Solaris Express Installation Guide: Planning for Installation and Upgrade

Sun microsystems

Contents

Preface

This book describes planning your installation or upgrade with the Solaris™ Operating System (OS) on both networked and nonnetworked SPARC® and x86 architecture based systems. This book also provides overviews of several technologies that relate to installation such as Solaris Zones, GRUB based booting, and the creation of RAID-1 volumes during installation.

This book does not include instructions about how to set up system hardware or other peripherals.

Note – This Solaris release supports systems that use the SPARC and x86 families of processor architectures: UltraSPARC®, SPARC64, AMD64, Pentium, and Xeon EM64T. The supported systems appear in the *Solaris 10 Hardware Compatibility List* at `http://www.sun.com/bigadmin/hcl`. This document cites any implementation differences between the platform types.

In this document these x86 related terms mean the following:

- "x86" refers to the larger family of 64-bit and 32-bit x86 compatible products.
- "x64" points out specific 64-bit information about AMD64 or EM64T systems.
- "32-bit x86" points out specific 32-bit information about x86 based systems.

For supported systems, see the *Solaris 10 Hardware Compatibility List*.

Who Should Use This Book

This book is intended for system administrators responsible for installing the Solaris OS. This book provides both of the following types of information.

- Advanced Solaris installation planning information for enterprise system administrators who manage multiple Solaris machines in a networked environment
- Basic Solaris installation planning information for system administrators who perform infrequent Solaris installations or upgrades

Related Books

Table P–1 lists documentation that developers need when they install the Solaris software.

TABLE P–1   Are You a Developer Installing on a Single System?

Description	Information
Do you need system requirements or other planning information, such as how to partition or backup your system?	*x86: Solaris Express Developer Edition Getting Started*
Do you need step-by-step installation instructions?	*Solaris Express Developer Edition Installation Guide: Laptop Installations*
Do you need a roadmap to learn about the numerous interfaces, frameworks, and tools to take advantage of Solaris technologies?	Introduction to the Solaris Development Environment
Do you need troubleshooting information?	*Solaris Express Developer Edition Release Notes*

Table P–2 lists documentation for system administrators.

TABLE P–2   Are You a System Administrator Who is Installing Solaris?

Description	Information
Do you need to install a single system from DVD or CD media? The Solaris installation program steps you through an installation.	*Solaris Express Installation Guide: Basic Installations*
Do you need to upgrade or patch your system with almost no downtime? Save system downtime when upgrading by using Solaris Live Upgrade.	*Solaris Express Installation Guide: Solaris Live Upgrade and Upgrade Planning*
Do you need to install a secure installation over the network or Internet? Use WAN boot to install a remote client. Or, do you need to install over the network from a network installation image? The Solaris installation program steps you through an installation.	*Solaris Express Installation Guide: Network-Based Installations*
Do you need to install Solaris on multiple machines? Use JumpStart™ to automate your installation.	*Solaris Express Installation Guide: Custom JumpStart and Advanced Installations*
Do you need to install or patch multiple systems quickly? Use Solaris Flash software to create a Solaris Flash archive and install a copy of the OS on clone systems.	*Solaris Express Installation Guide: Solaris Flash Archives (Creation and Installation)*
Do you need to back up your system?	Chapter 23, "Backing Up and Restoring File Systems (Overview)," in *System Administration Guide: Devices and File Systems*
Do you need troubleshooting information, a list of known problems, or a list of patches for this release?	*Solaris Release Notes*

TABLE P–2 Are You a System Administrator Who is Installing Solaris? *(Continued)*

Description	Information
Do you need to verify that your system works on Solaris?	SPARC: *Solaris Sun Hardware Platform Guide*
Do you need to check on which packages have been added, removed, or changed in this release?	*Solaris Package List*
Do you need to verify that your system and devices work with Solaris SPARC and x86 based systems and other third-party vendors.	Solaris Hardware Compatibility List for x86 Platforms

Documentation, Support, and Training

The Sun web site provides information about the following additional resources:

- Documentation (http://www.sun.com/documentation/)
- Support (http://www.sun.com/support/)
- Training (http://www.sun.com/training/)

Typographic Conventions

The following table describes the typographic conventions that are used in this book.

TABLE P–3 Typographic Conventions

Typeface	Meaning	Example
AaBbCc123	The names of commands, files, and directories, and onscreen computer output	Edit your `.login` file. Use `ls -a` to list all files. `machine_name% you have mail.`
AaBbCc123	What you type, contrasted with onscreen computer output	`machine_name% `**`su`** `Password:`
aabbcc123	Placeholder: replace with a real name or value	The command to remove a file is `rm` *filename*.
AaBbCc123	Book titles, new terms, and terms to be emphasized	Read Chapter 6 in the *User's Guide*. A *cache* is a copy that is stored locally. Do *not* save the file. **Note:** Some emphasized items appear bold online.

Shell Prompts in Command Examples

The following table shows the default UNIX® system prompt and superuser prompt for the C shell, Bourne shell, and Korn shell.

TABLE P–4 Shell Prompts

Shell	Prompt
C shell	`machine_name%`
C shell for superuser	`machine_name#`
Bourne shell and Korn shell	`$`
Bourne shell and Korn shell for superuser	`#`

Overall Planning of Any Solaris Installation or Upgrade

This part guides you through planning the installation or upgrade of the Solaris Operating System when using any installation program.

1

Where to Find Solaris Installation Planning Information

This book contains two parts: the high-level planning of your installation or upgrade and overviews of several technologies that relate to installation. This chapter provides a roadmap through this book.

Where to Find Planning and System Requirement Information

The *Solaris Express Installation Guide: Planning for Installation and Upgrade* provides system requirements and high-level planning information, such as planning guidelines for file systems, and upgrade planning and much more. The following list describes the chapters in the planning book and provides links to those chapters.

Chapter Descriptions	Reference
This chapter describes new features in the Solaris installation programs.	Chapter 2
This chapter provides you with information about decisions you need to make before you install or upgrade the Solaris OS. Examples are deciding when to use a network installation image or DVD media and descriptions of all the Solaris installation programs.	Chapter 3
This chapter describes system requirements to install or upgrade to the Solaris OS. General guidelines for planning the disk space and default swap space allocation are also provided. Upgrade limitations are also described.	Chapter 4
This chapter contains checklists to help you gather all of the information that you need to install or upgrade your system. This information is useful, for example, if you are performing an interactive installation. You'll have all the information in the checklist that you'll need to do an interactive installation.	Chapter 5

Chapter Descriptions	Reference
These chapters provide overviews of several technologies that relate to a Solaris OS installation or upgrade. Guidelines and requirements related to these technologies are also included. These chapters include information about GRUB based booting, Solaris Zones partitioning technology, and RAID-1 volumes that can be created at installation.	Part II

2

What's New in Solaris Installation

This chapter describes new features in the Solaris installation programs. To view features for all of the Solaris OS, see *Solaris Express Developer Edition What's New*. This chapter describes the following sections.

What's New in the Solaris Express Developer Edition

x86: GRUB Extended Support for Directly Loading and Booting the UNIX Kernel

Starting with the Solaris Express Developer Edition 5/07 release, changes have been made to GRUB that enable the boot loader to directly load and boot the unix kernel. The GRUB multiboot module is no longer used. This implementation integrates the previous multiboot functionality directly into the platform-specific unix kernel module. These changes reduce the time, as well as memory requirements, that are needed to boot the Solaris OS.

Two new keywords, kernel$ and module$, have been added to GRUB to assist in creating menu.lst entries that work with either 32-bit or 64-bit systems. Another new keyword, $ISADIR, displays 32–bit and 64–bit information in the boot command. In addition, the bootadm command that manages the menu.lst file has been modified to create file entries for the platform-specific unix module that is loaded by GRUB. During an upgrade, the bootadm command converts any existing multiboot menu.lst entries to unix entries.

Note – These new keywords are used in normal installations. However, the miniroot is 32-bit only. Therefore, failsafe installations do not use the new keywords.

For overview and task-related information, see Chapter 11, "Administering the GRUB Bootloader (Tasks)," in *System Administration Guide: Basic Administration*. See also Chapter 12, "Booting a Solaris System With GRUB (Tasks)," in *System Administration Guide: Basic Administration*.

For more information, see the boot(1M) and bootadm(1M) man pages.

The Solaris Express Developer Edition Release

The Solaris Express Developer Edition 5/07 (Developer) release includes new device drivers and additional developer tools. In addition, you can now upgrade your Developer release. Additional developer tools include Sun Studio 12, NetBeans Visual Web Pack 5.5, and NetBeans Profiler 5.5.

Starting with the Solaris Express Developer Edition 2/07 release, a new installation provides a simple initial installation of the Solaris OS for your laptop. Combined with community and Sun support and training services, the Developer release includes the tools, technologies, and platforms that enable developers to create custom Solaris, Java™, and Web 2.0 applications.

The Developer release installs a Solaris system that is automatically networked by using DHCP with DNS name resolution. IPv6 is also enabled. The Solaris Developer release is an initial installation, not an upgrade.

The Developer release is the new default installation from the DVD. In the initial installation screen, you now see the following choices with the Developer release as the default.

```
Solaris Express Developer Edition
Solaris Express
Solaris Express Serial Console ttya
Solaris Express Serial Console ttyb (for lx50,v60x and v65x)
```

The "Solaris Express" and "Solaris Express Serial Console" installations provide system administrators with the necessary choices to set up servers and clients. Because of the configuration choices, these installations require more time. These installation options do not include the developer tools. If you choose the Solaris Express Developer Edition option and do not have enough memory to run the graphical user interface (GUI), you must select one the of the other "Solaris Express" installations on the screen.

The Developer release includes the following developer tools, operating system, and desktop:

- Sun™ Studio 11 – C, C++, Fortran compilers, IDE, and integrated tools
- NetBeans™ IDE 5.5 – An open-sourced IDE for Java software developers
- NetBeans IDE Enterprise Pack 5.5 – Added to the NetBeans IDE, functionality to develop Java Platform, Enterprise Edition 5 based applications
- Java Platform, Standard Edition 6 – The OpenJDK based release of the Java platform JDK

- StarOffice™ 8 – The OpenOffice based productivity suite, including word processor, spreadsheet, and presentation tools
- Open Source Tools – Over 150 open source applications, including Perl, Python, and GCC
- Solaris Express operating system and desktop - Includes new features from the Java Desktop System (JDS). JDS is a secure and comprehensive enterprise desktop software solution that combines open-source innovation from communities such as GNOME, and Firefox. The Desktop includes the following:
  - GNOME 2.16 - The latest enhanced GNOME desktop
  - Firefox 2.0 and Thunderbird 1.5 - Current release of Mozilla browser and email service
  - Orca - Screen reader and magnifier for the JDS/GNOME desktop
  - Java and GNOME bindings for the GNOME Platform libraries and the Cairo 2D drawing engine - Enable GNOME and GTK+ applications to be written in Java software
  - NetBeans plug-ins - Used in the NetBeans IDE to create applications
  - Ekiga - An open-source desktop Voice over IP (VoIP) and video-conferencing application for the GNOME desktop
  - Vino - Provides the ability to remotely administer a desktop session

  To learn more about the JDS features, see Open Solaris
  http://opensolaris.org/os/project/jds/.

Note – The Solaris Express Developer Edition is currently only for x86 based systems. However, developers on SPARC based systems can obtain similar functionality by downloading Solaris Express Community Edition and then installing Sun Studio and NetBeans IDE 5.5 with NetBeans Enterprise Pack 5.5.

Downloads are available at the following Web sites:

- Solaris Express Community Edition (`http://opensolaris.org/os/downloads`)
- Sun Studio 11 (`http://developers.sun.com/sunstudio/downloads`)
- NetBeans IDE 5.5 (`http://www.netbeans.info/downloads/index.php`) with NetBeans Enterprise Pack 5.5.

Automated Network Configuration

Starting with the Solaris Express Developer Edition 5/07 release, the booting process runs the nwamd daemon. This daemon implements an alternate instance of the SMF service `svc:/network/physical` which enables automated network configuration with minimal intervention. The Open Solaris Network Auto-Magic Phase 0 page and nwamd man page contain further information, including instructions for turning off the NWAM daemon, if preferred. For more information and a link to the nwamd(1M) man page, see
http://www.opensolaris.org/os/project/nwam/phase0/.

Note –

For the 5/07 developer release, the NWAM daemon is enabled by default under the following circumstances:

- You have selected the "Solaris Express Developer Edition" choice on the installation screen.
- And, after having made this choice, you are performing an initial installation.

The NWAM daemon is not enabled under the following circumstances:

- On the installation screen, you choose "Solaris Express."
- Or, you choose to upgrade after any choice on the installation screen.

  In those cases, you must manually turn on the NWAM daemon. See the nwamd(1M) man page for details.

Upgrading the Solaris OS When Non-Global Zones Are Installed

Starting with the Solaris Express Developer Edition 2/07 release, you can upgrade the Solaris OS when non-global zones are installed.

Note – The only limitation to upgrading involves a Solaris Flash archive. When you use a Solaris Flash archive to install, an archive that contains non-global zones is not properly installed on your system.

Changes to accommodate systems that have non-global zones installed are summarized below.

- For the Solaris interactive installation program, you can upgrade or patch a system when non-global zones are installed. The time to upgrade or patch might be extensive, depending on the number of non-global zones that are installed.
- For an automated JumpStart installation, you can upgrade or patch with any keyword that applies to an upgrade or patching. The time to upgrade or patch might be extensive, depending on the number of non-global zones that are installed.
- For Solaris Live Upgrade, you can upgrade or patch a system that contains non-global zones. If you have a system that contains non-global zones, Solaris Live Upgrade is the recommended upgrade program or program to add patches. Other upgrade programs might require extensive upgrade time, because the time required to complete the upgrade increases linearly with the number of installed non-global zones. If you are patching a system with Solaris Live Upgrade, you do not have to take the system to single-user mode and you can maximize your system's uptime.

Solaris Live Upgrade creates a copy of the OS on the inactive boot environment. The inactive boot environment can be upgraded or patched when non-global zones are installed. The inactive boot environment can then be booted to become the new boot environment. Changes to accommodate systems that have non-global zones installed are the following:

- A new package, SUNWlucfg, is required to be installed with the other Solaris Live Upgrade packages, SUNWlur and SUNWluu. This package is required for any system, not just a system with non-global zones installed.

  These three packages comprise the software needed to upgrade by using Solaris Live Upgrade. These packages include existing software, new features, and bug fixes. If you do not install these packages on your system before using Solaris Live Upgrade, upgrading to the target release fails.

- Creating a new boot environment from the currently running boot environment remains the same as in previous releases with one exception. You can specify a destination disk slice for a shared file system within a non-global zone.

  The argument to the -m option has a new optional field, *zonename*. This new field enables creating the new boot environment and specifying zones that contain separate file systems. This argument places the zone's file system on a separate slice in the new boot environment.

- The lumount command now provides non-global zones with access to their corresponding file systems that exist on inactive boot environments. When the global zone administrator uses the lumount command to mount an inactive boot environment, the boot environment is mounted for non-global zones as well.

- Comparing boot environments is enhanced. The lucompare command now generates a comparison of boot environments that includes the contents of any non-global zone.

- Listing file systems with the lufslist command is enhanced to display a list of file systems for both the global zone and the non-global zones.

For step-by-step procedures for upgrading a system with non-global zones installed or for information on the Solaris Zones partitioning technology, see the following references.

Description	For More Information
Upgrading with Solaris Live Upgrade on a system with non-global zones	Chapter 9, "Upgrading the Solaris OS on a System With Non-Global Zones Installed," in *Solaris Express Installation Guide: Solaris Live Upgrade and Upgrade Planning*
Creating and using non-global zones	*System Administration Guide: Solaris Containers-Resource Management and Solaris Zones*
Upgrading with JumpStart	*Solaris Express Installation Guide: Custom JumpStart and Advanced Installations*

Description	For More Information
Upgrading with the Solaris installation interactive GUI	*Solaris Express Installation Guide: Basic Installations*

New `sysidkdb` Tool Prevents Having to Configure Your Keyboard

SPARC: This feature was introduced for SPARC based systems in the **Solaris Express 10/06 release**.

x86: This feature was introduced for x86 based systems in the **Solaris Express Developer Edition 2/07**.

The `sysidkdb` tool configures your USB language and its corresponding keyboard layout.

The following procedure occurs:

- If the keyboard is self-identifying, the keyboard language and layout automatically configures during installation.
- If the keyboard is not self-identifying, the `sysidkdb` tool provides you, during the installation, a list of supported keyboard layouts during installation, so that you can select a layout for keyboard configuration.

SPARC: Previously, the USB keyboard assumed a self-identifying value of 1 during the installation. Therefore, all of the keyboards that were not self-identifying always configured for a U.S. English keyboard layout during installation.

Note – PS/2 keyboards are not self-identifying. You are asked to select the keyboard layout during the installation.

Prevent Prompting When You Use the JumpStart Program

If the keyboard is not self-identifying and you want to prevent being prompted during your JumpStart installation, select the keyboard language in your `sysidcfg` file. For JumpStart installations, the default is for the U.S. English language. To select another language and its corresponding keyboard layout, set the keyboard keyword in your `sysidcfg` file.

For more information, see one of the following:

- "Preconfiguring With the sysidcfg File" in *Solaris Express Installation Guide: Network-Based Installations*
- `sysidtool`(1M) man page
- `sysidcfg`(4) man page

New `sharemgr` **Utility for File-Sharing**

Starting with the Solaris Express Developer Edition 2/07 release, you can use the new `sharemgr` utility for file-sharing tasks during installations. This new utility both simplifies and enhances the file-sharing process and related tasks. You do not need to use the `share`, `shareall`, or `unshare` utilities, although these utilities are still available. Additionally, you do not need to edit the `/etc/dfs/dfstab` file.

