               | <ol style="list-style-type: none"> <li>1. Reboot the system from the Solaris CD or from the network.</li> <li>2. Choose the upgrade option for installation.</li> </ol> <p>The Solaris Interactive Installation program will determine if the system has been partially upgraded and will continue the upgrade.</p>                                                                                                     |
| Problem                                                                                                                                                                                                                                                                                                                                         | How to Fix the Problem                                                                                                                                                                                                                                                                                                                                                                                                  |
| <p>The upgrade fails because the Solaris installation program could not mount a file system. During an upgrade, the installation program attempts to mount all the file systems listed in the system's /etc/vfstab file on the root file system being upgraded. If the installation program cannot mount a file system, it fails and exits.</p> | <p>Make sure all file systems in the system's /etc/vfstab file can be mounted. Comment out any file systems in the /etc/vfstab file that can't be mounted or that may cause the problem, so the installation program doesn't try to mount them during the upgrade.</p> <hr/> <p><b>Note</b> - Any system-based file systems that contain software to be upgraded (for example, /usr) cannot be commented out.</p> <hr/> |

---

**Problem****How to Fix the Problem**

There is not enough space on the system for the upgrade. Check the following reasons for the space problem and see if you can fix it without using auto-layout to rearrange space:

*Reason 1:* Since the automounter is not active during an upgrade, the Solaris installation program installs any package's files or directories that are symbolic links to automounted file systems. If a symbolic link is overwritten, the upgrade may fail because of insufficient disk space.

*Solution for Reason 1:* During the upgrade, delete software packages in the Customize Software screen that will create files or directories on the automounted file systems. Then the Solaris installation program will not overwrite the symbolic link with a package's files or directories.

---

**Note** - The `/var/mail` and `/var/news` directories, which usually reside on an automounted file system, are not affected by an upgrade.

---

*Reason 2:* New software has been added to the software group that you are upgrading or some of the existing software has increased in size. During an upgrade, the Solaris installation program installs any new software that is part of the software group previously installed on the system, and it also upgrades any existing packages on the system.

*Solution for Reason 2:* During the upgrade, delete software packages in the Customize Software screen that install into the file systems that need more space. Especially look for any new packages that have been added to the Solaris release that you don't want.





## Adding Software After Installation

1

## Adding and Removing Packages

---

This module describes how to add software packages to a system from the Solaris CD or another product CD, and how to remove software packages from a system. There are two methods for performing these tasks, from the command line and from a graphical user interface, Admintool.

For more information on adding and removing software packages on client systems in a variety of computing environments, see the *System Administration Guide*.

This is a list of the step-by-step instructions in this chapter.

- "How to Add Packages With the `pkgadd` Command" on page 7-1"
- "How to Remove Packages With the `pkgrm` Command" on page 7-3"
- "How to Add Packages With Admintool" on page 7-4"
- "How to Remove Packages With Admintool" on page 7-6"

---

### Adding and Removing Packages Using Commands

This section describes how to add and remove packages using commands at the command line.

#### ▼ How to Add Packages With the `pkgadd` Command

1. Log in to the installed system and become root.

At the shell prompt, type:

```
$ su
```

2. Load the CD that contains the packages to be added into the CD-ROM drive.

Volume Manager will automatically mount the CD.

3. Add one or more packages to the system using the `pkgadd` command.

```
/usr/sbin/pkgadd -d device_name pkgid
```

In this command,

|                    |                                                                                                  |
|--------------------|--------------------------------------------------------------------------------------------------|
| <i>device_name</i> | Is the path to the CD with the software to be added to the installed system.                     |
| <i>pkgid</i>       | Is the name of the software package to be added to the installed system. For example, SUNWaudio. |

If the `pkgadd` process encounters a problem during installation of the package, it displays a message related to the problem, followed by this prompt:

```
Do you want to continue with this installation?
```

Respond with `yes`, `no`, or `quit`. If more than one package has been specified, type `no` to stop the installation of the package being installed. The `pkgadd` process continues to install the other packages. Type `quit` to stop the installation.

4. Verify that the package has been installed correctly.

```
/usr/sbin/pkgchk -v pkgid
```

If the `pkgchk` command determines there are no errors, it returns a list of installed files. Otherwise, it reports the error.

## Example—Installing Software From a Mounted CD

The following example shows a command to install the SUNWaudio package from a mounted Solaris 2.6 CD. The example also shows the use of the `pkgchk` command to verify that the package files were installed properly.

```
/usr/sbin/pkgadd -d /cdrom/cdrom0/s0/Solaris_2.6 SUNWaudio.
.
.
Installation of <SUNWaudio> was successful.
pkgchk -v SUNWaudio
/usr
/usr/bin
/usr/bin/audioconvert
/usr/bin/audioplay
/usr/bin/audiorecord
#
```

## ▼ How to Remove Packages With the `pkgrm` Command

1. Log in to the installed system and become root.

At the shell prompt, type:

```
$ su
```

2. Remove one or more packages from the system using the `pkgrm` command.

```
/usr/sbin/pkgrm pkgid
```

In this command,

*pkgid*

Is the name of the software package to be removed from the installed system. For example, SUNWaudio.

3. Verify that the package has been removed correctly.

```
/usr/sbin/pkgchk pkgid
```

If the `pkgchk` command determines that the package is not installed, it will print a warning message.

## Example—Removing Software From a System

The following example shows a command to remove the `SUNWaudio` package from a system. The example also shows the use of the `pkgchk` command to verify that the package files were removed.

```
/usr/sbin/pkgrm SUNWaudio
The following package is currently installed:
 SUNWaudio Audio applications^M
 (sparc) 3.0,REV=1.2.13^M

Do you want to remove this package? y
.
.
.
Removal of <SUNWaudio> was successful.
pkgchk -v SUNWaudio
WARNING: no pathnames were associated with <SUNWaudio>
#
```

## Adding and Removing Packages By Using Admintool

This section describes how to add and remove software packages through the Admintool graphical user interface.