The `sharemgr` utility introduces the concept of a share group. Options for `sharemgr` are set to a share group, not to a specific file or directory. A share group can be used by multiple file-system types, such as NFS and ZFS. For example, the share group, `my_group`, could have one set of options for NFS and another set of options for ZFS.

For more information, see the `sharemgr`(1M) man page. See also, "sharemgr Command" in *System Administration Guide: Network Services.*

Note – Starting with the Solaris Express Developer Edition 5/07 release, installation documentation provides both options for file-sharing, using `sharemgr` or using the `share` command.

What's New in the Solaris Express 7/06 Release for Installation

Enhanced Security Using the Restricted Networking Profile

Starting with the Solaris Express 7/06, the generic installation has been changed so that all network services, except Secure Shell, are disabled or restricted to respond to local requests only. This change minimizes the potential vulnerabilities a remote attacker might try to exploit. In addition, the change provides a base for customers to enable only the services they require.

For Solaris Express releases, the hardening changes are automatically applied whenever a fresh install is performed. This effect is achieved by invoking the `netservices` command from the SMF upgrade file found in `/var/svc/profile`. Behavior is unchanged if the system is upgraded.

All of the affected services are controlled by the Service Management Framework (SMF). Any individual service can be enabled by using the `svsadm`(1M) and `svccfg`(1M) commands. The `netservices`(1M) command can be used to switch the service startup behavior.

Installing Solaris Trusted Extensions

Starting with the Solaris Express 7/06 release, Solaris Trusted Extensions provides multilevel security for the Solaris OS. This feature enables you to control information in a flexible but highly secure manner. You can now enforce strict access controls to your data based on data sensitivity, not just data ownership.

An installation that accesses Solaris Trusted Extensions differs from a standard installation. For a list of these installation differences and further information about Solaris Trusted Extensions, see "Installing or Upgrading the Solaris OS for Trusted Extensions" in *Solaris Trusted Extensions Installation and Configuration*.

Solaris Flash Can Create an Archive That Includes Large Files

The `flarcreate` command no longer has size limitations on individual files. You can create a Solaris Flash archive that contains individual files over 4 Gbytes. The following two archive utilities are available for use:

- The portable archive interchange utility, `pax`, is the default. The archive can be created without size limitations on individual files.
- The `cpio` archive utility is invoked with `-L cpio` option. Individual files cannot be greater than 2 or 4 Gbytes. The size limitation depends on the version of `cpio` used. This option is useful for backward compatibility issues.

For more information, see "Creating an Archive That Contains Large Files" in *Solaris Express Installation Guide: Solaris Flash Archives (Creation and Installation)*

What's New in the Solaris Express 5/06 Release for Installation

NFSv4 Domain Name Configurable During Installation

Starting with the Solaris Express 5/06 release, the NFS version 4 domain can now be defined during the installation of the Solaris OS. Previously, the NFS domain name was defined during the first system reboot after installation.

This new feature affects installation as follows:

- The `sysidtool` command includes an enhanced `sysidnfs4` program. The `sysidnfs4` program now runs during the installation process to determine whether an NFSv4 domain has been configured for the network.

For further information, see the `sysidtool`(1M) and `sysidnfs4`(1M) man pages.

During an interactive installation, the user is provided with the default NFSv4 domain name that is automatically derived from the OS. The user can accept this default. Or, the user can specify a different NFSv4 domain.

- As part of a Solaris JumpStart installation, a new keyword is available in the `sysidcfg` file. The user can now assign a value for the NFSv4 domain by using the new keyword, `nfs4_domain`.

  - For further information about this new keyword, see the `sysidnfs4`(1M) man page. This man page also provides an example of how to use this new keyword

  - For further information about the NFSv4 domain name configuration, see the *System Administration Guide: Network Services*

What's New in the Solaris Express 1/06 Release for Solaris Installation

This section describes the following new installation features in the Solaris Express release.

x86: GRUB Based Booting

Starting with the Solaris Express release, the open source GNU GRand Unified Boot Loader (GRUB) has been adopted in the Solaris OS for x86 based systems. GRUB is responsible for loading a boot archive into the system's memory. A boot archive is a collection of critical files that is needed during system startup before the root (`/`) file system is mounted. The boot archive is used to boot the Solaris OS.

The most notable change is the replacement of the Solaris Device Configuration Assistant with the GRUB menu. The GRUB menu facilitates booting the different operating systems that are installed on your system. The GRUB menu is displayed when you boot an x86 based system. From the GRUB menu, you can select an OS instance to install by using the arrow keys. If you do not make a selection, the default OS instance is booted.

The GRUB based boot feature provides the following improvements:

- Faster boot times
- Installation from USB CD or DVD drives
- Ability to boot from USB storage devices
- Simplified DHCP setup for PXE boot (no vendor-specific options)
- Elimination of all realmode drivers
- Ability to use Solaris Live Upgrade and the GRUB menu to quickly activate and fall back to boot environments

For more information about GRUB refer to the following sections.

Task	GRUB Task	For More Information
Installation	Overview information about GRUB based booting	What's New: "x86: GRUB Extended Support for Directly Loading and Booting the UNIX Kernel" on page 15
		"x86: GRUB Based Booting (Overview)" on page 69
	Installation planning for GRUB based booting	"x86: GRUB Based Booting (Planning)" on page 72
	How to boot and install over the network with the GRUB menu	"Installing the System From the Network With a DVD Image" in *Solaris Express Installation Guide: Network-Based Installations*
	How to boot and install with the GRUB menu and the Custom JumpStart installation method	"Performing a Custom JumpStart Installation" in *Solaris Express Installation Guide: Custom JumpStart and Advanced Installations*
	How to use the GRUB menu and Solaris Live Upgrade to activate and fall back to boot environments	■ "Activating a Boot Environment" in *Solaris Express Installation Guide: Solaris Live Upgrade and Upgrade Planning* ■ Chapter 6, "Failure Recovery: Falling Back to the Original Boot Environment (Tasks)," in *Solaris Express Installation Guide: Solaris Live Upgrade and Upgrade Planning*
	Locating the GRUB menu's `menu.lst` file	"Locating the GRUB Menu's menu.lst File (Tasks)" in *Solaris Express Installation Guide: Solaris Live Upgrade and Upgrade Planning*
System Administration	How to perform system administration tasks with the GRUB menu	■ *System Administration Guide: Basic Administration* ■ *System Administration Guide: Devices and File Systems* ■ `bootadm(1M)` ■ `installgrub(1M)`

Note – GNU is a recursive acronym for "GNU's Not UNIX." For more information, go to http://www.gnu.org.

3

Solaris Installation and Upgrade (Roadmap)

This chapter provides you with information about decisions you need to make before you install or upgrade the Solaris Operating System (Solaris OS). This chapter contains the following sections:

Note – This book uses the term *slice*, but some Solaris documentation and programs might refer to a slice as a partition.

x86: To avoid confusion, this book distinguishes between x86 `fdisk` partitions and the divisions within the Solaris `fdisk` partition. The x86 `fdisk` divisions are called partitions. The divisions within the Solaris `fdisk` partition are called slices.

Task Map: Installing or Upgrading the Solaris Software

The following task map is an overview of the steps necessary to install or upgrade the Solaris OS when using any installation program. Use this task map to identify all of the decisions that you need to make to complete the most efficient installation for your environment.

TABLE 3–1   Task Map: Installing or Upgrading the Solaris Software

Task	Description	For Instructions
Choose initial installation or upgrade.	Decide if you want to perform an initial installation or an upgrade.	"Initial Installation, or Upgrade?" on page 28.
Choose an installation program.	The Solaris OS provides several programs for installation or upgrade. Choose the installation method that is most appropriate for your environment.	"Choosing a Solaris Installation Method" on page 29.
(Solaris interactive installation program) Choose a default or custom installation.	Decide which type installation is suitable for your environment: ■ If you are using a graphical user interface (GUI) you can choose a default or a custom installation: 　■ A default installation formats the hard disk and installs a preselected set of software. 　■ A custom installation enables you to modify the hard disk layout and select the software that you want to install. ■ If you use a text installer (non-graphical interface), you can select the default values or edit the values to select the software you want to install.	For information on the Solaris installation program's choices, see Chapter 5
For initial installations only, choose open network security or restricted network security.	For an initial installation, determine whether to disable or constrain network services to respond to local requests only during the installation. The default is to select open network security during installation.	"Planning Network Security" on page 43
Review system requirements. Also, plan and allocate disk space and swap space.	Determine if your system meets the minimum requirements to install or upgrade. Allocate disk space on your system for the components of the Solaris OS that you want to install. Determine the appropriate swap-space layout for your system.	Chapter 4.
Choose to install a system from local media or from the network.	Decide on the most appropriate installation media for your environment.	"Installing From the Network or From DVD or CDs?" on page 28.

TABLE 3–1   Task Map: Installing or Upgrading the Solaris Software   *(Continued)*

Task	Description	For Instructions
Gather information about your system.	▪ For the Solaris installation program, complete the worksheet to collect all of the information that you need to install or upgrade. ▪ For the custom JumpStart installation method, decide which profile keywords to use in your profile. Then review the keyword descriptions to find the information about your system that you need.	▪ For the Solaris installation program, see either of the following documents: ▪ For an initial installation: "Checklist for Installation" on page 49 ▪ For an upgrade: Chapter 5 ▪ For the custom JumpStart installation method, see Chapter 8, "Custom JumpStart (Reference)," in *Solaris Express Installation Guide: Custom JumpStart and Advanced Installations*
(Optional) Set system parameters.	You can preconfigure system information to avoid being prompted for the information during the installation or upgrade.	Chapter 2, "Preconfiguring System Configuration Information (Tasks)," in *Solaris Express Installation Guide: Network-Based Installations*.
(Optional) Prepare to install the Solaris software from the network.	If you chose to install the Solaris software from the network, complete the following tasks. ▪ (x86 based systems) Verify that your system supports PXE ▪ Create an installation server ▪ Create a boot server (if necessary) ▪ Configure a DHCP server (if necessary) ▪ Set up systems to be installed from the network	To install over a local area network, see Chapter 6, "Installing From the Network With CD Media (Tasks)," in *Solaris Express Installation Guide: Network-Based Installations*. To install over a wide area network, see Chapter 11, "Installing With WAN Boot (Tasks)," in *Solaris Express Installation Guide: Network-Based Installations*.
(Upgrade only) Perform tasks prior to upgrade.	Back up your system and determine if you can upgrade with disk space reallocation.	"Upgrade Planning" on page 38.
Perform an installation or upgrade.	Use the Solaris installation method that you chose to install or upgrade the Solaris software.	The chapter or chapters that provide detailed instructions for the installation programs.
Troubleshoot installation problems	Review the troubleshooting information when you encounter problems with your installation.	Appendix A, "Troubleshooting (Tasks)," in *Solaris Express Installation Guide: Custom JumpStart and Advanced Installations*.

Installing From the Network or From DVD or CDs?

The Solaris software is distributed on DVD or CD media so that you can install or upgrade systems that have access to a DVD-ROM or CD-ROM drive.

You can set up the systems to install from the network with remote DVD or CD images. You might want to set up systems this way for the following reasons:

- If you have systems that do not have local DVD-ROM or CD-ROM drives
- If you are installing several systems and do not want to insert the discs into every local drive to install the Solaris software

You can use all of the Solaris installation methods to install a system from the network. However, by installing systems from the network with the Solaris Flash installation feature or with a custom JumpStart installation, you can centralize and automate the installation process in a large enterprise. For more details about the different installation methods, refer to "Choosing a Solaris Installation Method" on page 29.

Installing the Solaris software from the network requires initial setup. For information about preparing to install from the network, choose one of the following options.

For detailed instructions about preparing to install from a local area network	Chapter 6, "Installing From the Network With CD Media (Tasks)," in *Solaris Express Installation Guide: Network-Based Installations*
For instructions about preparing to install over a wide area network	Chapter 11, "Installing With WAN Boot (Tasks)," in *Solaris Express Installation Guide: Network-Based Installations*
For instructions about how to install x86 based clients over the network by using PXE	"Overview of Booting and Installing Over the Network With PXE" in *Solaris Express Installation Guide: Network-Based Installations*

Initial Installation, or Upgrade?

You can choose to perform an initial installation or, if your system is already running the Solaris OS, you can upgrade your system.

Initial Installation

An initial installation overwrites the system's disk with the new version of the Solaris OS. If your system is not running the Solaris OS, you must perform an initial installation.

If the system is already running the Solaris OS, you can choose to perform an initial installation. If you want to preserve any local modifications, before you install, you must back up the local modifications. After you complete the installation, you can restore the local modifications.

You can use any of the Solaris installation methods to perform an initial installation. For detailed information about the different Solaris installation methods, refer to "Choosing a Solaris Installation Method" on page 29.

Upgrade

You can upgrade the Solaris OS by using two upgrade methods: standard and Solaris Live Upgrade. A standard upgrade maintains as many existing configuration parameters as possible of the current Solaris OS. Solaris Live Upgrade creates a copy of the current system. This copy can be upgraded with a standard upgrade. The upgraded Solaris OS can then be switched to become the current system by a simple reboot. If a failure occurs, you can switch back to the original Solaris OS with a reboot. Solaris Live Upgrade enables you to keep your system running while you upgrade and enables you to switch back and forth between Solaris OS releases.

For more information about upgrading and the list of upgrade methods, see "Upgrade Planning" on page 38.

Choosing a Solaris Installation Method

The Solaris OS provides several programs for installation or upgrade. Each installation technology offers different features that are designed for specific installation requirements and environments. Use the following table to help you decide which installation method to use.

TABLE 3–2 Choosing Your Installation Method

Task	Installation Method	Reasons for Choosing This Program	Instructions
Install one system from CD-ROM or DVD-ROM media with an interactive program.	Solaris installation program	■ This program divides tasks into panels, prompts you for information, and offers default values. ■ This program is not an efficient method when you have to install or upgrade multiple systems. For batch installations of multiple systems, use custom JumpStart or the Solaris Flash installation feature.	*Solaris Express Installation Guide: Basic Installations*

TABLE 3–2 Choosing Your Installation Method *(Continued)*

Task	Installation Method	Reasons for Choosing This Program	Instructions
Install one system over a local area network.	Solaris installation program over the network	This program enables you to set up an image of the software you want to install on a server and install this image on a remote system. If you need to install multiple systems, you can use the network installation image with the custom JumpStart and Solaris Flash installation methods to efficiently install or upgrade systems on your network.	Part II, "Installing Over a Local Area Network," in *Solaris Express Installation Guide: Network-Based Installations*
Automate the installation or upgrade of multiple systems based on profiles you create.	Custom JumpStart	This program efficiently installs multiple systems. But if you only have a few systems, the creation of a custom JumpStart environment might be time consuming. For a few systems, use the Solaris interactive installation program.	Chapter 3, "Preparing Custom JumpStart Installations (Tasks)," in *Solaris Express Installation Guide: Custom JumpStart and Advanced Installations*
Replicate the same software and configuration on multiple systems.	Solaris Flash archives	■ This program saves installation time by installing all Solaris packages at once on your system. Other programs install each individual Solaris package and update the package map for each package. ■ Solaris Flash archives are large files and require a significant amount of disk space. To manage different installation configurations or to change your installation configuration, you might consider using the custom JumpStart installation method. Alternatively, you can accomplish system-specific customizations by using a JumpStart finish script or an embedded Solaris Flash postdeployment script.	Chapter 1, "Solaris Flash (Overview)," in *Solaris Express Installation Guide: Solaris Flash Archives (Creation and Installation)*
Install systems over a wide area network (WAN) or the Internet.	WAN boot	If you want to install a Solaris Flash archive over the network, this program enables a secure installation.	Chapter 9, "WAN Boot (Overview)," in *Solaris Express Installation Guide: Network-Based Installations*

TABLE 3–2 Choosing Your Installation Method *(Continued)*

Task	Installation Method	Reasons for Choosing This Program	Instructions
Upgrade a system while it is running.	Solaris Live Upgrade	■ This program enables you to upgrade or add patches to avoid the system down time related to a standard upgrade ■ This program enables you to test an upgrade or new patches without affecting the current OS	Chapter 2, "Solaris Live Upgrade (Overview)," in *Solaris Express Installation Guide: Solaris Live Upgrade and Upgrade Planning*
After installing the Solaris OS, create an isolated application environment.	Solaris Zones partitioning technology	This program creates isolated non-global zones that provide a secure application environment. This isolation prevents processes that are running in one zone from monitoring or affecting processes that are running in any other zones.	Chapter 16, "Introduction to Solaris Zones," in *System Administration Guide: Solaris Containers-Resource Management and Solaris Zones*

Sun Java System Application Server Platform Edition 9

The Sun Java System Application Server Platform Edition 9 provides for broad deployment of application services and web services. This software is automatically installed with the Solaris OS. You can find documentation for the server in the following areas:

Description	For More Information
For documentation about starting the server	*Sun Java System Application Server Platform Edition 9 Quick Start Guide*
For the full Application Server documentation set	http://docs.sun.com/app/docs/coll/1343.3
For the JavaTM EE 5 Tutorial	http://java.sun.com/javaee/5/docs/tutorial/doc/index.html

◆ ◆ ◆ **C H A P T E R 4**

4

System Requirements, Guidelines, and Upgrade (Planning)

This chapter describes system requirements to install or upgrade to the Solaris OS. General guidelines for planning the disk space and default swap space allocation are also provided. This chapter contains the following sections:

- "System Requirements and Recommendations" on page 33
- "Allocating Disk and Swap Space" on page 34
- "Upgrade Planning" on page 38
- "Locale Values" on page 44
- "Platform Names and Groups" on page 45
- "x86: Partitioning Recommendations" on page 45
- "How to Find the Version of the Solaris OS That Your System Is Running" on page 46

System Requirements and Recommendations

TABLE 4–1 Memory, Swap, and Processor Recommendations

Requirement Type	Size
Memory to install or upgrade	■ **SPARC**: 512 MB is the recommended size. 128 MB is the minimum size. ■ **x86**: 512 MB is the recommended size. 256 MB is the minimum size. **Note –** Some optional installation features are enabled only when sufficient memory is present. For example, if your system has insufficient memory and you install from a DVD, you install through the Solaris installation program 's text installer, not through the GUI. For more information about these memory requirements, see Table 4–2.
Swap area	512 MB is the default size. **Note –** You might need to customize the swap space. Swap space is based on the size of the system's hard disk.

TABLE 4–1 Memory, Swap, and Processor Recommendations   *(Continued)*

Requirement Type	Size
Processor requirements	■ **SPARC**: 200–MHz or faster processor is required. ■ **x86**: 120–MHz or faster processor is recommended. Hardware floating-point support is required.

You can choose to install the software with a GUI or with or without a windowing environment. If there is sufficient memory, the GUI is displayed by default. Other environments are displayed by default if memory is insufficient for the GUI. You can override defaults with the nowin or text boot options. But, you are limited by the amount of memory in your system or by installing remotely. Also if the Solaris installation program does not detect a video adapter, it automatically displays in a console-based environment. Table 4–2 describes these environments and lists minimal memory requirements for displaying them.

TABLE 4–2 Memory Requirements for Display Options

Memory	Type of Installation	Description
■ **SPARC**: 64–511 MB ■ **x86**: 256–511 MB	Text-based	Contains no graphics, but provides a window and the ability to open other windows. If you install by using the text boot option and the system has enough memory, you are installing in a windowing environment. If you are installing remotely through a tip line or using the nowin boot option, you are limited to the console-based installation.
■ **SPARC**: 512 MB or greater ■ **x86**: 512 MB	GUI-based	Provides windows, pull-down menus, buttons, scrollbars, and iconic images.

Allocating Disk and Swap Space

Before you install the Solaris software, you can determine if your system has enough disk space by doing some high-level planning.

General Disk Space Planning and Recommendations

Planning disk space is different for everyone. Consider allocating space for the following conditions, depending on your needs.

TABLE 4–3   General Disk Space and Swap Space Planning

Conditions for Space Allocations	Description
File systems	For each file system that you create, allocate an additional 30 percent more disk space than you need to enable you to upgrade to future Solaris versions.
	By default, the Solaris installation methods create only root (/) and /swap. When space is allocated for OS services, the /export directory is also created. If you are upgrading to a major Solaris release, you might need to reslice your system or allocate double the space that you need at installation time. If you are upgrading to an update, you could prevent having to reslice your system by allocating extra disk space for future upgrades. A Solaris update release needs approximately 10 percent more disk space than the previous release. You can allocate an additional 30 percent of disk space for each file system to allow space for several Solaris updates.
The /var file system	If you intend to use the crash dump feature savecore(1M), allocate double the amount of your physical memory in the /var file system.
Swap	The Solaris installation program allocates a default swap area of 512 MB under the following conditions: - If you use the installation program's automatic layout of disk slices - If you avoid manually changing the size of the swap slice
	By default, the Solaris installation programs allocate swap space by placing swap so that it starts at the first available disk cylinder (typically cylinder 0 on SPARC based systems). This placement provides maximum space for the root (/) file system during the default disk layout and enables the growth of the root (/) file system during an upgrade.
	If you think you might need to expand the swap area in the future, you can place the swap slice so that it starts at another disk cylinder by using one of the following methods. For the Solaris installation program, you can customize the disk layout in cylinder mode and manually assign the swap slice to the desired location.
	For the custom JumpStart installation program, you can assign the swap slice in the profile file. For more information about the JumpStart profile file, see "Creating a Profile" in *Solaris Express Installation Guide: Custom JumpStart and Advanced Installations*.
	For an overview of the swap space, see Chapter 20, "Configuring Additional Swap Space (Tasks)," in *System Administration Guide: Devices and File Systems*.
A server that is providing home directory file systems	By default, home directories are usually located in the /export file system.
The Solaris software group you are installing	A software group is a grouping of software packages. When you are planning disk space, remember that you can add or remove individual software packages from the software group that you select. For information about software groups, see "Disk Space Recommendations for Software Groups" on page 36.

TABLE 4–3 General Disk Space and Swap Space Planning *(Continued)*

Conditions for Space Allocations	Description
Upgrade	▪ If you are using Solaris Live Upgrade to upgrade an inactive boot environment and want information about disk space planning, see "Solaris Live Upgrade Disk Space Requirements" in *Solaris Express Installation Guide: Solaris Live Upgrade and Upgrade Planning*
	▪ If you are using the Solaris installation program or custom Jumpstart to plan disk space, see "Upgrading With Disk Space Reallocation" on page 41
	▪ If you have non-global zones installed on a system, see "Disk Space Requirements for Non-Global Zones" on page 81
Language support	For example, Chinese, Japanese, or Korean. If you plan to install a single language, allocate approximately 0.7 GB of additional disk space for the language. If you plan to install all language supports, you need to allocate up to approximately 2.5 GB of additional disk space for the language supports, depending on the software group you install.
Printing or mail support	Allocate additional space.
Additional software or third-party software	Allocate additional space.

Disk Space Recommendations for Software Groups

The Solaris software groups are collections of Solaris packages. Each software group includes support for different functions and hardware drivers.

▪ For an initial installation, you select the software group to install, based on the functions that you want to perform on the system.

▪ For an upgrade, you must upgrade to a software group that is installed on the system. For example, if you previously installed the End User Solaris Software Group on your system, you cannot use the upgrade option to upgrade to the Developer Solaris Software Group. However, during the upgrade you can add software to the system that is not part of the currently installed software group.

When you are installing the Solaris software, you can choose to add or remove packages from the Solaris software group that you selected. When you are selecting which packages to add or remove, you need to know about software dependencies and how the Solaris software is packaged.

The following figure shows the grouping of software packages. Reduced Network Support contains the minimal number of packages and Entire Solaris Software Group Plus OEM Support contains all the packages.
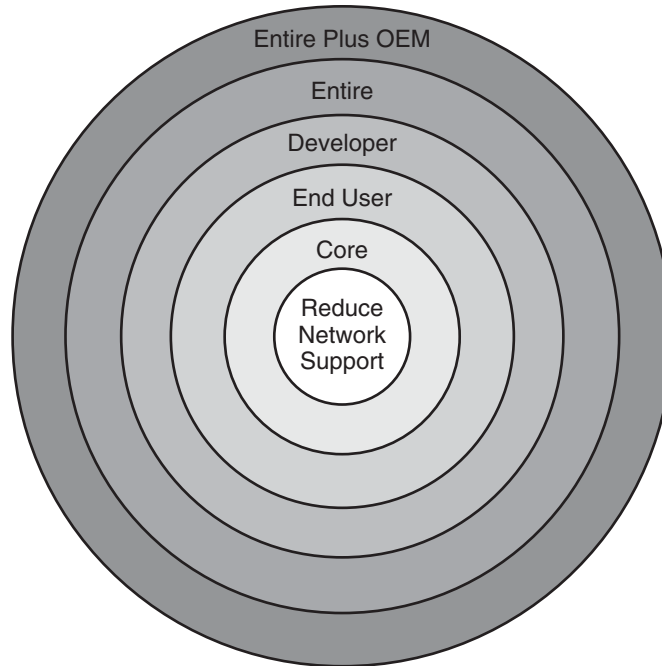
FIGURE 4–1 Solaris Software Groups

Table 4–4 lists the Solaris software groups and the recommended amount of disk space that you need to install each group.

Note – The disk space recommendations in Table 4–4 include space for the following items.

- Swap space
- Patches
- Additional software packages

You might find that the software groups require less disk space than the amount that is listed in this table.

TABLE 4–4 Disk Space Recommendations for Software Groups

Software Group	Description	Recommended Disk Space
Entire Solaris Software Group Plus OEM Support	Contains the packages for the Entire Solaris Software Group plus additional hardware drivers, including drivers for hardware that is not on the system at the time of installation.	6.8 GB

TABLE 4–4 Disk Space Recommendations for Software Groups *(Continued)*

Software Group	Description	Recommended Disk Space
Entire Solaris Software Group	Contains the packages for the Developer Solaris Software Group and additional software that is needed for servers.	6.7 GB
Developer Solaris Software Group	Contains the packages for the End User Solaris Software Group plus additional support for software development. The additional software development support includes libraries, include files, man pages, and programming tools. Compilers are not included.	6.6 GB
End User Solaris Software Group	Contains the packages that provide the minimum code that is required to boot and run a networked Solaris system and the Common Desktop Environment.	5.3 GB
Core System Support Software Group	Contains the packages that provide the minimum code that is required to boot and run a networked Solaris system.	2.0 GB
Reduced Network Support Software Group	Contains the packages that provide the minimum code that is required to boot and run a Solaris system with limited network service support. The Reduced Network Support Software Group provides a multiuser text-based console and system administration utilities. This software group also enables the system to recognize network interfaces, but does not activate network services.	2.0 GB

Upgrade Planning

You can upgrade a system by using one of three different upgrade methods: Solaris Live Upgrade, the Solaris installation program, and custom JumpStart.

TABLE 4–5 Solaris Upgrade Methods

Current Solaris OS	Solaris Upgrade Methods
Solaris 8, Solaris 9, Solaris 10	■ Solaris Live Upgrade – Upgrades a system by creating and upgrading a copy of the running system ■ The Solaris installation program – Provides an interactive upgrade with a graphical user interface or command-line interface ■ Custom JumpStart method – Provides an automated upgrade

Upgrade Limitations

The following table lists limitations when you upgrade a system under some conditions.

Issue	Description
Upgrading to a different software group	You cannot upgrade your system to a software group that is not installed on the system. For example, if you previously installed the End User Solaris Software Group on your system, you cannot use the upgrade option to upgrade to the Developer Solaris Software Group. However, during the upgrade you can add software to the system that is not part of the currently installed software group.
Upgrading when non-global zones are installed	You can upgrade a system that has non-global zones installed with the Solaris installation program, Solaris Live Upgrade or JumpStart. The following limitations apply: ■ Solaris Live Upgrade is the recommend program to upgrade or patch a system. Other upgrade programs might require extensive upgrade time, because the time required to complete the upgrade increases linearly with the number of installed non-global zones. If you are patching a system with Solaris Live Upgrade, you do not have to take the system to single-user mode and you can maximize your system's uptime. ■ When you use a Solaris Flash archive to install, an archive that contains non-global zones is not properly installed on your system.
Upgrading with Veritas file systems	The Solaris interactive installation and custom JumpStart programs do not present you with the opportunity to upgrade a system when you are using Veritas VxVM file systems under these conditions: ■ If the root file system to be upgraded is under Veritas control. For example, if the root (/) file system is mounted on a /dev/vx/... device. ■ If any Solaris software is installed on any file system that is under Veritas control. For example, if the /usr file system is mounted on a /dev/vx/... device. To upgrade when Veritas VxVM is configured, use one of the following methods: ■ Use Solaris Live Upgrade with this procedure, "System Panics When Upgrading With Solaris Live Upgrade Running Veritas VxVm" in *Solaris Express Installation Guide: Solaris Live Upgrade and Upgrade Planning*. ■ If you have non-global zones installed, you must migrate the affected file systems from VxVM file systems to UFS file systems. You cannot use the Solaris Live Upgrade procedure in the previous procedure.

Upgrade Programs

You can perform a standard interactive upgrade with the Solaris installation program or an unattended upgrade with the custom JumpStart installation method. Solaris Live Upgrade enables you to upgrade a running system.

Upgrade Program	Description	For More Information
Solaris Live Upgrade	Enables you to create a copy of the currently running system. The copy can be upgraded and then a reboot switches the upgraded copy to become the currently running system. Using Solaris Live Upgrade reduces the downtime that is required to upgrade the Solaris OS. Also, Solaris Live Upgrade can prevent problems with upgrading. An example is the ability to recover from an upgrade if the power fails, because the copy being upgraded is not the currently running system.	To plan for disk space allocation when using Solaris Live Upgrade, see "Solaris Live Upgrade Requirements" in *Solaris Express Installation Guide: Solaris Live Upgrade and Upgrade Planning.*
The Solaris installation program	Guides you through an upgrade with an interactive GUI.	Chapter 2, "Installing With the Solaris Installation Program (Tasks)," in *Solaris Express Installation Guide: Basic Installations.*
Custom JumpStart program	Provides an automated upgrade. A profile file and optional preinstallation and postinstallation scripts provide the information required. When creating a custom JumpStart profile for an upgrade, specify `install_type upgrade`. You must test the custom JumpStart profile against the system's disk configuration and currently installed software before you upgrade. Use the `pfinstall -D` command on the system that you are upgrading to test the profile. You cannot test an upgrade profile by using a disk configuration file.	■ For more information about testing the upgrade option, refer to "Testing a Profile" in *Solaris Express Installation Guide: Custom JumpStart and Advanced Installations* ■ For more information about creating a upgrade profile, see "Profile Examples" in *Solaris Express Installation Guide: Custom JumpStart and Advanced Installations* ■ For more information about performing an upgrade, see "Performing a Custom JumpStart Installation" in *Solaris Express Installation Guide: Custom JumpStart and Advanced Installations*

Installing a Solaris Flash Archive Instead of Upgrading

The Solaris Flash installation feature provides a method of creating a copy of the whole installation from a master system that can be replicated on many clone systems. This copy is called a Solaris Flash archive. You can install an archive by using any installation program.

⚠️ **Caution** – A Solaris Flash archive cannot be properly created when a non-global zone is installed. The Solaris Flash feature is not compatible with Solaris Zones partitioning technology. If you create a Solaris Flash archive, the resulting archive is not installed properly when the archive is deployed under these conditions:

- The archive is created in a non-global zone
- The archive is created in a global zone that has non-global zones installed

Creating an Archive That Contains Large Files

The default copy method that is used when you create a Solaris Flash archive is the pax utility. The flarcreate command uses the pax utility to create an archive without size limitations on individual files. Individual file sizes can be greater than 4 Gbytes. The flarcreate command with the -L cpio option creates a cpio archive. This option is useful for backward compatibility.

For information about installing an archive, see the following table.

Solaris Live Upgrade	"Installing Solaris Flash Archives on a Boot Environment" in *Solaris Express Installation Guide: Solaris Live Upgrade and Upgrade Planning*
Custom JumpStart	"To Prepare to Install a Solaris Flash Archive With a Custom JumpStart Installation" in *Solaris Express Installation Guide: Custom JumpStart and Advanced Installations*
Solaris interactive installation	Chapter 4, "Installing and Administering Solaris Flash Archives (Tasks)," in *Solaris Express Installation Guide: Solaris Flash Archives (Creation and Installation)*
WANboot	Chapter 12, "Installing With WAN Boot (Tasks)," in *Solaris Express Installation Guide: Network-Based Installations*

Upgrading With Disk Space Reallocation

The upgrade option in the Solaris installation program and the upgrade keyword in the custom JumpStart program provide the ability to reallocate disk space. This reallocation automatically changes the sizes of the disk slices. You can reallocate disk space if the current file systems do not have enough space for the upgrade. For example, file systems might need more space for the upgrade for the following reasons:

- The Solaris software group that is currently installed on the system contains new software in the new release. Any new software that is included in a software group is automatically selected to be installed during the upgrade.
- The size of the existing software on the system has increased in the new release.

The auto-layout feature attempts to reallocate the disk space to accommodate the new size requirements of the file system. Initially, auto-layout attempts to reallocate space, based on a set of default constraints. If auto-layout cannot reallocate space, you must change the constraints on the file systems.

Note – Auto-layout does not have the ability to "grow" file systems. Auto-layout reallocates space by the following process:

1. Backing up required files on the file systems that need to change.
2. Repartitioning the disks on the basis of the file system changes.
3. Restoring the backup files before the upgrade happens.

- If you are using the Solaris installation program, and auto-layout cannot determine how to reallocate the disk space, you must use the custom JumpStart program to upgrade.
- If you are using the custom JumpStart method to upgrade and you create an upgrade profile, disk space might be a concern. If the current file systems do not contain enough disk space for the upgrade, you can use the backup_media and layout_constraint keywords to reallocate disk space. For an example of how to use the backup_media and layout_constraint keywords in a profile, refer to "Profile Examples" in *Solaris Express Installation Guide: Custom JumpStart and Advanced Installations*.

Backing Up And Restarting Systems For an Upgrade

Backing up your existing file systems before you upgrade to the Solaris OS is highly recommended. If you copy file systems to removable media, such as tape, you can safeguard against data loss, damage, or corruption.

- For detailed instructions to back up your system, refer to Chapter 23, "Backing Up and Restoring File Systems (Overview)," in *System Administration Guide: Devices and File Systems*.
- To backup your system when non-global zones are installed, see Chapter 26, "Solaris Zones Administration (Overview)," in *System Administration Guide: Solaris Containers-Resource Management and Solaris Zones*.

In previous releases, the restart mechanism enabled you to continue an upgrade after a loss of power or other similar problem. Starting with the Solaris Express 2/07 release, the restart mechanism is unreliable. If you have a problem, your upgrade might not restart.

Planning Network Security

Starting with the Solaris Express 7/06 release, the generic installation has been changed so that all network services except Secure Shell are disabled or restricted to respond to local requests only. This change minimizes the potential vulnerabilities a remote attacker might try to exploit. In addition, the change provides a base for customers to enable only the services they require.