### ▼ How to Add Packages With Admintool

1. Log in to the installed system and become root.

At the shell prompt, type:

```
$ su
```

Unless you are a member of the UNIX `sysadmin` group (group 14), you must become root on your system to add or remove software packages with Admintool.

2. Load the CD that contains the package to be added into the CD-ROM drive.

Volume Manager will automatically mount the CD.

3. Start Admintool.

```
admintool &
```

The Users window is displayed.

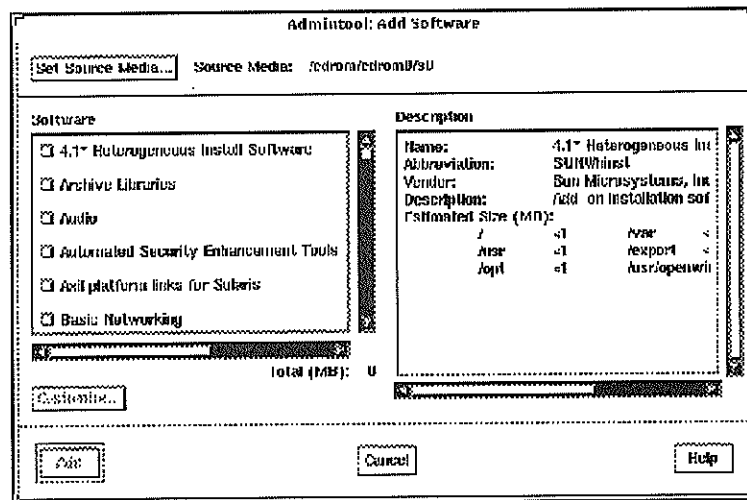
4. Choose Software from the Browse menu.

The Software window is displayed.

5. Choose Add from the Edit menu.

The Set Source Media window may appear. If so, specify the path to the installation media and click on OK. The default path is a mounted SPARC Solaris CD.

The Add Software window is displayed.



6. Select the software you want to install on the local system.

In the Software portion of the window, select the software you want to install.

7. Click on Add.

A Command Tool window appears for each package being installed, displaying the installation output.

| Year | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 | 2042 | 2043 | 2044 | 2045 | 2046 | 2047 | 2048 | 2049 | 2050 | 2051 | 2052 | 2053 | 2054 | 2055 | 2056 | 2057 | 2058 | 2059 | 2060 | 2061 | 2062 | 2063 | 2064 | 2065 | 2066 | 2067 | 2068 | 2069 | 2070 | 2071 | 2072 | 2073 | 2074 | 2075 | 2076 | 2077 | 2078 | 2079 | 2080 | 2081 | 2082 | 2083 | 2084 | 2085 | 2086 | 2087 | 2088 | 2089 | 2090 | 2091 | 2092 | 2093 | 2094 | 2095 | 2096 | 2097 | 2098 | 2099 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 | 2042 | 2043 | 2044 | 2045 | 2046 | 2047 | 2048 | 2049 | 2050 | 2051 | 2052 | 2053 | 2054 | 2055 | 2056 | 2057 | 2058 | 2059 | 2060 | 2061 | 2062 | 2063 | 2064 | 2065 | 2066 | 2067 | 2068 | 2069 | 2070 | 2071 | 2072 | 2073 | 2074 | 2075 | 2076 | 2077 | 2078 | 2079 | 2080 | 2081 | 2082 | 2083 | 2084 | 2085 | 2086 | 2087 | 2088 | 2089 | 2090 | 2091 | 2092 | 2093 | 2094 | 2095 | 2096 | 2097 | 2098 | 2099 |      |

## ▼ How to Remove Packages With Admintool

1. Log in to the installed system and become root.

At the shell prompt, type:

§ 80

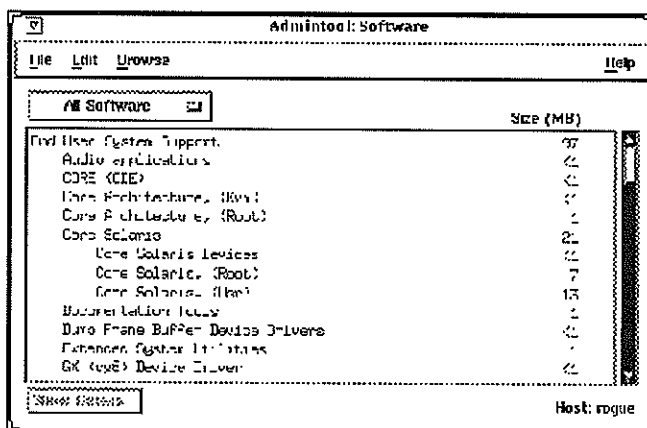
Unless you are a member of the UNIX sysadmin group (group 14), you must become root on your system to add or remove software packages with Admintool.

- ## 2. Start Admintool.

```
admintool &
```

- 3. Choose Software from the Browse menu.**

The Software window is displayed.



4. Select the software you want to remove from the local system.

- 5. Choose Delete from the Edit menu.**

A warning pop-up window is displayed to confirm whether you really want to delete the software.

6. Click **Delete** to confirm that you want to remove the software.

For each package that is being deleted, a Command Tool window is displayed that asks for confirmation, again, on deleting the software. Type



y, n, or q. If you choose to delete the software, the output from the removal process is displayed.

The Software window refreshes, and no longer displays the packages just removed.