For Solaris Express releases, the hardening changes are automatically applied whenever a fresh install is performed. This effect is achieved by invoking the `netservices` command from the SMF upgrade file found in `/var/svc/profile`. Behavior is unchanged if the system is upgraded.

Restricted Security Specifics

Numerous services are fully disabled. Other services are still enabled, but these services are restricted to local connections only. The Secure Shell remains fully enabled.

For example, the following table lists network services that, for the Solaris 10 11/06 release, are restricted to local connections.

TABLE 4–6   Solaris 10 11/06 SMF Restricted Services

Service	FMRI	Property
rpcbind	`svc:/network/rpc/bind`	`config/local_only`
syslogd	`svc:/system/system-log`	`config/log_from_remote`
sendmail	`svc:/network/smtp:sendmail`	`config/local_only`
smcwebserver	`svc:/system/webconsole:console`	`options/tcp_listen`
WBEM	`svc:/application/management/wbem`	`options/tcp_listen`
X server	`svc:/application/x11/x11-server`	`options/tcp_listen`
dtlogin	`svc:/application/graphical-login/cde-login`	`dtlogin/args`
ToolTalk	`svc:/network/rpc cde-ttdbserver:tcp`	`proto=ticotsord`
dtcm	`svc:/network/rpc cde-calendar-manager`	`proto=ticits`

TABLE 4–6 Solaris 10 11/06 SMF Restricted Services   *(Continued)*

Service	FMRI	Property
BSD print	`svc:/application/` `print/rfc1179:default`	`bind_addr=localhost`

Revising Security Settings After Installation

With the restricted network security feature, all of the affected services are controlled by the Service Management Framework (SMF). Any individual network service can be enabled after an initial installation by using the svcadm and svccfg commands. The netservices(1M) command can be used to switch the service startup behavior.

For further information about revising security settings, see "How to Create an SMF Profile" in *System Administration Guide: Basic Administration*. See also the following man pages.

- netservices(1M)
- svcadm(1M)
- svccfg(1M) commands.

Locale Values

As a part of your installation, you can preconfigure the locale that you want the system to use. A *locale* determines how online information is displayed in a specific language and specific region. A language might also include more than one locale to accommodate regional differences, such as differences in the format of date and time, numeric and monetary conventions, and spelling.

You can preconfigure the system locale in a custom JumpStart profile or in the sysidcfg file.

Task	For More Information
Setting the locale in a profile	"Creating a Profile" in *Solaris Express Installation Guide: Custom JumpStart and Advanced Installations*
Setting the locale in the sysidcfg file	"Preconfiguring With the sysidcfg File" in *Solaris Express Installation Guide: Network-Based Installations*
List of locale values	*International Language Environments Guide*

Platform Names and Groups

When you are adding clients for a network installation, you must know your system architecture (platform group). If you are writing a custom JumpStart installation rules file, you need to know the platform name.

Some examples of platform names and groups follow. For a full list of SPARC based systems, see *Solaris Sun Hardware Platform Guide* at `http://docs.sun.com/`.

TABLE 4–7   Example of Platform Names and Groups

System	Platform Name	Platform Group
Sun Fire	T2000	sun4v
Sun Blade™	SUNW,Sun-Blade-100	sun4u
x86 based	i86pc	i86pc

Note – On a running system, you can also use the uname -i command to determine a system's *platform name* or the uname -m command to determine a system's *platform group*.

x86: Partitioning Recommendations

When using the Solaris OS on x86 based systems, follow these guidelines for partitioning your system.

The Solaris installation program uses a default boot-disk partition layout. These partitions are called fdisk partitions. An fdisk partition is a logical partition of a disk drive that is dedicated to a particular operating system on x86 based systems. To install the Solaris software, you must set up at least one Solaris fdisk partition on an x86 based system. x86 based systems allow up to four different fdisk partitions on a disk. These partitions can be used to hold individual operating systems. Each operating system must be located on a unique fdisk partition. A system can only have one Solaris fdisk partition per disk.

TABLE 4–8   x86: Default Partitions

Partitions	Partition Name	Partition Size
First partition (on some systems)	Diagnostic or Service partition	Existing size on system.

TABLE 4–8   x86: Default Partitions   *(Continued)*

Partitions	Partition Name	Partition Size
Second partition (on some systems)	x86 boot partition	■ If you are performing an initial installation, this partition is not created.
		■ If you upgrade and your system does not have an existing x86 boot partition, this partition is not created.
		■ If you upgrade and your system has an x86 boot partition:
		■ If the partition is required to bootstrap from one boot device to another, the x86 boot partition is preserved on the system.
		■ If the partition is not required to boot additional boot devices, the x86 boot partition is removed. The contents of the partition are moved to the root partition.
Third partition	Solaris OS partition	Remaining space on the boot disk.

Default Boot-Disk Partition Layout Preserves the Service Partition

The Solaris installation program uses a default boot-disk partition layout to accommodate the diagnostic or Service partition. If your system currently includes a diagnostic or Service partition, the default boot-disk partition layout enables you to preserve this partition.

Note – If you install the Solaris OS on an x86 based system that does not currently include a diagnostic or Service partition, the installation program does not create a new diagnostic or Service partition by default. If you want to create a diagnostic or Service partition on your system, see your hardware documentation.

How to Find the Version of the Solaris OS That Your System Is Running

To see the version of Solaris software that is running on your system, type either of the following commands.

```
$ uname -a
```

The cat command provides more detailed information.

```
$ cat /etc/release
```

5

Gathering Information Before Installation or Upgrade (Planning)

This chapter contains checklists to help you gather all of the information that you need to install or upgrade your system.

Checklist for Installation

Use the following checklist to gather the information that you need to install the Solaris OS. You do not need to gather all of the information that is requested on the worksheet. You need to collect only the information that applies to your system.

TABLE 5–1   Installation Checklist

Information for Installation	Description or Example	Answer — Defaults are noted with an asterisk (*)
Network connection	Is the system connected to a network?	Networked/Nonnetworked
Network security	**Starting with the Solaris Express 7/06 release**, the generic installation has been changed so that all network services except Secure Shell are disabled or restricted to respond to local requests only. Individual services can be enables after installation. For further information, see "Planning Network Security" on page 43.	Restricted/Open network security
DHCP	Can the system use Dynamic Host Configuration Protocol (DHCP) to configure its network interfaces? DHCP provides the network parameters that are necessary for installation.	Yes/No*

TABLE 5–1   Installation Checklist   *(Continued)*

Information for Installation		Description or Example	Answer — Defaults are noted with an asterisk (*)
If you are not using DHCP, note the network address.	IP Address	If you are not using DHCP, supply the IP address for the system. Example: 172.31.255.255 To find this information on a running system, type the following command. `# ypmatch host-name hosts`	
	Subnet	If you are not using DHCP, is the system part of a subnet? If yes, what is the netmask of the subnet? Example: 255.255.255.0 To find this information on a running system, type the following command. `# more /etc/netmasks`	
	IPv6	Do you want to enable IPv6 on this machine? IPv6 is a part of the TCP/IP Internet protocol that facilitates IP addressing by adding better security and increasing Internet addresses.	Yes/No*
Host name		Host name that you choose for the system. To find this information on a running system, type the following command. `# uname -n`	
Kerberos		Do you want to configure Kerberos security on this machine? If yes, gather this information: Default Realm: Administration Server: First KDC: (Optional) Additional KDCs: The Kerberos service is a client-server architecture that provides secure transactions over networks.	Yes/No*

TABLE 5–1 Installation Checklist   *(Continued)*

Information for Installation		Description or Example	Answer — Defaults are noted with an asterisk (*)
If the system uses a naming service, provide the following information.	Naming Service	Which naming service should this system use? To find this information on a running system, type the following command. **# cat /etc/nsswitch.conf** A naming service stores information in a central place, which enables users, machines, and applications to communicate across the network. Examples of information that is stored are host names and addresses or user names and passwords.	NIS+/NIS/DNS/ LDAP/None
	Domain Name	Provide the name of the domain in which the system resides. During installation, you can choose the default NFSv4 domain name. Or, you can specify a custom NFSv4 domain name. ■ For instructions about how to find the domain name on a running system, see "Checking for the NFS Version 4 Domain" in *System Administration Guide: Network Services* ■ To preconfigure the NFSv4 domain name in the sysidcfg file, see "nfs4_domain Keyword" in *Solaris Express Installation Guide: Network-Based Installations*.	

TABLE 5–1   Installation Checklist   *(Continued)*

Information for Installation		Description or Example	Answer — Defaults are noted with an asterisk (*)
	NIS+ and NIS	Do you want to specify a name server or let the installation program find one?	Specify one/Find one*
		If you want to specify a name server, provide the following information.	
		Server's host name:	
		■ For NIS clients, type the following command to display the server's host name. `# ypwhich`	
		■ For NIS+ clients, type the following command to display the server's host name. `# nisping`	
		Server's IP Address:	
		■ For NIS clients, type the following command to display the server's IP address. `# ypmatch` *nameserver-name* `hosts`	
		■ For NIS+ clients, type the following command to display the server's IP address. `# nismatch` *nameserver-name* `hosts.org_dir`	
		Network Information Service (NIS) makes network administration more manageable by providing centralized control over a variety of network information, such as machine names and addresses.	

TABLE 5–1 Installation Checklist *(Continued)*

Information for Installation		Description or Example	Answer — Defaults are noted with an asterisk (*)
	DNS	Provide IP addresses for the DNS server. You must enter at least one IP address, but you can enter up to three addresses. Server's IP Address: To display the server's IP address, type the following command. `# getent hosts dns` You can enter a list of domains to search when a DNS query is made. List of domains to be searched: The domain name system (DNS) is the naming service that the Internet provides for TCP/IP networks. DNS provides host names to the IP address service. DNS simplifies communication by using machine names instead of numerical IP addresses. DNS also serves as a database for mail administration.	
	LDAP	Provide the following information about your LDAP profile. Profile Name: Profile Server: If you specify a proxy credential level in your LDAP profile, gather this information. Proxy-bind distinguished name: Proxy-bind password: Lightweight Directory Access Protocol (LDAP) defines a relatively simple protocol for updating and searching directories that are running over TCP/IP.	

TABLE 5–1 Installation Checklist   *(Continued)*

Information for Installation	Description or Example	Answer — Defaults are noted with an asterisk (*)
Default route	Do you want to specify a default route IP address or let the Solaris installation program find one? The default route provides a bridge that forwards traffic between two physical networks. An IP address is a unique number that identifies each host on a network. You have the following choices: ■ You can specify the IP address. An `/etc/defaultrouter` file is created with the specified IP address. When the system is rebooted, the specified IP address becomes the default route. ■ You can let the Solaris installation program detect an IP address. However, the system must be on a subnet that has a router that advertises itself by using the ICMP router discovery protocol. If you are using the command-line interface, the software detects an IP address when the system is booted. ■ You can choose None if you do not have a router or do not want the software to detect an IP address at this time. The software automatically tries to detect an IP address on reboot.	Detect one*/Specify one/None
Time zone	How do you want to specify your default time zone?	Geographic region* Offset from GMT Time zone file
Root password	Provide the root password for the system.	

TABLE 5–1 Installation Checklist *(Continued)*

Information for Installation	Description or Example	Answer — Defaults are noted with an asterisk (*)
Keyboard	This feature is new in the following releases: ■ For SPARC, **starting with the Solaris Express 2/07 release** ■ For x86, **starting with the Solaris Express 2/07 release** If the keyboard is self-identifying, the keyboard language and layout automatically configures during installation. If the keyboard is not self-identifying, the sysidkdb tool provides you, during the installation, a list of supported keyboard layouts during installation, so that you can select a layout for keyboard configuration. **SPARC**: Previously, the USB keyboard assumed a self-identifying value of 1 during the installation. Therefore, all of the keyboards that were not self-identifying always configured for a U.S. English keyboard layout during installation. For further information, see "Preconfiguring With the sysidcfg File" in *Solaris Express Installation Guide: Network-Based Installations.*	
Locales	For which geographic regions do you want to install support? **Note –** The locale can be preconfigured by NIS or NIS+. For more information, see "sysidcfg File Keywords" in *Solaris Express Installation Guide: Network-Based Installations.*	
SPARC: Power Management (only available on SPARC systems that support Power Management)	Do you want to use Power Management? **Note –** If your system has Energy Star version 3 or later, you are not prompted for this information.	Yes*/No
Automatic reboot or CD/DVD ejection	Reboot automatically after software installation? Eject CD/DVD automatically after software installation?	Yes*/No Yes*/No
Default or custom installation	Do you want to perform a default installation, or customize the installation? ■ Select Default installation to format the entire hard disk and install a preselected set of software. ■ Select Custom installation to modify the hard disk layout and select the software that you want to install. **Note –** The text installer does not prompt you to select a Default or Custom Installation. To perform a default installation, accept the default values that are provided in the text installer. To perform a custom installation, edit the values in the text installer screens.	Default installation*/Custom installation

TABLE 5–1   Installation Checklist   *(Continued)*

Information for Installation	Description or Example	Answer — Defaults are noted with an asterisk (*)
Software group	Which Solaris Software Group do you want to install?	Entire Plus OEM Entire* Developer End User Core Reduced Networking
Custom package selection	Do you want to add or remove software packages from the Solaris Software Group that you install? **Note –** When you select which packages to add or remove, you need to know about software dependencies and how Solaris software is packaged.	
Select disks	On which disks do you want to install the Solaris software? Example: `c0t0d0`	
x86: `fdisk` partitioning	Do you want to create, delete, or modify a Solaris `fdisk` partition? Each disk that is selected for file system layout must have a Solaris `fdisk` partition. If your system currently has a Service partition, the Solaris installation program preserves the Service partition by default. If you do not want to preserve the Service partition, you must customize the `fdisk` partitions. For more information about preserving a Service partition, see "Default Boot-Disk Partition Layout Preserves the Service Partition" on page 46. Select Disks for `fdisk` Partition Customization?	 Yes/No*
	Customize `fdisk` partitions?	Yes/No*
Preserve Data	Do you want to preserve any data that exists on the disks where you are installing the Solaris software?	Yes/No*
Auto-layout file systems	Do you want the installation program to automatically lay out file systems on your disks? If yes, which file systems should be used for auto-layout? Example: `/`, `/opt`, `/var` If no, you must provide file system configuration information. **Note –** The Solaris installation GUI lays out file systems automatically by default.	Yes*/No

TABLE 5–1   Installation Checklist   *(Continued)*

Information for Installation	Description or Example	Answer — Defaults are noted with an asterisk (*)
Mount remote file systems	Does this system need to access software on another file system? If yes, provide the following information about the remote file system. Server: IP Address: Remote File System: Local Mount Point:	Yes/No*
If you are installing through a `tip` line, follow these instructions.	Ensure that your window display is at least 80 columns wide and 24 rows long. For more information, see `tip(1)`. To determine the current dimensions of your `tip` window, use the `stty` command. For more information, see the man page, `stty(1)`.	
Check your Ethernet connection.	If the system is part of a network, verify that an Ethernet connector or similar network adapter is connected to your system.	

Review the planning chapter and other relevant documentation.	■ Review the entire planning chapter or specific sections in Chapter 4.
	
	■ Review the *Solaris Express Developer Edition Release Notes* and vendor release notes to ensure that the software you use is supported in the new Solaris release.
	
	■ Review the following to ensure that your hardware is supported:
	   ■ Solaris Hardware Compatibility List
	   ■ SPARC: *Solaris Sun Hardware Platform Guide* at `http://docs.sun.com`
	
	■ Review the documentation that accompanied your system to ensure that your system and devices are supported by the Solaris release.	

Checklist for Upgrading

Use the following checklist to gather the information that you need to upgrade the Solaris OS. You do not need to gather all of the information that is requested on the checklist. You only need to collect the information that applies to your system. If you are performing the upgrade over the network, the installation program provides the information for you, based on the current system configuration.

You cannot change basic system identification, such as host name or IP address. The installation program might prompt you for basic system identification, but you must enter the original values. If you use the Solaris installation program to upgrade, the upgrade fails if you attempt to change any of the values.

TABLE 5–2 Upgrade Checklist

Information for Upgrade		Description or Example	Answer – Defaults are noted with an asterisk (*)
Network connection		Is the system connected to a network?	Networked/Nonnetworked
DHCP		Can the system use Dynamic Host Configuration Protocol (DHCP) to configure its network interfaces? DHCP provides the network parameters that are necessary for installation.	Yes/No*
If you are not using DHCP, note the network address.	IP Address	If you are not using DHCP, supply the IP address for the system. Example: 172.31.255.255 To find this information on a running system, type the following command. `# ypmatch` *host-name* `hosts`	
	Subnet	If you are not using DHCP, is the system part of a subnet? If yes, what is the netmask of the subnet? Example: 255.255.255.0 To find this information on a running system, type the following command. `# more /etc/netmasks`	
	IPv6	Do you want to enable IPv6 on this machine? IPv6 is a part of the TCP/IP Internet protocol that facilitates IP addressing by adding better security and increasing Internet addresses.	Yes/No*
Host name		Host name that you choose for the system. To find this information on a running system, type the following command. `# uname -n`	

TABLE 5–2 Upgrade Checklist   *(Continued)*

Information for Upgrade		Description or Example	Answer – Defaults are noted with an asterisk (*)
Kerberos		Do you want to configure Kerberos security on this machine?	Yes/No*
		If yes, gather this information:	
		Default Realm:	
		Administration Server:	
		First KDC:	
		(Optional) Additional KDCs:	
		The Kerberos service is a client-server architecture that provides secure transactions over networks.	
If the system uses a naming service, provide the following information.	Naming service	Which naming service should this system use?	NIS+/NIS/DNS/ LDAP/None
		To find this information on a running system, type the following command.	
		`# cat /etc/nsswitch.conf`	
		A naming service stores information in a central place, which enables users, machines, and applications to communicate across the network. Examples of information that is stored are host names and addresses or user names and passwords.	
	Domain name	Provide the name of the domain in which the system resides.	
		During installation, you can choose the default NFSv4 domain name. Or, you can specify a custom NFSv4 domain name.	
		■ For instructions about how to find the domain name on a running system, see "Checking for the NFS Version 4 Domain" in *System Administration Guide: Network Services*.	
		■ To preconfigure the NFSv4 domain name in the `sysidcfg` file, see "nfs4_domain Keyword" in *Solaris Express Installation Guide: Network-Based Installations*.	

TABLE 5–2 Upgrade Checklist *(Continued)*

Information for Upgrade		Description or Example	Answer – Defaults are noted with an asterisk (*)
	NIS+ and NIS	Do you want to specify a name server or let the installation program find one?	Specify one/Find one*
		If you want to specify a name server, provide the following information.	
		Server's host name:	
		■ For NIS clients, type the following command to display the server's host name.	
		# ypwhich	
		■ For NIS+ clients, type the following command to display the server's host name.	
		# nisping	
		Server's IP Address:	
		■ For NIS clients, type the following command to display the server's IP address.	
		# ypmatch *nameserver-name* **hosts**	
		■ For NIS+ clients, type the following command to display the server's IP address.	
		# nismatch *nameserver-name* **hosts.org_dir**	
		Network Information Service (NIS) makes network administration more manageable by providing centralized control over a variety of network information, such as machine names and addresses.	

TABLE 5–2 Upgrade Checklist   *(Continued)*

Information for Upgrade		Description or Example	Answer – Defaults are noted with an asterisk (*)
	DNS	Provide IP addresses for the DNS server. You must enter at least one IP address, but you can enter up to three addresses. Server's IP Address: To display the server's IP address, type the following command. **# getent hosts dns** You can enter a list of domains to search when a DNS query is made. List of domains to be searched: The domain name system (DNS) is the naming service that the Internet provides for TCP/IP networks. DNS provides host names to the IP address service. DNS simplifies communication by using machine names instead of numerical IP addresses. DNS also serves as a database for mail administration.	
	LDAP	Provide the following information about your LDAP profile. Profile Name: Profile Server: If you specify a proxy credential level in your LDAP profile, gather this information. Proxy-bind distinguished name: Proxy-bind password: Lightweight Directory Access Protocol (LDAP) defines a relatively simple protocol for updating and searching directories that are running over TCP/IP.	

TABLE 5–2 Upgrade Checklist *(Continued)*

Information for Upgrade	Description or Example	Answer – Defaults are noted with an asterisk (*)
Default route	Do you want to specify a default route IP address or let the Solaris installation program find one? The default route provides a bridge that forwards traffic between two physical networks. An IP address is a unique number that identifies each host on a network. You have the following choices: ■ You can specify the IP address. An /etc/defaultrouter file is created with the specified IP address. When the system is rebooted, the specified IP address becomes the default route. ■ You can let the Solaris installation program detect an IP address. However, the system must be on a subnet that has a router that advertises itself by using the ICMP router discovery protocol. If you are using the command-line interface, the software detects an IP address when the system is booted. ■ You can choose None if you do not have a router or do not want the software to detect an IP address at this time. The software automatically tries to detect an IP address on reboot.	Detect one*/Specify one/None
Time zone	How do you want to specify your default time zone?	Geographic region* Offset from GMT Time zone file
Root password	Provide the root password for the system.	

TABLE 5–2 Upgrade Checklist *(Continued)*

Information for Upgrade	Description or Example	Answer – Defaults are noted with an asterisk (*)
Default or custom installation	Do you want to perform a default installation, or customize the installation? ■ Select Default installation to format the entire hard disk and install a preselected set of software. ■ Select Custom installation to modify the hard disk layout and select the software that you want to install. **Note –** The text installer does not prompt you to select a Default or Custom Installation. To perform a default installation, accept the default values that are provided in the text installer. To perform a custom installation, edit the values in the text installer screens.	Default installation*/Custom installation
Keyboard	This feature is new in the following releases: ■ For SPARC, **starting with the Solaris Express 2/07 release** ■ For x86, **starting with the Solaris Express 2/07 release** If the keyboard is self-identifying, the keyboard language and layout automatically configures during installation. If the keyboard is not self-identifying, the sysidkdb tool provides you, during the installation, a list of supported keyboard layouts during installation, so that you can select a layout for keyboard configuration. **SPARC**: Previously, the USB keyboard assumed a self-identifying value of 1 during the installation. Therefore, all of the keyboards that were not self-identifying always configured for a U.S. English keyboard layout during installation. For further information, see "Preconfiguring With the sysidcfg File" in *Solaris Express Installation Guide: Network-Based Installations*.	

TABLE 5–2 Upgrade Checklist *(Continued)*

Information for Upgrade	Description or Example	Answer – Defaults are noted with an asterisk (*)
Locales	For which geographic regions do you want to install support? **Note –** The locale can be preconfigured by NIS or NIS+. For more information, see "sysidcfg File Keywords" in *Solaris Express Installation Guide: Network-Based Installations*.	
SPARC: Power Management (only available on SPARC systems that support Power Management)	Do you want to use Power Management? **Note –** If your system has Energy Star version 3 or later, you are not prompted for this information.	Yes/No
Automatic reboot or CD/DVD ejection	Reboot automatically after software installation? Eject CD/DVD automatically after software installation?	Yes*/No Yes*/No
Disk space reallocation	Do you want the installation program to automatically re-layout the systems on your disks? If yes, which file system should be used for auto-layout? Example: /, /opt, /var If no, you must provide information for the system configuration.	Yes/No*
If you are installing through a tip line, follow these instructions.	Ensure that your window display is at least 80 columns wide and 24 rows long. For more information, see tip(1). To determine the current dimensions of your tip window, use the stty command. For more information, see the man page, stty(1).	
Check your Ethernet connection.	If the system is part of a network, verify that an Ethernet connector or similar network adapter is connected to your system.	

TABLE 5–2 Upgrade Checklist   *(Continued)*

Information for Upgrade	Description or Example	Answer – Defaults are noted with an asterisk (*)
Solaris Live Upgrade use	■ Determine your resource requirements for creating a new boot environment and upgrading it. For detailed information, refer to Chapter 3, "Solaris Live Upgrade (Planning)," in *Solaris Express Installation Guide: Solaris Live Upgrade and Upgrade Planning.* ■ Determine the requirements if you are using RAID-1 volumes. For detailed information, refer to "Guidelines for Selecting Slices for File Systems" in *Solaris Express Installation Guide: Solaris Live Upgrade and Upgrade Planning.*	
Check the system for the existence of Prestoserve software.	If you begin the upgrade process by shutting down the system with the `init 0` command and you're using Prestoserve software, you might lose data. Refer to the Prestoserve documentation for shutdown instructions.	
Check for patches needed.	The most recent patch list is provided at http://sunsolve.sun.com.	
Review the planning chapter and other relevant documentation.	■ Review the entire planning chapter or specific sections in Chapter 4. ■ Review the *Solaris Express Developer Edition Release Notes* and vendor release notes to ensure that the software you use is supported in the new Solaris release. ■ Review the *Solaris Sun Hardware Platform Guide* to ensure that your hardware is supported. ■ Review the documentation that accompanied your system to ensure that your system and devices are supported by the Solaris release.	

Understanding Installations That Relate to GRUB, Solaris Zones, and RAID-1 Volumes

This part provides an overview of several technologies that relate to a Solaris OS installation or upgrade. Guidelines and requirements are also included.

- GRUB based booting on x86 based systems
- Solaris Zones partitioning technology
- Solaris Volume Manager components such as RAID-1 volumes

6

x86: GRUB Based Booting for Solaris Installation

This chapter describes the GRUB based booting on x86 based systems that relates to Solaris installation. This chapter contains the following sections:

x86: GRUB Based Booting (Overview)

GRUB, the open source boot loader, has been adopted as the default boot loader in the Solaris OS.

Note – GRUB based booting is not available on SPARC based systems.

The *boot loader* is the first software program that runs after you power on a system. After you power on an x86 based system, the Basic Input/Output System (BIOS) initializes the CPU, the memory, and the platform hardware. When the initialization phase has completed, the BIOS loads the boot loader from the configured boot device, and then transfers control of the system to the boot loader.

GRUB is an open source boot loader with a simple menu interface that includes boot options that are predefined in a configuration file. GRUB also has a command-line interface that is accessible from the menu interface for performing various boot commands. In the Solaris OS, the GRUB implementation is compliant with the Multiboot Specification. The specification is described in detail at `http://www.gnu.org/software/grub/grub.html`.

Because the Solaris kernel is fully compliant with the Multiboot Specification, you can boot a Solaris x86 based system by using GRUB. With GRUB, you can more easily boot and install various operating systems. For example, on one system, you could individually boot the following operating systems:

- Solaris OS
- Microsoft Windows

> **Note –** GRUB detects Microsoft Windows partitions but does not verify that the OS can be booted.

- Linux

A key benefit of GRUB is that it is intuitive about file systems and kernel executable formats, which enables you to load an operating system without recording the physical position of the kernel on the disk. With GRUB based booting, the kernel is loaded by specifying its file name, and the drive, and the partition where the kernel resides. GRUB based booting replaces the Solaris Device Configuration Assistant and simplifies the booting process with a GRUB menu.

x86: How GRUB Based Booting Works

After GRUB gains control of the system, a menu is displayed on the console. In the GRUB menu, you can do the following:

- Select an entry to boot your system
- Modify a boot entry by using the built-in GRUB edit menu
- Manually load an OS kernel from the command line

A configurable timeout is available to boot the default OS entry. Pressing any key aborts the default OS entry boot.

To view an example of a GRUB menu, see .

x86: GRUB Device Naming Conventions

The device naming conventions that GRUB uses are slightly different from previous Solaris OS versions. Understanding the GRUB device naming conventions can assist you in correctly specifying drive and partition information when you configure GRUB on your system.

The following table describes the GRUB device naming conventions.

TABLE 6–1 Naming Conventions for GRUB Devices

Device Name	Description
(fd0), (fd1)	First diskette, second diskette

TABLE 6–1 Naming Conventions for GRUB Devices *(Continued)*

Device Name	Description
(nd)	Network device
(hd0,0), (hd0,1)	First and second `fdisk` partition of first `bios` disk
(hd0,0,a), (hd0,0,b)	Solaris/BSD slice 0 and 1 on first `fdisk` partition on the first `bios` disk

Note – All GRUB device names must be enclosed in parentheses. Partition numbers are counted from 0 (zero), not from 1.

For more information about `fdisk` partitions, see "Guidelines for Creating an fdisk Partition" in *System Administration Guide: Devices and File Systems*.

x86: Where to Find Information About GRUB Based Installations

For more information about these changes, see the following references.

TABLE 6–2 Where to Find Information on GRUB Based Installations

Topic	GRUB Menu Tasks	For More Information
Installation	To install from the Solaris OS CD or DVD media	*Solaris Express Installation Guide: Basic Installations*.
	To install from a network installation image	Part II, "Installing Over a Local Area Network," in *Solaris Express Installation Guide: Network-Based Installations*
	To configure a DHCP server for network installations	"Preconfiguring System Configuration Information With the DHCP Service (Tasks)" in *Solaris Express Installation Guide: Network-Based Installations*
	To install with the Custom JumpStart program	"Performing a Custom JumpStart Installation" in *Solaris Express Installation Guide: Custom JumpStart and Advanced Installations*

TABLE 6–2 Where to Find Information on GRUB Based Installations   *(Continued)*

Topic	GRUB Menu Tasks	For More Information
	To activate or fall back to a boot environment by using Solaris Live Upgrade	▪ "Activating a Boot Environment" in *Solaris Express Installation Guide: Solaris Live Upgrade and Upgrade Planning*
		▪ Chapter 6, "Failure Recovery: Falling Back to the Original Boot Environment (Tasks)," in *Solaris Express Installation Guide: Solaris Live Upgrade and Upgrade Planning*
System administration	For more detailed information about GRUB and for administrative tasks	Chapter 12, "Booting a Solaris System With GRUB (Tasks)," in *System Administration Guide: Basic Administration*

Note – Starting with the Solaris Express Developer Edition 5/07 release, see new GRUB enhancements described at "x86: GRUB Extended Support for Directly Loading and Booting the UNIX Kernel" on page 15.

x86: GRUB Based Booting (Planning)

This section describes the basics of GRUB based booting and describes the GRUB menu.

When you install the Solaris OS, two GRUB menu entries are installed on the system by default. The first entry is the Solaris OS entry. The second entry is the failsafe boot archive, which is to be used for system recovery. The Solaris GRUB menu entries are installed and updated automatically as part of the Solaris software installation and upgrade process. These entries are directly managed by the OS and should not be manually edited.

During a standard Solaris OS installation, GRUB is installed on the Solaris fdisk partition without modifying the system BIOS setting. If the OS is not on the BIOS boot disk, you need to do one of the following:

▪ Modify the BIOS setting.
▪ Use a boot manager to bootstrap to the Solaris partition. For more details, see your boot manager.

The preferred method is to install the Solaris OS on the boot disk. If multiple operating systems are installed on the machine, you can add entries to the menu.lst file. These entries are then displayed in the GRUB menu the next time you boot the system.

For additional information on multiple operating systems, see "How Multiple Operating Systems Are Supported in the GRUB Boot Environment" in *System Administration Guide: Basic Administration*.

x86: Performing a GRUB Based Installation From the Network

Performing a GRUB based network boot requires a DHCP server that is configured for PXE clients and an install server that provides `tftp` service. The DHCP server must be able to respond to the DHCP classes, `PXEClient` and `GRUBClient`. The DHCP response must contain the following information:

- IP address of the file server
- Name of the boot file (`pxegrub`)

Note – `rpc.bootparamd`, which is usually a requirement on the server side for performing a network boot, is not required for a GRUB based network boot.

If no PXE or DHCP server is available, you can load GRUB from CD-ROM or local disk. You can then manually configure the network in GRUB and download the multiboot program and the boot archive from the file server.

For more information, see "Overview of Booting and Installing Over the Network With PXE" in *Solaris Express Installation Guide: Network-Based Installations*.

Description of the GRUB Main Menu

When you boot an x86 based system, the GRUB menu is displayed. This menu provides a list of boot entries to choose from. A *boot entry* is an OS instance that is installed on your system. The GRUB menu is based on the `menu.lst` file, which is a configuration file. The `menu.lst` file is created by the Solaris installation program and can be modified after installation. The `menu.lst` file dictates the list of OS instances that are shown in the GRUB menu.

- If you install or upgrade the Solaris OS, the GRUB menu is automatically updated. The Solaris OS is then displayed as a new boot entry.
- If you install an OS other than the Solaris OS, you must modify the `menu.lst` configuration file to include the new OS instance. Adding the new OS instance enables the new boot entry to appear in the GRUB menu the next time that you boot the system.

EXAMPLE 6–1 GRUB Main Menu

In the following example, the GRUB main menu shows the Solaris and Microsoft Windows operating systems. A Solaris Live Upgrade boot environment is also listed that is named `second_disk`. See the following for descriptions of each menu item.

```
GNU GRUB version 0.95 (616K lower / 4127168K upper memory)
+-------------------------------------------------------------------+
|Solaris                                                            |
```

EXAMPLE 6–1 GRUB Main Menu   *(Continued)*

```
|Solaris failsafe                                                |
|second_disk                                                     |
|second_disk failsafe                                            |
|Windows                                                         |
+----------------------------------------------------------------+
Use the ^ and v keys to select which entry is highlighted. Press
enter to boot the selected OS, 'e' to edit the commands before
booting, or 'c' for a command-line.
```

Solaris   Specifies the Solaris OS.

Solaris failsafe   Specifies a boot archive that can be used for recovery if the Solaris OS is damaged.

second_disk   Specifies a Solaris Live Upgrade boot environment. The second_disk boot environment was created as a copy of the Solaris OS. It was upgraded and activated with the luactivate command. The boot environment is available for booting.

Windows   Specifies the Microsoft Windows OS. GRUB detects these partitions but does not verify that the OS can be booted.

Description of GRUB menu.lst **File**

The GRUB menu.lst file lists the contents of the GRUB main menu. The GRUB main menu lists boot entries for all the OS instances that are installed on your system, including Solaris Live Upgrade boot environments. The Solaris software upgrade process preserves any changes that you make to this file.

Any revisions made to the menu.lst file are displayed on the GRUB main menu, along with the Solaris Live Upgrade entries. Any changes that you make to the file become effective at the next system reboot. You can revise this file for the following reasons:

- To add to the GRUB menu entries for operating systems other than Solaris
- To customize booting behavior such as specifying the default OS on the GRUB menu

⚠ **Caution** – Do not use the GRUB menu.lst file to modify Solaris Live Upgrade entries. Modifications could cause Solaris Live Upgrade to fail.

Although you can use the menu.lst file to customize booting behavior such as booting with the kernel debugger, the preferred method for customization is to use the eeprom command. If you use the menu.lst file to customize, the Solaris OS entries might be modified during a software upgrade. Changes to the file would then be lost.

For information about how to use the eeprom command, see "How to Modify Boot Behavior by Using the eeprom Command" in *System Administration Guide: Basic Administration*.