**Figure 1**

## Accessing Online Documentation

---

This chapter explains how to install and use the AnswerBook2 product to browse, search, and print online documentation. It includes the following information:

- "Introduction to AnswerBook2" on page 8-1
- "Where's the Documentation?" on page 8-5
- "Getting Started" on page 8-12
- "Installing Document Server Software" on page 8-14

---

### Introduction to AnswerBook2

The AnswerBook2 product is Sun's online documentation system. It uses a web-browser interface that lets you view and print a variety of Solaris information, including SGML-based AnswerBook™ collections, Display PostScript™ AnswerBook collections, and man pages.

The AnswerBook2 product provides a robust search engine that lets you find information throughout the documentation library. You can install AnswerBook2 document collections on a centralized documentation server or locally.

---

**Note** - Throughout the AnswerBook2 documentation, the term *AnswerBook1* refers to the version of the AnswerBook product provided with pre-2.6 versions of the Solaris operating system.

---

## Features and Functions

The AnswerBook2 product provides the following features and functions:

- Uses a web-browser-based interface so that you can view online documentation from any platform (running any operating system), provided that your web browser supports HTML 3.2
- Depending on your web browser's configuration, lets you copy information from AnswerBook2 documents and paste it into other locations, such as your command line
- Provides a robust search engine for finding words and word phrases throughout the documentation library
- Gives you the ability to print pages, chapters, and books directly from the AnswerBook2 interface
- Lets you view old and new AnswerBook documents using a single interface
- Lets you define a subset of document collections (a Personal Library) to be displayed when using a specific document server
- Uses a client-server architecture that allows the documents to be stored in a single location (server) and accessed from the user's desktop (client)
- Provides a command-line interface (CLI) and a browser-based interface (GUI) for performing administrative functions

## Differences Between AnswerBook1 and AnswerBook2

The following list identifies the significant differences between the AnswerBook1 and AnswerBook2 products:

- Web-browser-based interface—The AnswerBook2 product uses a web-browser-based interface. As a result, you can use any HTML 3.2-compliant browser on any platform to view online documentation.
- Source flexibility—You can use the AnswerBook2 server to deliver AnswerBook1 (Display Postscript™) documents, AnswerBook2 documents (developed in SGML), or regular HTML files.

---

**Note** - Although you can use the server to deliver HTML documents, complete AnswerBook2 functionality is not provided for these files.

---

- Client-server support—The AnswerBook2 product supports the client-server architecture, which allows you to install the server and document collections in a central location and view the documents from other systems. In addition, it includes a "fail-over" mechanism in which

the document administrator can define multiple document servers so that links between documents always work.

- Cross-platform—For this release, the AnswerBook2 document server must run on a Solaris 2.6 platform (SPARC or Intel). However, AnswerBook2 clients can run on any platform, and future releases might provide server functionality on additional platforms.
- Default search behavior—The AnswerBook2 product uses AND for its default search behavior rather than OR (the default search behavior in the AnswerBook1 product).

## Pieces and Parts

The AnswerBook2 product is relatively simple. It consists of the following elements:

- A web browser—The Solaris 2.6 product release includes the HotJava™ browser; however, you can use any HTML 3.2-compliant browser to view Sun's online documentation.

---

**Note** - If you just want to view online documentation, you only need this element. All other elements are part of the document server system.

---

- The AnswerBook2 application and utilities—Includes GUIs for document viewing and printing as well as administrative functions (you can also perform administrative functions from a command-line interface).
- A document and administration server—Performs query functions and "serves" documents to the application; also, performs database, password authentication, and other administrative functions.
- Documents—Can be new (SGML) documents or old (Display PostScript) documents.

## Frequently-Asked Questions

This section lists some common questions about the AnswerBook2 product along with answers to those questions.

### What is AnswerBook2?

The AnswerBook2 product uses a standards-based document server to deliver Sun's online documentation through your favorite web browser. The AnswerBook2 interface lets you browse, search, and print a variety of

Solaris information, including AnswerBook1 collections and man pages.

**How is AnswerBook2 different from AnswerBook?**

The previous AnswerBook product (now called AnswerBook1) used Display PostScript to display electronic versions of documents primarily developed for paper delivery. The AnswerBook2 product uses a web browser to display documentation developed for online delivery using SGML and to display existing AnswerBook1 documents. Also, the AnswerBook2 product supports a client-server model, where the documents can be kept on a central server and users only need a web browser to view them.

**Can I still view my old AnswerBook collections with AnswerBook2?**

Yes, unless your old AnswerBook documents were created before the release of the Solaris 2.2 operating system. To add AnswerBook1 collections to the AnswerBook2 server's database, use the AnswerBook2 "add collection" function and point to the directory containing the AnswerBook1 `ab_cardcatalog` file.

**Does AnswerBook2 provide the same functionality for AnswerBook1 and AnswerBook2 documents?**

No. For consistency, the AnswerBook2 interface for AnswerBook1 documents is similar to the AnswerBook1 product interface. Thus, the AnswerBook2 product provides the following differences in functionality for AnswerBook1 and AnswerBook2 collections:

- You cannot expand or collapse an entire AnswerBook1 table of contents listing; you can only expand or collapse a specific section within the table of contents.
- AnswerBook1 content pages do not include Other Topics sections. To navigate from one page to another, you can use the Next Topic link or return to the Table of Contents and select another section in the book.
- AnswerBook1 content pages display the entire chapter at one time, not smaller sections.
- Search results are not presented in a hierarchical structure for AnswerBook1 books.
- Search results icons poorly represent the probability of a match for AnswerBook1 information; the icons tend to be either completely filled or completely empty.
- Search terms are not highlighted in AnswerBook1 text.
- Some AnswerBook1 graphics cannot be displayed inline; they are identified by an icon that, when clicked on, brings up a PostScript display of the graphic.

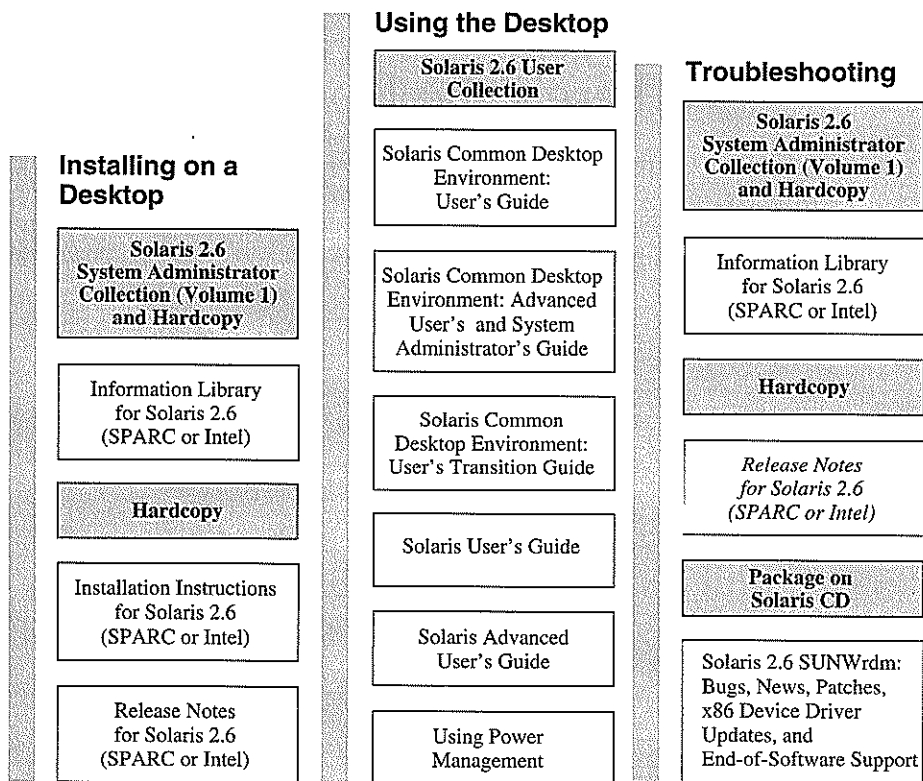
---

## Where's the Documentation?

For the Solaris 2.6 operating system release, the document server software and document collections are on the Documentation CD. Figure 8-6 through Figure 8-4 list the specific document collections available and identify those documents that are available only in hardcopy (printed) format.



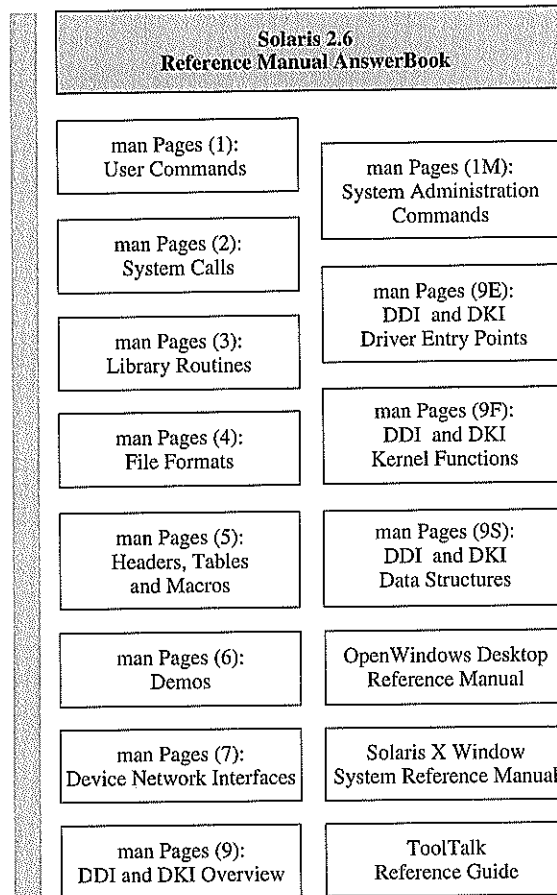
## Solaris 2.6 Desktop Documentation



**Note:** Online documentation is available on the Solaris 2.6 Documentation CD except for the SUNWrdm package which is available on the Solaris 2.6 (SPARC Platform Edition) CD or the Solaris 2.6 (Intel Platform Edition) CD.

Figure 8-1 Desktop Documentation

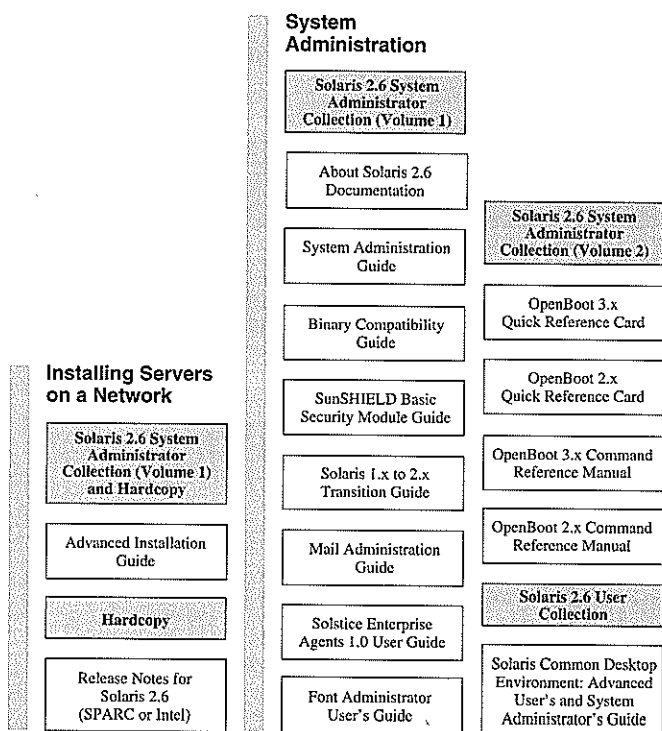
## Solaris 2.6 Man Page Documentation



**Note:** Online documentation is available on the Solaris 2.6 Documentation CD except for the SUNWrdm package which is available on the Solaris 2.6 (SPARC Platform Edition) CD or the Solaris 2.6 (Intel Platform Edition) CD.