EXAMPLE 6–2 Menu.lst File

Here is a sample of a menu.lst file:

```
default 0
timeout 10
title Solaris
  root (hd0,0,a)
  kernel$ /platform/i86pc/kernel/$ISADIR/unix -B console=ttya
  module$ /platform/i86pc/$ISADIR/boot_archive
title Solaris failsafe
  root (hd0,0,a)
  kernel /boot/platform/i86pc/kernel/unix -s -B console=ttya
  module /boot/x86.miniroot-safe
#----- second_disk - ADDED BY LIVE UPGRADE - DO NOT EDIT  -----
title second_disk
  root (hd0,1,a)
  kernel$ /platform/i86pc/kernel/$ISADIR/unix
  module$ /platform/i86pc/$ISADIR/boot_archive
title second_disk failsafe
  root (hd0,1,a)
  kernel /boot/platform/i86pc/kernel/unix -s
  module /boot/x86.miniroot-safe
#----- second_disk ------------- END LIVE UPGRADE -----------
title Windows
  root (hd0,0)
  chainloader -1
```

default
   Specifies which item to boot if the timeout expires. To change the default, you can specify another item in the list by changing the number. The count begins with zero for the first title. For example, change the default to 2 to boot automatically to the second_disk boot environment.

timeout
   Specifies the number of seconds to wait for user input before booting the default entry. If no timeout is specified, you are required to choose an entry.

title *OS name*
   Specifies the name of the operating system.

   ▪ If this is a Solaris Live Upgrade boot environment, *OS name* is the name you gave the new boot environment when it was created. In the previous example, the Solaris Live Upgrade boot environment is named second_disk.

EXAMPLE 6–2   Menu.lst File   *(Continued)*

- If this is a failsafe boot archive, this boot archive is used for recovery when the primary OS is damaged. In the previous example, Solaris failsafe and second_disk failsafe are the recovery boot archives for the Solaris and second_disk operating systems.

root (hd0,0,a)
   Specifies on which disk, partition, and slice to load files. GRUB automatically detects the file system type.

kernel$ /platform/i86pc/kernel/$ISADIR/unix
   Specifies the boot loader that runs on the system. GRUB expands the $ISADIR keyword to amd64 on 64-bit hardware. $ISADIR becomes a null value on 32-bit only hardware.

   Starting with the Solaris Express Developer Edition 5/07 release, see new GRUB enhancements described at "x86: GRUB Extended Support for Directly Loading and Booting the UNIX Kernel" on page 15.

For a complete description of multiple operating systems, see "How Multiple Operating Systems Are Supported in the GRUB Boot Environment" in *System Administration Guide: Basic Administration.*

Locating the menu.lst File to Change the GRUB Menu

You must always use the bootadm command to locate the GRUB menu's menu.lst file. The list-menu subcommand finds the active GRUB menu. The menu.lst file lists all the operating systems that are installed on a system. The contents of this file dictate the list of operating systems that is displayed on the GRUB menu. If you want to make changes to this file, see "Locating the GRUB Menu's menu.lst File (Tasks)" in *Solaris Express Installation Guide: Solaris Live Upgrade and Upgrade Planning.*

7

Upgrading When Solaris Zones Are Installed on a System (Planning)

This chapter provides an overview of how Solaris Zones partitioning technology relates to upgrading the Solaris OS when non-global zones are configured.

This chapter contains the following sections:

Solaris Zones (Overview)

The Solaris Zones partitioning technology is used to virtualize operating system services and provide an isolated and secure environment for running applications. A non-global zone is a virtualized operating system environment created within a single instance of the Solaris OS. When you create a non-global zone, you produce an application execution environment in which processes are isolated from the rest of the system. This isolation prevents processes that are running in one non-global zone from monitoring or affecting processes that are running in other non-global zones. Even a process running with superuser credentials cannot view or affect activity in other zones. A non-global zone also provides an abstract layer that separates applications from the physical attributes of the machine on which they are deployed. Examples of these attributes include physical device paths.

Every Solaris system contains a global zone. The global zone has a dual function. The global zone is both the default zone for the system and the zone used for system-wide administrative control. All processes run in the global zone if no non-global zones are created by the global administrator. The global zone is the only zone from which a non-global zone can be configured, installed, managed, or uninstalled. Only the global zone is bootable from the system hardware. Administration of the system infrastructure, such as physical devices, routing, or dynamic reconfiguration (DR), is only possible in the global zone. Appropriately privileged processes running in the global zone can access objects associated with the non-global zones.

Description	For More Information
The following sections describe how you can upgrade a system that contains non-global zones.	"Upgrading With Non-Global Zones" on page 78
For complete information on creating and configuring non-global zones	Chapter 16, "Introduction to Solaris Zones," in *System Administration Guide: Solaris Containers-Resource Management and Solaris Zones*

Upgrading With Non-Global Zones

After the Solaris OS is installed, you can install and configure non-global zones. You can upgrade the Solaris OS when non-global zones are installed. If you have branded non-global zones installed, they are ignored during the upgrade process. Changes to accommodate systems that have non-global zones installed are summarized below.

- For the Solaris interactive installation program, you can upgrade or patch a system when non-global zones are installed. The time to upgrade or patch might be extensive, depending on the number of non-global zones that are installed. For more information about installing with this program, see Chapter 2, "Installing With the Solaris Installation Program (Tasks)," in *Solaris Express Installation Guide: Basic Installations*.

- For an automated JumpStart installation, you can upgrade or patch with any keyword that applies to an upgrade or patching. The time to upgrade or patch might be extensive, depending on the number of non-global zones that are installed. For more information about installing with this program, see *Solaris Express Installation Guide: Custom JumpStart and Advanced Installations*.

- For Solaris Live Upgrade, you can upgrade or patch a system that contains non-global zones. If you have a system that contains non-global zones, Solaris Live Upgrade is the recommended upgrade program or program to add patches. Other upgrade programs might require extensive upgrade time, because the time required to complete the upgrade increases linearly with the number of installed non-global zones. If you are patching a system with Solaris Live Upgrade, you do not have to take the system to single-user mode and you can maximize your system's uptime. Changes to accommodate systems that have non-global zones installed are the following:

  - A new package, SUNWlucfg, is required to be installed with the other Solaris Live Upgrade packages, SUNWlur and SUNWluu.

  - Creating a new boot environment from the currently running boot environment remains the same with one exception. You can specify a destination slice for a shared file system within a non-global zone. This exception occurs under the following circumstances:

    - If on the current boot environment the zonecfg add fs command was used that created a separate file system for a non-global zone

    - If this separate file system resides on a shared file system, such as /zone/root/export

To prevent this separate file system from being shared in the new boot environment, the `lucreate` command has changed to enable specifying a destination slice for a separate file system for a non-global zone. The argument to the `-m` option has a new optional field, *zonename*. This new field places the non-global zone's separate file system on a separate slice in the new boot environment. For more information on setting up a non-global zone with a separate file system, see `zonecfg`(1M).

Note – By default, any file system other than the critical file systems (root (`/`), `/usr`, and `/opt` file systems) is shared between the current and new boot environments. Updating shared files in the active boot environment also updates data in the inactive boot environment. The `/export` file system is an example of a shared file system. If you use the `-m` option and the *zonename* option, the non-global zone's shared file system is copied to a separate slice and data is not shared. This option prevents non-global zone file systems that were created with the `zonecfg add fs` command from being shared between the boot environments.

- Comparing boot environments is enhanced. The `lucompare` command now generates a comparison of boot environments that includes the contents of any non-global zone.
- The `lumount` command now provides non-global zones with access to their corresponding separate file systems that exist on inactive boot environments. When the global zone administrator uses the `lumount` command to mount an inactive boot environment, the boot environment is mounted for non-global zones as well.
- Listing file systems with the `lufslist` command is enhanced to display a list of file systems for both the global zone and the non-global zones.

For step-by-step instructions on using Solaris Live Upgrade when non-global zones are installed, see Chapter 9, "Upgrading the Solaris OS on a System With Non-Global Zones Installed," in *Solaris Express Installation Guide: Solaris Live Upgrade and Upgrade Planning*.

TABLE 7–1 Limitations When Upgrading With Non-Global Zones

Program or Condition	Description
Solaris Flash archives	A Solaris Flash archive cannot be properly created when a non-global zone is installed. The Solaris Flash feature is not compatible with Solaris Zones partitioning technology. If you create a Solaris Flash archive, the resulting archive is not installed properly when the archive is deployed under these conditions: ■ The archive is created in a non-global zone. ■ The archive is created in a global zone that has non-global zones installed. For more information about using Solaris Flash archives, see *Solaris Express Installation Guide: Solaris Flash Archives (Creation and Installation)*.
Using a command that uses the -R option or equivalent must not be used in some situations.	Any command that accepts an alternate root (/) file system by using the -R option or equivalent must not be used if the following are true: ■ The command is run in the global zone. ■ The alternative root (/) file system refers to any path within a non-global zone. An example is the -R *root_path* option to the pkgadd utility run from the global zone with a path to the root (/) file system in a non-global zone. For a list of utilities that accept an alternate root (/) file system and more information about zones, see "Restriction on Accessing A Non-Global Zone From the Global Zone" in *System Administration Guide: Solaris Containers-Resource Management and Solaris Zones*.
ZFS file systems and non-global zones	If a non-global zone is on a ZFS file system, the upgrade process does not upgrade the non-global zone.

Backing Up Your System Before Performing an Upgrade With Zones

You should back up the global and non-global zones on your Solaris system before you perform the upgrade. For information about backing up a system with zones installed, see Chapter 26, "Solaris Zones Administration (Overview)," in *System Administration Guide: Solaris Containers-Resource Management and Solaris Zones*.

Disk Space Requirements for Non-Global Zones

When installing the global zone, be sure to reserve enough disk space for all of the zones you might create. Each non-global zone might have unique disk space requirements.

No limits are placed on how much disk space can be consumed by a zone. The global zone administrator is responsible for space restriction. Even a small uniprocessor system can support a number of zones running simultaneously. The characteristics of the packages installed in the global zone affect the space requirements of the non-global zones that are created. The number of packages and space requirements are factors.

For complete planning requirements and recommendations, see Chapter 18, "Planning and Configuring Non-Global Zones (Tasks)," in *System Administration Guide: Solaris Containers-Resource Management and Solaris Zones*.

8

Creating RAID-1 Volumes (Mirrors) During Installation (Overview)

This chapter discusses the advantages of creating RAID-1 volumes (mirrors) for the root (/) file system. This chapter also describes the Solaris Volume Manager components that are required to create mirrors for file systems. This chapter describes the following topics.

- "Why Use RAID-1 Volumes?" on page 83
- "How Do RAID-1 Volumes Work?" on page 84
- "Overview of Solaris Volume Manager Components" on page 86
- "Example of RAID-1 Volume Disk Layout" on page 88

For additional information specific to Solaris Live Upgrade or JumpStart, see the following references:

- For Solaris Live Upgrade: "General Guidelines When Creating RAID-1 Volumes (Mirrored) File Systems" in *Solaris Express Installation Guide: Solaris Live Upgrade and Upgrade Planning*

- For JumpStart:

  - "filesys Profile Keyword (Creating RAID-1 Volumes)" in *Solaris Express Installation Guide: Custom JumpStart and Advanced Installations*

  - "metadb Profile Keyword (Creating State Database Replicas)" in *Solaris Express Installation Guide: Custom JumpStart and Advanced Installations*

Why Use RAID-1 Volumes?

During the installation or upgrade, you can create RAID-1 volumes to duplicate your system data over multiple physical disks. By duplicating your data over separate disks, you can protect your data from disk corruption or a disk failure.

The Solaris custom JumpStart and Solaris Live Upgrade installation methods use the Solaris Volume Manager technology to create RAID-1 volumes that mirror a file system. Solaris Volume Manager provides a powerful way to reliably manage your disks and data by using

volumes. Solaris Volume Manager enables concatenations, stripes, and other complex configurations. The custom JumpStart and Solaris Live Upgrade installation methods enable a subset of these tasks, such as creating a RAID-1 volume for the root (/) file system. You can create RAID-1 volumes during your installation or upgrade, eliminating the need to create them after the installation.

- For guidelines, see "Custom JumpStart and Solaris Live Upgrade Guidelines" on page 93.
- For detailed information about complex Solaris Volume Manager software and components, see *Solaris Volume Manager Administration Guide*.

How Do RAID-1 Volumes Work?

Solaris Volume Manager uses virtual disks to manage physical disks and their associated data. In Solaris Volume Manager, a virtual disk is called a *volume*. A *volume* is a name for a group of physical slices that appear to the system as a single, logical device. Volumes are actually pseudo, or virtual, devices in standard UNIX® terms.

A volume is functionally identical to a physical disk in the view of an application or a file system (such as UFS). Solaris Volume Manager converts I/O requests that are directed at a volume into I/O requests to the underlying member disks. Solaris Volume Manager volumes are built from slices (disk partitions) or from other Solaris Volume Manager volumes.

You use volumes to increase performance and data availability. In some instances, volumes can also increase I/O performance. Functionally, volumes behave the same way as slices. Because volumes look like slices, they are transparent to end users, applications, and file systems. Like physical devices, you can use Solaris Volume Manager software to access volumes through block or raw device names. The volume name changes, depending on whether the block or raw device is used. The custom JumpStart installation method and Solaris Live Upgrade support the use of block devices to create mirrored file systems. See "RAID Volume Name Requirements and Guidelines for Custom JumpStart and Solaris Live Upgrade" on page 95 for details about volume names.

When you create RAID-1 volumes) with RAID-0 volumes (single-slice concatenations), Solaris Volume Manager duplicates data on the RAID-0 submirrors and treats the submirrors as one volume.

Figure 8–1 shows a mirror that duplicates the root (/) file system over two physical disks.
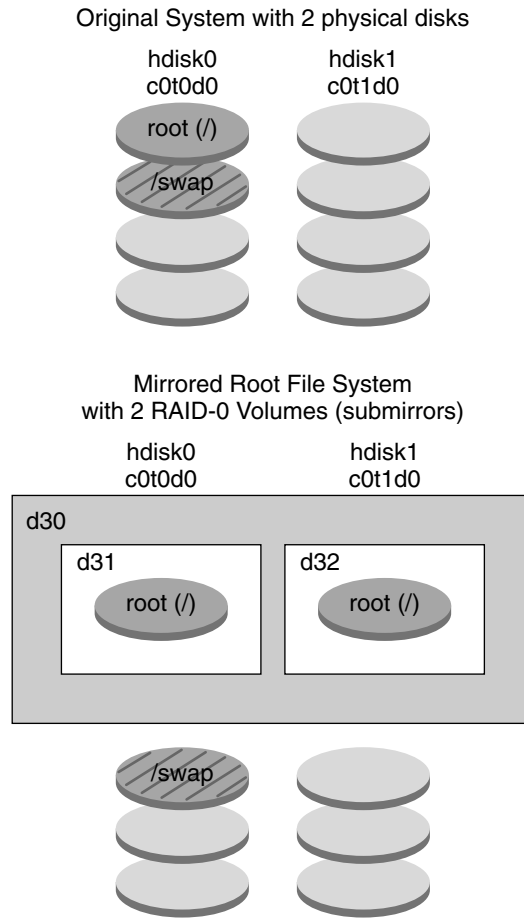
Original System with 2 physical disks

Mirrored Root File System
with 2 RAID-0 Volumes (submirrors)

d30 — RAID-1 volume (mirror)

d31 — Single-slice concatenation (submirror)

d32 — Single-slice concatenation (submirror)

FIGURE 8–1 Creating RAID-1 Volumes on the Root (/) File System on Two Disks

Figure 8–1 shows a system with the following configuration.

- The mirror that is named d30 consists of the submirrors that are named d31 and d32. The mirror, d30, duplicates the data in the root (/) file system on both submirrors.

- The root (/) file system on hdisk0 is included in the single-slice concatenation that is named d31.

- The root (/) file system is copied to the hard disk named hdisk1. This copy is the single-slice concatenation that is named d32.

Overview of Solaris Volume Manager Components

The custom JumpStart installation method and Solaris Live Upgrade enable you to create the following components that are required to replicate data.

- State database and state database replicas (metadbs)
- RAID-1 volumes (mirrors) with single-slice concatenations (submirrors)

This section briefly describes each of these components. For complete information about these components, see *Solaris Volume Manager Administration Guide*.

State Database and State Database Replicas

The *state database* is a database that stores information on a physical disk. The state database records and tracks changes that are made to your configuration. Solaris Volume Manager automatically updates the state database when a configuration or state change occurs. Creating a new volume is an example of a configuration change. A submirror failure is an example of a state change.

The state database is actually a collection of multiple, replicated database copies. Each copy, referred to as a *state database replica*, ensures that the data in the database is always valid. Having copies of the state database protects against data loss from single points of failure. The state database tracks the location and status of all known state database replicas.

Solaris Volume Manager cannot operate until you have created the state database and its state database replicas. A Solaris Volume Manager configuration must have an operating state database.

The state database replicas ensure that the data in the state database is always valid. When the state database is updated, each state database replica is also updated. The updates occur one at a time to protect against corruption of all updates if the system crashes.

If your system loses a state database replica, Solaris Volume Manager must identify which state database replicas still contain valid data. Solaris Volume Manager determines this information by using a *majority consensus algorithm*. This algorithm requires that a majority (half + 1) of the state database replicas be available and in agreement before any of them are considered valid. Because of this majority consensus algorithm, you must create at least three state database replicas when you set up your disk configuration. A consensus can be reached if at least two of the three state database replicas are available.

Each state database replica occupies 4 Mbytes (8192 disk sectors) of disk storage by default. Replicas can be stored on the following devices:

- A dedicated local disk slice

- **Solaris Live Upgrade only**:
    - A local slice that will be part of a volume
    - A local slice that will be part of a UFS logging device

Replicas cannot be stored on the root (/), swap, or /usr slices, or on slices that contain existing file systems or data. After the replicas have been stored, volumes or file systems can be placed on the same slice.