Figure 8-2 Reference Documentation (Man Pages)

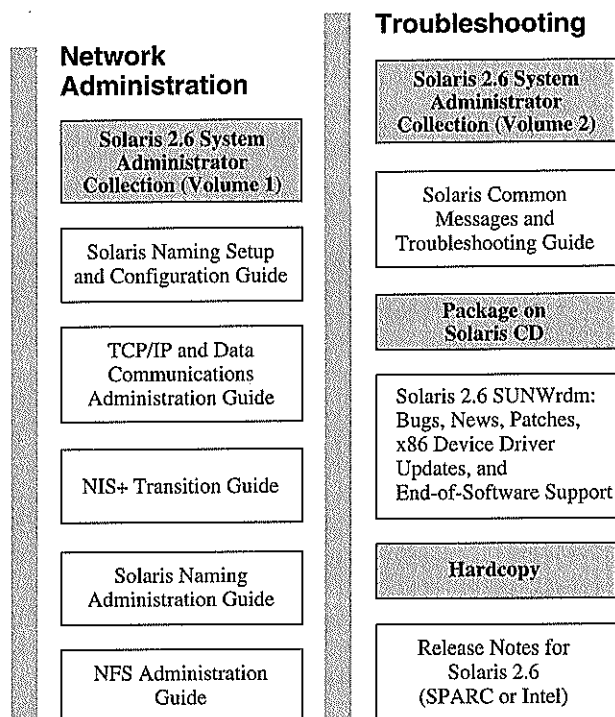
## Solaris 2.6 System Administration Documentation



Note: Online documentation is available on the Solaris 2.6 Documentation CD except for the SUNWrdm package which is available on the Solaris 2.6 (SPARC Platform Edition) CD or the Solaris 2.6 (Intel Platform Edition) CD.

Figure 8-3 System Administration Documentation — Part 1

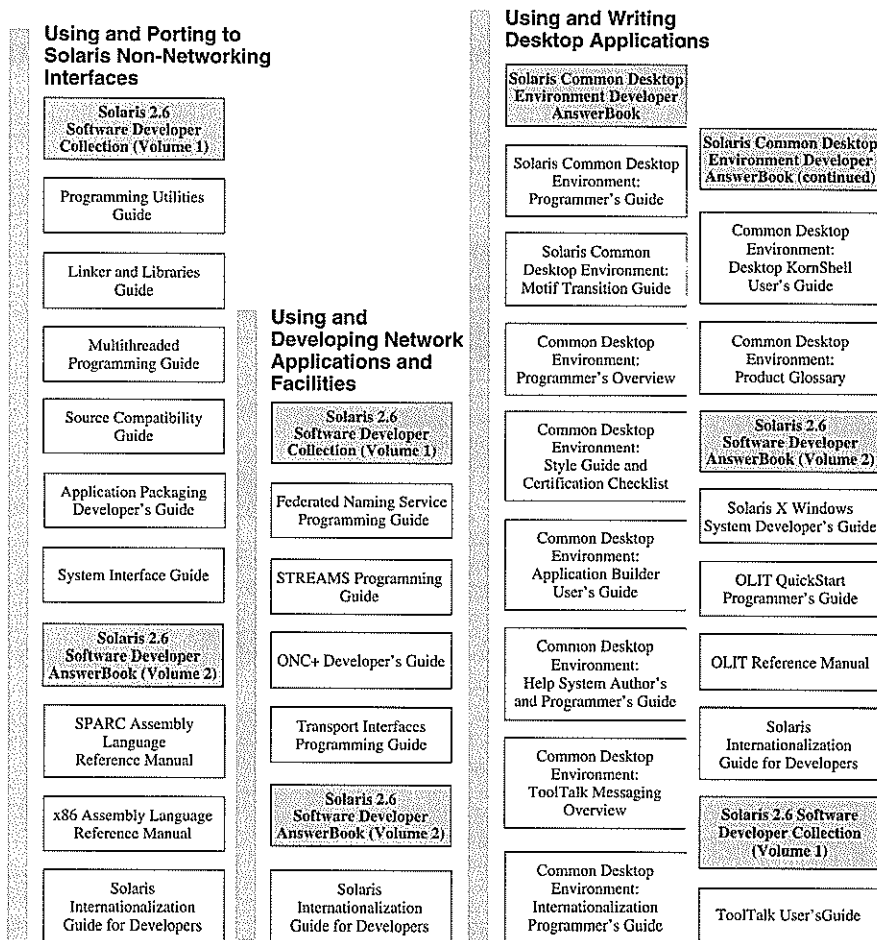
## Solaris 2.6 System Administration Documentation (Continued)



**Note:** Online documentation is available on the Solaris 2.6 Documentation CD except for the SUNWrdm package which is available on the Solaris 2.6 (SPARC Platform Edition) CD or the Solaris 2.6 (Intel Platform Edition) CD.

Figure 8-4 System Administration Documentation — Part 2

## Solaris 2.6 Developer Documentation



Note: Online documentation is available on the Solaris 2.6 Documentation CD except for the SUNWrdm package which is available on the Solaris 2.6 (SPARC Platform Edition) CD or the Solaris 2.6 (Intel Platform Edition) CD.

Figure 8-5 Developer Documentation — Part 1

## Solaris 2.6 Developer Documentation (Continued)

### Developing Graphics, Multimedia Applications, and Imaging

|                                                |                                                      |                                                  |
|------------------------------------------------|------------------------------------------------------|--------------------------------------------------|
|                                                | Solaris XGL 3.3<br>AnswerBook                        |                                                  |
| Solaris XIL 1.3<br>AnswerBook                  | XGL Test Suite<br>User's Guide                       |                                                  |
| XIL Programmer's Guide                         | Getting Started Writing<br>XGL Device Handlers       | KCMS<br>AnswerBook                               |
| XIL Reference Manual                           | XGL Accelerator Guide for<br>Reference Frame Buffers | KCMS Test Suite<br>User's Guide                  |
| PEX<br>AnswerBook                              | XGL Reference Manual                                 | KCMS Application<br>Developer's Guide            |
| Solaris PEX<br>Implementation<br>Specification | XGL Programmer's<br>Guide                            | KCMS Calibrator Tool<br>Loadable Interface Guide |
| Solaris PEXlib<br>Reference Manual             | XGL Architecture<br>Guide                            | KCMS CMM<br>Developer's Guide                    |
| CGE PEX 5.1<br>Portability Guide               | XGL Device Pipeline<br>Porting Guide                 | KCMS CMM<br>Reference Manual                     |

**Note:** Online documentation is available on the Solaris 2.6 Documentation CD except for the SUNWrdm package which is available on the Solaris 2.6 (SPARC Platform Edition) CD or the Solaris 2.6 (Intel Platform Edition) CD.

Figure 8-6 Developer Documentation — Part 2

# Getting Started

The AnswerBook2 product is a replacement for the existing AnswerBook product and is part of the Solaris 2.6 operating system release. To view online documentation, you need an HTML 3.2-compatible browser (such as HotJava™, Netscape Navigator™, or Lynx™) and access to a document server (a URL that identifies a machine on which the document collections are installed and which runs a web-based server to deliver them to you). For more information, choose from the following:

- "What Do I Need to Install?" on page 8-12
- "Launching the AnswerBook2 Viewer" on page 8-13
- "Finding a Document Server" on page 8-13

For detailed information about using the AnswerBook2 product or administering a document server, use the online help once you have a document server to access.

## What Do I Need to Install?

Table 8-1 indicates what you need to install to provide specific AnswerBook2 functionality.

**TABLE 8-1** When and What to Install

| If you want to do this....                                                            | Then do this...                                                                                                                                                                                                                             |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| View online documentation from your desktop (any platform, any operating system).     | Start a web browser and point it at the document server's URL (for example, <code>http://my_docs:8888</code> ). See "Launching the AnswerBook2 Viewer" on page 8-13.                                                                        |
| Automatically launch a web browser with the appropriate server URL from your desktop. | If you are running the Solaris 2.6 operating system, then identify a document server and select the AnswerBook2 option from the CDE Help pop-up menu or the OpenWindows Programs menu. See "Launching the AnswerBook2 Viewer" on page 8-13. |

**TABLE 8-1** When and What to Install *(continued)*

| If you want to do this...                                                               | Then do this...                                                                                                                                                                                                 |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Enable your system (machine) to deliver (serve) documentation.                          | Install the document server software from the Solaris Documentation CD. See "Installing Document Server Software" on page 8-14.                                                                                 |
| Add documentation from the Solaris 2.6 Documentation CD to your document server.        | The document administrator is the only user authorized to perform this function. For information about installing the document collections, see "Installing Server Software" on page 8-17, Step 5 on page @-18. |
| Add existing documentation (for example, AnswerBook1 packages) to your document server. | The document administrator is the only user authorized to perform this function. See "Installing Server Software" on page 8-17, Step 5 on page @-18.                                                            |

## Launching the AnswerBook2 Viewer

If you are running the Solaris 2.6 operating system and you select the AnswerBook2 icon provided on the CDE front panel, select AnswerBook2 from the OpenWindows Programs menu, or enter the `answerbook2` command, the system launches a web browser with the URL for the document server. It finds the web browser to launch by searching your path and launching HotJava or the first web browser it finds in your path. For information on how the system determines the URL for the document server, see "Finding a Document Server" on page 8-13.

If you are not running the Solaris 2.6 operating system, you can also access the AnswerBook2 product from any HTML 3.2-compliant web browser. Start up your web browser and point it to the appropriate document server URL. For example, if your system administrator installed an AnswerBook2 document server on the system `imayoyo`, you would access the URL `http://imayoyo:8888`.



## Finding a Document Server

If this is the first time you have started the AnswerBook2 viewer, the software displays a list of the complete library (all collections and their books) installed on the "default" document server. The "default" server is identified using one of the following mechanisms:

1. If you have defined the environment variable, `AB2_DEFAULTSERVER`, the AnswerBook2 viewer launches using the URL defined by that variable. For example, you might have the following line in your `.cshrc` file:

```
setenv AB2_DEFAULTSERVER http://imayoyo.eng.sun.com:8888/
```

2. If the machine from which you initiated the AnswerBook2 function is a document server, the AnswerBook2 viewer launches using the URL: `localhost:8888`.
3. If you are using FNS (Federated Naming Services), the AnswerBook2 viewer launches using the document servers it finds under the FNS `thisorgunit/answerbook/servers` list. For more information about FNS, see "Registering the Server" on page 8-20.

If you have no document servers available, you can also access Sun's master document server at `http://docs.sun.com`.

---

## Installing Document Server Software

This section explains the requirements you must meet and decisions you should make before you install the AnswerBook2 server software.

---

**Note** - There is no specific installation needed to be an AnswerBook2 client. Only the person who wants to serve documentation needs to read this section.

---

---

**Note** - Be aware that there is no client-level access control for this product. If a client machine can access the URL for your document server, it can view the documents on that server.