You can keep more than one copy of a state database on one slice. However, you might make the system more vulnerable to a single point of failure by placing state database replicas on a single slice.

Description	For More Information
When using custom JumpStart or Solaris Live Upgrade to install RAID-1 volumes, review these guidelines and requirements.	"State Database Replicas Guidelines and Requirements" on page 92
Obtain more detailed information about the state database and state database replicas.	*Solaris Volume Manager Administration Guide*

RAID-1 Volumes (Mirrors)

A RAID-1 volume, or *mirror*, is a volume that maintains identical copies of the data in RAID-0 volumes (single-slice concatenations). After you configure a RAID-1 volume, the volume can be used just as if it were a physical slice. You can duplicate any file system, including existing file systems. You can also use a RAID-1 volume for any application, such as a database.

Using RAID-1 volumes to mirror file systems has advantages and disadvantages:

- With RAID-1 volumes, data can be read from both RAID-0 volumes simultaneously (either volume can service any request), providing improved performance. If one physical disk fails, you can continue to use the mirror with no loss in performance or loss of data.

- Using RAID-1 volumes requires an investment in disks. You need at least twice as much disk space as the amount of data.

- Because Solaris Volume Manager software must write to all RAID-0 volumes, duplicating the data can also increase the time that is required for write requests to be written to disk.

Description	For More Information
Planning for RAID-1 volumes	"RAID-1 and RAID-0 Volume Requirements and Guidelines" on page 93
Detailed information about RAID-1 volumes	*Solaris Volume Manager Administration Guide*

RAID-0 Volumes (Concatenations)

A RAID-0 volume is a single-slice concatenation. The concatenation is a volume whose data is organized serially and adjacently across components, forming one logical storage unit. The custom JumpStart installation method and Solaris Live Upgrade do not enable you to create stripes or other complex Solaris Volume Manager volumes.

During the installation or upgrade, you can create RAID-1 volumes (mirrors) and attach RAID-0 volumes to these mirrors. The RAID-0 volumes that are *mirrored* are called *submirrors*. A mirror is made of one or more RAID-0 volumes. After the installation, you can manage the data on separate RAID-0 submirror volumes by administering the RAID-1 mirror volume through the Solaris Volume Manager software.
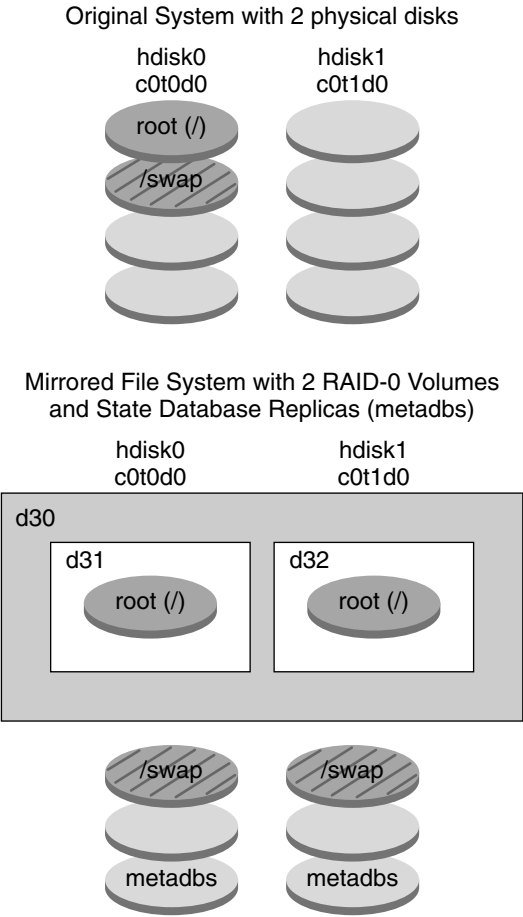
The custom JumpStart installation method enables you to create a mirror that consists of up to two submirrors. Solaris Live Upgrade enables you to create a mirror that consists of up to three submirrors. Practically, a two-way mirror is usually sufficient. A third submirror enables you to make online backups without losing data redundancy while one submirror is offline for the backup.

Description	For More Information
Planning for RAID–0 volumes	"RAID-1 and RAID-0 Volume Requirements and Guidelines" on page 93
Detailed information about RAID-0 volumes	*Solaris Volume Manager Administration Guide*

Example of RAID-1 Volume Disk Layout

The following figure shows a RAID-1 volume that duplicates the root file system (/) over two physical disks. State database replicas (metadbs) are placed on both disks.

Original System with 2 physical disks

Mirrored File System with 2 RAID-0 Volumes
and State Database Replicas (metadbs)

d30 — RAID-1 volume (mirror)

d31 — Single-slice concatenation (submirror)

d32 — Single-slice concatenation (submirror)

FIGURE 8–2   RAID-1 Volume Disk Layout

Figure 8–2 shows a system with the following configuration.

- The mirror that is named d30 consists of the submirrors that are named d31 and d32. The mirror, d30, duplicates the data in the root (/) file system on both submirrors.

- The root (/) file system on hdisk0 is included in the single-slice concatenation that is named d31.

- The root (`/`) file system is copied to the hard disk named `hdisk1`. This copy is the single-slice concatenation that is named `d32`.
- State database replicas are created on both slices: `hdisk0` and `hdisk1`.

Description	For More Information
JumpStart profile example	"Profile Examples" in *Solaris Express Installation Guide: Custom JumpStart and Advanced Installations*
Solaris Live Upgrade step-by-step procedures	"To Create a Boot Environment With RAID-1 Volumes (Mirrors)" in *Solaris Express Installation Guide: Solaris Live Upgrade and Upgrade Planning*

9

Creating RAID-1 Volumes (Mirrors) During Installation (Planning)

This chapter describes the requirements and guidelines that are necessary to create RAID-1 volumes with the custom JumpStart or Solaris Live Upgrade installation methods.

This chapter describes the following topics.

- "System Requirement" on page 91
- "State Database Replicas Guidelines and Requirements" on page 92
- "RAID-1 and RAID-0 Volume Requirements and Guidelines" on page 93
- "Booting Into Single-User Mode Causes Mirror to Appear to Need Maintenance" on page 98

For additional information specific to Solaris Live Upgrade or JumpStart, see the following references:

- For Solaris Live Upgrade: "General Guidelines When Creating RAID-1 Volumes (Mirrored) File Systems" in *Solaris Express Installation Guide: Solaris Live Upgrade and Upgrade Planning*

- For JumpStart:
  - "filesys Profile Keyword (Creating RAID-1 Volumes)" in *Solaris Express Installation Guide: Custom JumpStart and Advanced Installations*
  - "metadb Profile Keyword (Creating State Database Replicas)" in *Solaris Express Installation Guide: Custom JumpStart and Advanced Installations*

System Requirement

To create RAID-1 volumes to duplicate data on specific slices, the disks that you plan to use must be directly attached and available to the system during the installation.

State Database Replicas Guidelines and Requirements

You should distribute state database replicas across slices, drives, and controllers, to avoid single points of failure. You want a majority of replicas to survive a single component failure. If you lose a replica, when a device fails, for example, the failure might cause problems with running Solaris Volume Manager software or when rebooting the system. Solaris Volume Manager software requires at least half of the replicas to be available to run, but a majority (half plus one) to reboot into multiuser mode.

For detailed instructions about creating and administering state database replicas, see *Solaris Volume Manager Administration Guide*.

Selecting Slices for State Database Replicas

Before selecting slices for state database replicas, consider the following guidelines and recommendations.

Task	Description
Choose a dedicated slice	You should create state database replicas on a dedicated slice of at least 4 MB per replica. If necessary, you could create state database replicas on a slice that is to be used as part of a RAID-0 or RAID-1 volume. You must create the replicas before you add the slice to the volume.
Resize a slice	By default, the size of a state database replica is 4 MB or 8192 disk blocks. Because your disk slices might not be that small, you can resize a slice to hold the state database replica. For information about resizing a slice, see Chapter 11, "Administering Disks (Tasks)," in *System Administration Guide: Devices and File Systems*.
Choose a slice that is not in use	You can create state database replicas on slices that are not in use. The part of a slice that is reserved for the state database replica should not be used for any other purpose.
	You cannot create state database replicas on existing file systems, or the root (/), /usr, and swap file systems. If necessary, you can create a new slice (provided a slice name is available) by allocating space from swap and then put state database replicas on that new slice.
Choosing a slice that becomes a volume	When a state database replica is placed on a slice that becomes part of a volume, the capacity of the volume is reduced by the space that is occupied by the replica or replicas. The space that is used by a replica is rounded up to the next cylinder boundary and this space is skipped by the volume.

Choosing the Number of State Database Replicas

Before choosing the number of state database replicas, consider the following guidelines.

- A minimum of 3 state database replicas are recommended, up to a maximum of 50 replicas per Solaris Volume Manager disk set. The following guidelines are recommended:
  - For a system with only a single drive: put all three replicas in one slice.
  - For a system with two to four drives: put two replicas on each drive.
  - For a system with five or more drives: put one replica on each drive.
- Additional state database replicas can improve the mirror's performance. Generally, you need to add two replicas for each mirror you add to the system.
- If you have a RAID-1 volume that is to be used for small-sized random I/O (for example, for a database), consider your number of replicas. For best performance, ensure that you have at least two extra replicas per RAID-1 volume on slices (and preferably on disks and controllers) that are unconnected to the RAID-1 volume.

Distributing State Database Replicas Across Controllers

If multiple controllers exist, replicas should be distributed as evenly as possible across all controllers. This strategy provides redundancy if a controller fails and also helps balance the load. If multiple disks exist on a controller, at least two of the disks on each controller should store a replica.

RAID-1 and RAID-0 Volume Requirements and Guidelines

When you are working with RAID-1 volumes (mirrors) and RAID-0 volumes (single-slice concatenations), consider the following guidelines.

Custom JumpStart and Solaris Live Upgrade Guidelines

The custom JumpStart installation method and Solaris Live Upgrade support a subset of the features that are available in the Solaris Volume Manager software. When you create mirrored file systems with these installation programs, consider the following guidelines.

Installation Program	Supported Feature	Unsupported Feature
Custom JumpStart and Solaris Live Upgrade	■ Supports RAID-0 and RAID-1 volumes, but does not support other Solaris Volume Manager components, such as RAID-5 volumes. ■ RAID-0 volume is supported, but only as a single-slice concatenation.	In Solaris Volume manager a RAID-0 volume can refer to disk stripes or disk concatenations. You cannot create RAID-0 stripe volumes during the installation or upgrade.
Custom JumpStart	■ Supports the creation of RAID-1 volumes during an initial installation only. ■ You can create up to two RAID-0 volumes (submirrors) for each RAID-1 volume. Two submirrors usually provide sufficient data redundancy for most applications, and the disk drive costs are less expensive.	■ Does not support an upgrade when RAID-1 volumes are configured. ■ More than two RAID-0 volumes are not supported.
Solaris Live Upgrade	■ You can create up to three RAID-0 volumes (submirrors) for each RAID-1 volume. Three submirrors enable you to take a submirror offline and perform a backup while maintaining the two remaining submirrors for continued data redundancy. ■ Supports the creation of RAID-1 volumes during an upgrade. For examples, see "To Create a Boot Environment With RAID-1 Volumes (Mirrors)" in *Solaris Express Installation Guide: Solaris Live Upgrade and Upgrade Planning*.	More than three RAID-0 volumes are not supported.
Creating and Installing a Solaris Flash with RAID-1 volumes	You can create a Solaris Flash archive created from a master system that has Solaris Volume Manager RAID-1 volumes configured. The Solaris Flash creation software removes all RAID-1 volume information from the archive to keep the integrity of the clone system. With custom JumpStart you can rebuild the RAID-1 volumes by using a JumpStart profile. With Solaris Live Upgrade, you create a boot environment with RAID-1 volumes configured and install the archive. The Solaris installation program cannot be used to install RAID-1 volumes with a Solaris Flash archive. For examples of RAID-1 volumes in JumpStart profiles, see "Profile Examples" in *Solaris Express Installation Guide: Custom JumpStart and Advanced Installations*.	Veritas VxVM stores configuration information in areas not available to Solaris Flash. If Veritas VxVm file systems have been configured, you should not create a Solaris Flash archive. Also, Solaris install, including JumpStart and Solaris Live Upgrade do not support rebuilding VxVM volumes at installation time. Therefore, if you are planning to deploy Veritas VxVM software using a Solaris Flash archive, the archive must be created prior to configuring the VxVM file systems. The clone systems must be then configured individually after the archive has been applied and the system rebooted.

RAID Volume Name Requirements and Guidelines for Custom JumpStart and Solaris Live Upgrade

Observe the following rules when assigning names for volumes.

- Use a naming method that maps the slice number and disk number to volume numbers.
- Volume names must begin with the letter d followed by a number, for example, d0.
- Solaris Volume Manager has 128 default volume names from 0–127. The following list shows some example volume names.
  - Device /dev/md/dsk/d0 – block volume d0
  - Device /dev/md/dsk/d1 – block volume d1
- Use ranges for each particular type of volume. For example, assign numbers 0–20 for RAID-1 volumes, and 21–40 for RAID-0 volumes.

RAID Volume Naming Conventions for Solaris Live Upgrade

When you use the Solaris Live Upgrade to create RAID-1 volumes (mirrors) and RAID-0 volumes (submirrors), you can enable the software to detect and assign volume names, or you can assign the names. If you enable the software to detect the names, the software assigns the first mirror or submirror name that is available. If you assign mirror names, assign names ending in zero so that the installation can use the names ending in 1 and 2 for submirrors. If you assign submirror names, assign names ending in 1 or 2. If you assign numbers incorrectly, the mirror might not be created. For example, if you specify a mirror name with a number that ends in 1 or 2 (d1 or d2), Solaris Live Upgrade fails to create the mirror if the mirror name duplicates a submirror's name.

Note – In previous releases, an abbreviated volume name could be entered. Starting with the Solaris Express 2/07 release, only the full volume name can be entered. For example, only the full volume name, such as /dev/md/dsk/d10, can be used to specify a mirror.

EXAMPLE 9–1 Solaris Live Upgrade: Enable the Software to Detect and Name the Mirror and Submirror

In this example, Solaris Live Upgrade assigns the volume names. The RAID-1 volumes d0 and d1 are the only volumes in use. For the mirror d10, Solaris Live Upgrade chooses d2 for the submirror for the device c0t0d0s0 and d3 for the submirror for the device c1t0d0s0.

```
lucreate -n newbe -m /:/dev/md/dsk/d10:mirror,ufs -m /:/dev/dsk/c0t0d0s0:attach
-m /:/dev/dsk/c1t0d0s0:attach
```

EXAMPLE 9–2 Solaris Live Upgrade: Assign Mirror and Submirror Names

In this example, the volume names are assigned in the command. For the mirror d10, d11 is the name for the submirror for the device c0t0d0s0 and d12 is the name for the submirror for the device c1t0d0s0.

```
lucreate -n newbe -m /:/dev/md/dsk/d10:mirror,ufs -m /:/dev/dsk/c0t0d0s0,/dev/md/dsk/d11:attach
-m /:/dev/dsk/c1t0d0s0,/dev/md/dsk/d12:attach
```

For detailed information about Solaris Volume Manager naming requirements, see *Solaris Volume Manager Administration Guide*.

RAID-Volume Naming Conventions for Custom JumpStart

When you use the custom JumpStart installation method to create RAID-1 volumes (mirrors) and RAID-0 volumes (submirrors), you can enable the software to detect and assign volume names to mirrors, or you can assign the names in the profile.

- If you enable the software to detect the names, the software assigns the first volume number that is available.
- If you assign names in the profile, assign mirror names ending in zero so that the installation can use the names ending in 1 and 2 for submirrors.

Note – If you assign numbers incorrectly, the mirror might not be created. For example, if you specify a mirror name with a number that ends in 1 or 2 (d1 or d2), JumpStart fails to create the mirror if the mirror name duplicates a submirror's name.

Note – You can abbreviate the names of physical disk slices and Solaris Volume Manager volumes. The abbreviation is the shortest name that uniquely identifies a device. Examples follow.

- A Solaris Volume Manager volume can be identified by its d*num* designation, so that, for example, /dev/md/dsk/d10 becomes simply d10.
- If a system has a single controller and multiple disks, you might use t0d0s0, but with multiple controllers use c0t0d0s0.

EXAMPLE 9–3 Enable the Software to Detect the Mirror and Submirror Names

In the following profile example, the mirror is assigned the first volume numbers that are available. If the next available mirror ending in zero is d10, then the names d11 and d12 are assigned to the submirrors.

```
filesys                 mirror c0t0d0s1  /
```

EXAMPLE 9–4 Assigning Mirror and Submirror Names

In the following profile example, the mirror number is assigned in the profile as d30. The submirror names are assigned by the software, based on the mirror number and the first available submirrors. The submirrors are named d31 and d32.

```
filesys                 mirror:d30 c0t1d0s0 c0t0d0s0  /
```

For detailed information about Solaris Volume Manager naming requirements, see *Solaris Volume Manager Administration Guide*.

Guidelines for Selecting Disks and Controllers

When you choose the disks and controllers that you want to use to mirror a file system, consider the following guidelines.

- Use components that are on different controllers to increase the number of simultaneous reads and writes that can be performed.
- Keep the slices of different submirrors on different disks and controllers. Data protection is diminished considerably if slices of two or more submirrors of the same mirror are on the same disk.
- Organize submirrors across separate controllers, because controllers and associated cables tend to fail more often than disks. This practice also improves mirror performance.
- Use the same type of disks and controllers in a single mirror. Particularly in old SCSI storage devices, different models or brands of disk or controller can have widely varying performance. Mixing the different performance levels in a single mirror can cause performance to degrade significantly.