---

This section contains the following information:

- "Before Installing Server Software" on page 8-15
- "Installing Server Software" on page 8-17
- "Registering the Server" on page 8-20

- "Name Services and AnswerBook2" on page 8-21

For detailed information about administering a document server, use the online help available from the AnswerBook2 interface once you have installed the document server software.

## Before Installing Server Software

Before you start the installation process, verify that your system meets the requirements listed in "Hardware and Software Requirements" on page 8-15 and decide where you want to install the software as explained in "Installation Choices" on page 8-16.

## Hardware and Software Requirements

Before you start the installation process, verify that the system(s) on which you plan to install AnswerBook2 server software meet the hardware and software requirements listed in Table 8-2 and Table 8-3.

**TABLE 8-2** Hardware and Software Requirements

| Component                               | Requirement                                                                            |
|-----------------------------------------|----------------------------------------------------------------------------------------|
| Document server system hardware         | SPARCstation 2 or higher (SPARCstation 5 recommended)<br>Intel-based personal computer |
| Operating system                        | Solaris 2.6 (for SPARC or x86, as appropriate)                                         |
| Admin GUI and AnswerBook2 client viewer | Any HTML 3.2-compliant browser, such as HotJava, Netscape Navigator, or Lynx           |

TABLE 8-3 Disk Space Requirements Table

| Directory Path     | Description                                                                                                                          | Space                                                          |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|
| /usr/lib/ab2/      | Contains executable files, server processing files, library files, and graphics and document source files for the product interface. | 19.5 Megabytes                                                 |
| /var/log/ab2/      | Contains catalog files and log files, if logging functions are enabled.                                                              | 0.01 Megabytes (grows according to amount of access to server) |
| /etc/init.d/ab2mgr | Server startup file                                                                                                                  | 0.01 Megabytes                                                 |

In addition, you need to set aside some amount of disk space for the actual book files. The exact amount of space depends on the specific collections.

## Installation Choices

Before you install the AnswerBook2 server software, you should consider your installation choices:

### ■ Install Everything on One System

The AnswerBook2 server software and documentation collections are on the Solaris 2.6 Documentation CD. If you install both parts of the server product on a single system, when you finish the installation process and start the server, it will be ready to serve documents to all clients. See "Installing Server Software" on page 8-17 for more information.

### ■ Install Server and Documentation on Separate Systems

You can install the document server software on one system and point to document collections that are physically located on a different system. You might want to do this if you have minimal space available on your server's system or if you have existing collections location on another system. If you do this, you will need to manually add each collection to the server's database and the **Scan for Locally Installed Collections** function will not find these collections. See "Installing Server Software" on page 8-17 for more information.

### ■ Run from the CD

If you are operating in a non-networked environment (stand-alone) or you only occasionally view the online documentation, you can run the AnswerBook2 server directly from the Solaris 2.6 Documentation CD. To run the server directly from the CD:

1. Make sure you are logged in as root. `% su -`
2. Change directory to, or bring up file manager and go to, the following location: `/cdrom/Solaris_2.6_Doc/`

This directory contains three directories and one executable script (`ab2_cd`).

3. Run the following command: `./ab2_cd`
4. Access the document server using the following URL: `http://localhost:8888`

where *localhost* is the name of the machine to which the CD is attached.

5. To stop running the server from the CD, run the following command: `/cdrom/Solaris_2.6_Doc/ab2_cd stop`



---

**Caution** - Be aware that running the document server directly from the CD is slow. Thus, it is not recommended that you use this approach if you expect other users to access this document server.

---

## Installing Server Software

To install the AnswerBook2 server software, perform the following steps:

1. Insert the Solaris Documentation CD into your CD-ROM drive.
2. Log in as `root` on the document server machine and change directory to the location of the installation packages.

For example, the path to the server software packages for a SPARC server might look like the following:

```
cd cdrom/Solaris_2.6_Doc/sparc/Product/
```

where *cdrom* is the mount-point for the CD-ROM device.

3. Use the `pkgadd` utility or the `swmtool` utility and select the following server software packages:
  - SUNWab2r (0.02 Megabytes)—Installs in root partition and provides configuration and start-up files.
  - SUNWab2s (0.21 Megabytes)—Provides shared files for performing document processing.

- SUNWab2u (21.02 Megabytes)—Provides executable and back-end processing files for server and administration functions.

**Note** - To install the server packages into a non-default directory, use the following command: # pkgadd -d . -a none. This causes the pkgadd utility to prompt you for the directory into which you want the software installed.

#### 4. Start up the server, if needed.

Installing the packages should cause the server to start up on the default port of 8888. If it does not start, use the following command to start it:

```
/usr/lib/ab2/bin/ab2admin -o start
```

#### 5. Install the book collections.

Your document server cannot do its job if no documents are installed for it to serve. You can install collections from the Solaris 2.6 Documentation CD or from other locations, such as existing document collections or collections that come with other products. Table 8-4 lists the document collections available on the Solaris 2.6 Documentation CD.

**TABLE 8-4** Solaris 2.6 Documentation CD Book Packages

| Package Name | Collection Title                                |
|--------------|-------------------------------------------------|
| SUNWabe      | Solaris 2.6 User Collection                     |
| SUNWaxg      | Solaris XGL 3.3 AnswerBook                      |
| SUNWaxi      | Solaris XIL 1.3 AnswerBook                      |
| SUNWapex     | PEX AnswerBook                                  |
| SUNWaman     | Reference Manual AnswerBook                     |
| SUNWabsdk    | Solaris 2.6 Software Developer Collection Vol 1 |
| SUNWadm      | Solaris 2.6 System Administrator Collection     |
| SUNWakcs     | KCMS AnswerBook                                 |

TABLE 8-4 Solaris 2.6 Documentation CD Book Packages (continued)

| Package Name | Collection Title                                        |
|--------------|---------------------------------------------------------|
| SUNWdtad     | Solaris Common Desktop Environment Developer AnswerBook |
| SUNWabdev    | Solaris 2.6 Software Developer AnswerBook Vol 2         |

- a. Use the **pkgadd** utility or the **swmtool** utility to install new book collections onto your server.

The document collection packages are located in the following directory on the Solaris 2.6 Documentation CD:

```
cd cdrom/Solaris_2.6_Doc/common/Product/
```

If you install document collection packages from this CD, the collections are automatically added to the document server's database during the **pkgadd** process. If you install collection packages from any other location, you need to use either the Admin GUI's **Add Collection to List** function or the **ab2admin -o add\_coll** command to add these collections to the document server's database.

- b. If collection packages are already installed on your system, you can use the server's **Scan for Locally Installed Collections** function or the **ab2admin -o scan** command to have them automatically found and added to the server's document database.

This function only works for locally installed packages.

To serve document collections located on some other system, use the **Add Collection to List** function or the **ab2admin -o add\_coll** command and provide the full path name to the **ab\_cardcatalog** or **collinfo** file. For example, if the document server is **imayoyo** and you want it to serve document collections located on the system **elsewhere**, you might use the following command:

```
ab2admin -o add_coll -d /net/elsewhere/books/SUNWdtad
```

6. (Optional) Register the server.

If you want other users to automatically find your document server through Federated Naming Services (FNS), you need to register the server. To register your server, use the following command:

```
/usr/lib/ab2/bin/ab2regsvr server_url
```

where *server\_url* is the fully qualified URL to get to this server (for example: `imayoyo.eng.sun.com:8888`). See "Registering the Server" on page 8-20 for more information.

## Registering the Server

To include your document server in a pool of servers for a site, or to give users the ability to choose from several document servers, you can register the name of your server with the Federated Naming Services system. Users can still access unregistered document servers if they know the URL.

To register your server, use the `ab2regsvr` command. The `ab2regsvr` command looks at your system's configuration and, depending on the naming service you are using, sets up the appropriate name space for your server.

To register your server, use the following command:

```
/usr/lib/ab2/bin/ab2regsvr server_url
```

where *server\_url* is the fully qualified URL to get to this server (for example: `imayoyo.eng.sun.com:8888`).

To find out what servers are currently registered, use the following command:

```
% fnlookup -v thisorgunit/service/answerbook2
```

This returns a list of registered servers that looks similar to the following:

```
Reference type: onc_answerbook2
Address type: onc_addr_answerbook2
length: 19
data: 0x68 0x74 0x74 0x70 0x3a 0x2f 0x2f 0x61 0x6e 0x73 http://
ans
 0x77 0x65 0x72 0x73 0x3a 0x38 0x38 0x38 0x38 wers:8888
```

In this example, the registered server is `answers:8888`.

If you get a response similar to the following, then no document servers are registered.

```
Lookup of 'thisorgunit/service/answerbook2' failed: Name Not Found: 'answerbook2'
```

## Name Services and AnswerBook2

In the Solaris environment, the primary name services are:

- NIS+ (Network Information Service Plus)

NIS+ is the primary name service used for Solaris 2.6 and is a redesigned version of NIS that takes into account recent changes in client/server environments. NIS+ was introduced in the SunOS 5.0 (Solaris 2.0) release. If your system is using NIS+, you can run `ab2regsvr` on the document server system. It creates an entry like this:  
`thisorgunit/service/answerbook2.`

- NIS (Network Information Service)

NIS was the standard name service provided in SunOS 4.x (Solaris 1.x) environments. If your system is using NIS, you must contact your NIS administrator and have that person run `ab2regsvr` on the NIS master system to set up the name space for AnswerBook2 servers.

- File System

If a user chooses not to run either NIS or NIS+, the AnswerBook2 product also works with a file-system defined naming system in which all names are manually entered into data files. In this instance, these files would be stored in the directory `/var/fn`. The server would need to export this directory and any clients that wanted to access documents on this server would need to mount this directory.

Rather than using the described name services to find a document server, the user can define a default AnswerBook2 server using the environment variable `AB2_DEFAULTSERVER`. For example, the user could have the following line in the `.cshrc` file:

```
setenv AB2_DEFAULTSERVER http://imayoyo.eng.sun.com:8888
```

If the user has not defined an environment variable, when the user launches AnswerBook2 from the desktop, the system performs an  
`fnlookup thisorgunit/service/answerbook2` command to find out



what document servers are available. It then chooses one of those servers and launches the AnswerBook2 browser using that server name for the URL.

## Supported Hardware

## Supported Hardware

---

The Solaris 2.6 release supports all sun4c and sun4d platforms. Most sun4u and sun4m platforms are also supported, but check with your hardware vendor for exceptions.

Solaris 2.6 installation requires a minimum of 16 Mbytes of RAM. *At least 32 Mbytes of RAM is strongly recommended* (Solaris Web Start requires 48 Mbytes of RAM). On some platforms, 16 Mbytes of RAM will not support the installation graphical user interface (GUI), which means the character user interface (CUI) must be used to install the Solaris 2.6 release.

The minimum disk space requirements for the Solaris 2.6 release are described in this table.

| The Software Group ... | Requires a Minimum Disk Space of ... |
|------------------------|--------------------------------------|
| End User               | 281 Mbytes <sup>1</sup>              |
| Developer              | 537 Mbytes                           |
| Entire                 | 608 Mbytes                           |
| Entire plus OEM        | 616 Mbytes                           |

1. The End User software group, including swap, must fit on a 424-Mbyte disk.

---

**Note** - Contact your hardware manufacturer to determine if a specific system or device is supported by the Solaris 2.6 release.

---





[illegible]

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100





1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

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