Guidelines for Selecting Slices

When you choose the slices that you want to use to mirror a file system, consider the following guidelines.

- Any file system, including root (/), swap, and /usr, can use a mirror. Any application, such as a database, also can use a mirror.
- Make sure that your submirror slices are of equal size. Submirrors of different sizes result in unused disk space.
- If you have a mirrored file system in which the first submirror attached does not start on cylinder 0, all additional submirrors you attach must also not start on cylinder 0. If you attempt to attach a submirror starting on cylinder 0 to a mirror in which the original submirror does not start on cylinder 0, the following error message is displayed:

```
can't attach
labeled submirror to an unlabeled mirror
```

You must ensure that all submirrors you plan to attach to a mirror either all start on cylinder 0, or that none of them start on cylinder 0.

Starting cylinders do not have to be identical across all submirrors, but all submirrors must either include or not include cylinder 0.

Booting Into Single-User Mode Causes Mirror to Appear to Need Maintenance

If a system with mirrors for root (/), /usr, and swap is booted into single-user mode, the system indicates that these mirrors are in need of maintenance. When you view these mirrors with the metastat command, these mirrors, and possibly all mirrors on the system, appear in the "Needing Maintenance" state.

Though this situation appears to be potentially dangerous, do not be concerned. The metasync -r command, which normally occurs during boot to resynchronize mirrors, is interrupted when the system is booted into single-user mode. After the system is rebooted, the metasync -r command runs and resynchronizes all mirrors.

If this interruption is a concern, run the metasync -r command manually.

For more information about the metasync, see the metasync(1M) man page, and *Solaris Volume Manager Administration Guide*.

Glossary

3DES ([Triple DES] Triple-Data Encryption Standard). A symmetric-key encryption method that provides a key length of 168 bits.

AES (Advanced Encryption Standard) A symmetric 128-bit block data encryption technique. The U.S. government adopted the Rijndael variant of the algorithm as its encryption standard in October 2000. AES replaces DES encryption as the government standard.

archive A file that contains a collection of files that were copied from a master system. The file also contains identification information about the archive, such as a name and the date that you created the archive. After you install an archive on a system, the system contains the exact configuration of the master system.

An archive could be a differential archive, which is a Solaris Flash archive that contains only the differences between two system images, an unchanged master image and an updated master image. The differential archive contains files to be retained, modified, or deleted from the clone system. A differential update changes only the files specified and is restricted to systems that contain software consistent with the unchanged master image.

arrow keys One of the four directional keys on the numeric keypad.

begin script A user-defined Bourne shell script, specified within the `rules` file, that performs tasks before the Solaris software is installed on the system. You can use begin scripts only with custom JumpStart installations.

boot To load the system software into memory and start it.

boot archive **x86 only**: A boot archive is a collection of critical files that is used to boot the Solaris OS. These files are needed during system startup before the root (/) file system is mounted. Two boot archives are maintained on a system:
- The boot archive that is used to boot the Solaris OS on a system. This boot archive is sometimes called the primary boot archive.
- The boot archive that is used for recovery when the primary boot archive is damaged. This boot archive starts the system without mounting the root (/) file system. On the GRUB menu, this boot archive is called failsafe. The archive's essential purpose is to regenerate the primary boot archive, which is usually used to boot the system.

boot environment A collection of mandatory file systems (disk slices and mount points) that are critical to the operation of the Solaris OS. These disk slices might be on the same disk or distributed across multiple disks.

	The active boot environment is the one that is currently booted. Exactly one active boot environment can be booted. An inactive boot environment is not currently booted, but can be in a state of waiting for activation on the next reboot.
boot loader	**x86 only**: The boot loader is the first software program that runs after you turn on a system. This program begins the booting process.
boot server	A server system that provides client systems on the same network subnet with the programs and information that they need to start. A boot server is required to install over the network if the install server is on a different subnet than the systems on which Solaris software is to be installed.
`bootlog-cgi` **program**	The CGI program that enables a web server to collect and store remote client-booting and installation console messages during a WAN boot installation.
certificate authority	(CA) A trusted third-party organization or company that issues digital certificates that are used to create digital signatures and public-private key pairs. The CA guarantees that the individual who is granted the unique certificate is who she or he claims to be.
`certstore` **file**	A file that contains a digital certificate for a specific client system. During an SSL negotiation, the client might be asked to provide the certificate file to the server. The server uses this file to verify the identity of the client.
CGI	(Common Gateway Interface) An interface by which external programs communicate with the HTTP server. Programs that are written to use CGI are called CGI programs or CGI scripts. CGI programs handle forms or parse output the server does not normally handle or parse.
checksum	The result of adding a group of data items that are used for checking the group. The data items can be either numerals or other character strings that are treated as numerals during the checksum calculation. The checksum value verifies that communication between two devices is successful.
client	In the client-server model for communications, the client is a process that remotely accesses resources of a compute server, such as compute power and large memory capacity.
clone system	A system that you install by using a Solaris Flash archive. The clone system has the same installation configuration as the master system.
cluster	A logical collection of packages (software modules). The Solaris software is divided into *software groups*, which are each composed of clusters and *packages*.
command line	A string of characters that begins with a command, often followed by arguments, including options, file names, and other expressions, and terminated by the end-of-line character.
concatenation	A RAID-0 volume. If slices are concatenated, the data is written to the first available slice until that slice is full. When that slice is full, the data is written to the next slice, serially. A concatenation provides no data redundancy unless it is contained in a mirror. See also RAID-0 volume.
Core Software Group	A software group that contains the minimum software that is required to boot and run the Solaris OS on a system. Core includes some networking software and the drivers that are required to run the Common Desktop Environment (CDE) desktop. Core does not include the CDE software.

critical file systems File systems that are required by the Solaris OS. When you use Solaris Live Upgrade, these file systems are separate mount points in the `vfstab` file of the active and inactive boot environments. Example file systems are root (`/`), `/usr`, `/var`, and `/opt`. These file systems are always copied from the source to the inactive boot environment.

custom JumpStart A type of installation in which the Solaris software is automatically installed on a system that is based on a user-defined profile. You can create customized profiles for different types of users and systems. A custom JumpStart installation is a JumpStart installation you create.

custom probes file A file, which must be located in the same JumpStart directory as the `rules` file, that is a Bourne shell script that contains two types of functions: probe and comparison. Probe functions gather the information you want or do the actual work and set a corresponding `SI_` environment variable you define. Probe functions become probe keywords. Comparison functions call a corresponding probe function, compare the output of the probe function, and return 0 if the keyword matches or 1 if the keyword doesn't match. Comparison functions become rule keywords. See also *rules file*.

decryption The process of converting coded data to plain text. See also encryption.

derived profile A profile that is dynamically created by a begin script during a custom JumpStart installation.

DES (Data Encryption Standard) A symmetric-key encryption method that was developed in 1975 and standardized by ANSI in 1981 as ANSI X.3.92. DES uses a 56-bit key.

Developer Solaris Software Group A software group that contains the End User Solaris Software Group plus the libraries, include files, man pages, and programming tools for developing software.

DHCP (Dynamic Host Configuration Protocol) An application-layer protocol. Enables individual computers, or clients, on a TCP/IP network to extract an IP address and other network configuration information from a designated and centrally maintained DHCP server or servers. This facility reduces the overhead of maintaining and administering a large IP network.

differential archive A Solaris Flash archive that contains only the differences between two system images, an unchanged master image and an updated master image. The differential archive contains files to be retained, modified, or deleted from the clone system. A differential update changes only the files that are specified and is restricted to systems that contain software consistent with the unchanged master image.

digital certificate A nontransferable, nonforgeable, digital file issued from a third party that both communicating parties already trust.

disc An optical disc, as opposed to a magnetic disk, which recognizes the common spelling that is used in the compact disc (CD) market. For example, a CD-ROM or DVD-ROM is an optical disc.

disk A round platter, or set of platters, of a magnetized medium that is organized into concentric tracks and sectors for storing data such as files. See also disc.

disk configuration file A file that represents a structure of a disk (for example, bytes/sector, flags, slices). Disk configuration files enable you to use the `pfinstall` command from a single system to test profiles on different–size disks.

diskless client A client on a network that relies on a server for all of its disk storage.

document root directory The root of a hierarchy on a web server machine that contains the files, images, and data you want to present to users who are accessing the web server.

domain	A part of the Internet naming hierarchy. A domain represents a group of systems on a local network that share administrative files.
domain name	The name that is assigned to a group of systems on a local network that share administrative files. The domain name is required for the Network Information Service (NIS) database to work properly. A domain name consists of a sequence of component names that are separated by periods (for example: tundra.mpk.ca.us). As you read a domain name from left to right, the component names identify more general (and usually remote) areas of administrative authority.
encryption	The process of protecting information from unauthorized use by making the information unintelligible. Encryption is based on a code, called a key, which is used to decrypt the information. See also decryption.
End User Solaris Software Group	A software group that contains the Core Software Group plus the recommended software for an end user, including the Common Desktop Environment (CDE) and DeskSet software.
Entire Solaris Software Group	A software group that contains the entire Solaris release.
Entire Solaris Software Group Plus OEM Support	A software group that contains the entire Solaris release plus additional hardware support for OEMs. This software group is recommended when installing Solaris software on SPARC based servers.
/etc **directory**	A directory that contains critical system configuration files and maintenance commands.
/etc/netboot **directory**	The directory on a WAN boot server that contains the client configuration information and security data that are required for a WAN boot installation.
/export **file system**	A file system on an OS server that is shared with other systems on a network. For example, the /export file system can contain the root (/) file system and swap space for diskless clients and the home directories for users on the network. Diskless clients rely on the /export file system on an OS server to boot and run.
failsafe boot archive	**x86 only**: A boot archive that is used for recovery when the primary boot archive is damaged. This boot archive starts the system without mounting the root (/) file system. This boot archive is called failsafe on the GRUB menu. The archive's essential purpose is to regenerate the primary boot archive, which is usually used to boot the system. See *boot archive*.
fallback	A reversion to the environment that ran previously. Use fallback when you are activating an environment and the boot environment that is designated for booting fails or shows some undesirable behavior.
fdisk **partition**	A logical partition of a disk drive that is dedicated to a particular operating system on x86 based systems. To install the Solaris software, you must set up at least one Solaris fdisk partition on an x86 based system. x86 based systems allow up to four different fdisk partitions on a disk. These partitions can be used to hold individual operating systems. Each operating system must be located on a unique fdisk partition. A system can only have one Solaris fdisk partition per disk.
file server	A server that provides the software and file storage for systems on a network.
file system	In the SunOS™ operating system, a tree-structured network of files and directories that you can access.
finish script	A user-defined Bourne shell script, specified within the rules file, that performs tasks after the Solaris software is installed on the system but before the system reboots. You use finish scripts with custom JumpStart installations.

format	To put data into a structure or divide a disk into sectors for receiving data.
function key	One of the 10 or more keyboard keys that are labeled F1, F2, F3, and so on that are mapped to particular tasks.
global zone	In Solaris Zones, the global zone is both the default zone for the system and the zone used for system-wide administrative control. The global zone is the only zone from which a non-global zone can be configured, installed, managed, or uninstalled. Administration of the system infrastructure, such as physical devices, routing, or dynamic reconfiguration (DR), is only possible in the global zone. Appropriately privileged processes running in the global zone can access objects associated with other zones. See also *Solaris Zones* and *non-global zone*.
GRUB	**x86 only**: GNU GRand Unified Bootloader (GRUB) is an open source boot loader with a simple menu interface. The menu displays a list of operating systems that are installed on a system. GRUB enables you to easily boot these various operating systems, such as the Solaris OS, Linux, or Microsoft Windows.
GRUB edit menu	**x86 only**: A boot menu that is a submenu of the GRUB main menu. GRUB commands are displayed on this menu. These commands can be edited to change boot behavior.
GRUB main menu	**x86 only**: A boot menu that lists the operating systems that are installed on a system. From this menu, you can easily boot an operating system without modifying the BIOS or `fdisk` partition settings.
hard link	A directory entry that references a file on disk. More than one such directory entry can reference the same physical file.
hash	A number that is produced by taking some input and generating a number that is significantly shorter than the input. The same output value is always generated for identical inputs. Hash functions can be used in table search algorithms, in error detection, and in tamper detection. When used for tamper detection, hash functions are chosen such that it is difficult to find two inputs that yield the same hash result. MD5 and SHA-1 are examples of one-way hash functions. For example, a message digest takes a variable-length input such as a disk file and reduces it to a small value.
hashing	The process of changing a string of characters into a value or key that represents the original string.
HMAC	Keyed hashing method for message authentication. HMAC is used with an iterative cryptographic hash function, such as MD5 or SHA-1, in combination with a secret shared key. The cryptographic strength of HMAC depends on the properties of the underlying hash function.
host name	The name by which a system is known to other systems on a network. This name must be unique among all the systems within a particular domain (usually, this means within any single organization). A host name can be any combination of letters, numbers, and minus signs (-), but it cannot begin or end with a minus sign.
HTTP	(Hypertext Transfer Protocol) (n.) The Internet protocol that fetches hypertext objects from remote hosts. This protocol is based on TCP/IP.
HTTPS	A secure version of HTTP, implemented by using the Secure Sockets Layer (SSL).
initial installation	An installation that overwrites the currently running software or initializes a blank disk.

An initial installation of the Solaris OS overwrites the system's disk or disks with the new version of the Solaris OS. If your system is not running the Solaris OS, you must perform an initial installation. If your system is running an upgradable version of the Solaris OS, an initial installation overwrites the disk and does not preserve the OS or local modifications.

install server   A server that provides the Solaris DVD or CD images from which other systems on a network can install Solaris (also called a *media server*). You can create an install server by copying the Solaris DVD or CD images to the server's hard disk.

IP address   (Internet protocol address) In TCP/IP, a unique 32-bit number that identifies each host in a network. An IP address consists of four numbers that are separated by periods (192.168.0.0, for example). Most often, each part of the IP address is a number between 0 and 225. However, the first number must be less than 224 and the last number cannot be 0.

IP addresses are logically divided into two parts: the network (similar to a telephone area code), and the local system on the network (similar to a phone number). The numbers in a Class A IP address, for example, represent "network.local.local.local" and the numbers in a Class C IP address represent "network.network.network.local."

IPv6   IPv6 is a version (version 6) of Internet Protocol (IP) that is designed to be an evolutionary step from the current version, IPv4 (version 4). Deploying IPv6, by using defined transition mechanisms, does not disrupt current operations. In addition, IPv6 provides a platform for new Internet functionality. IPv6 is described in more detail inChapter 3, "Planning an IPv6 Addressing Scheme (Overview)," in *System Administration Guide: IP Services*.

job   A user-defined task to be completed by a computer system.

JumpStart directory   When you use a profile diskette for custom JumpStart installations, the JumpStart directory is the root directory on the diskette that contains all the essential custom JumpStart files. When you use a profile server for custom JumpStart installations, the JumpStart directory is a directory on the server that contains all the essential custom JumpStart files.

JumpStart installation   A type of installation in which the Solaris software is automatically installed on a system by using the factory-installed JumpStart software.

Kerberos   A network authentication protocol that uses strong, secret-key cryptography to enable a client and server to identify themselves to each other over an insecure network connection.

key   The code for encrypting or decrypting data. See also encryption.

keystore **file**   A file that contains keys shared by a client and server. During a WAN boot installation, the client system uses the keys to verify the integrity of, or decrypt the data and files transmitted from, the server.

LAN   (local area network) A group of computer systems in close proximity that can communicate by way of some connecting hardware and software.

LDAP   (Lightweight Directory Access Protocol) A standard, extensible directory access protocol that is used by LDAP naming service clients and servers to communicate with each other.

locale   A geographic or political region or community that shares the same language, customs, or cultural conventions (English for the U.S. is en_US, and English for the U.K. is en_UK).

logical device	A group of physical slices on one or more disks that appear to the system as a single device. A logical device is called a volume in Solaris Volume Manager. A volume is functionally identical to a physical disk for the purposes of an application or file system.
manifest section	A section of a Solaris Flash archive that is used to validate a clone system. The manifest section lists the files on a system to be retained, added to, or deleted from the clone system. This section is informational only. The section lists the files in an internal format and cannot be used for scripting.
master system	A system that you use to create a Solaris Flash archive. The system configuration is saved in the archive.
MD5	(Message Digest 5) An iterative cryptographic hash function that is used for message authentication, including digital signatures. The function was developed in 1991 by Rivest.
media server	See *install server*.
menu.lst **file**	**x86 only**: A file that lists all the operating systems that are installed on a system. The contents of this file dictate the list of operating systems that is displayed on the GRUB menu. From the GRUB menu, you can easily boot an operating system without modifying the BIOS or fdisk partition settings.
metadevice	See *volume*.
miniroot	A minimal, bootable root (/) file system that is included in Solaris installation media. A miniroot consists of the Solaris software that is required to install and upgrade systems. On x86 based systems, the miniroot is copied to the system to be used as the failsafe boot archive. See *failsafe boot archive*.
mirror	See *RAID-1 volume*.
mount	The process of accessing a directory from a disk that is attached to a machine that is making the mount request or a remote disk on a network. To mount a file system, you need a mount point on the local system and the name of the file system to be mounted (for example, /usr).
mount point	A workstation directory to which you mount a file system that exists on a remote machine.
name server	A server that provides a naming service to systems on a network.
naming service	A distributed network database that contains key system information about all the systems on a network so that the systems can communicate with each other. With a naming service, the system information can be maintained, managed, and accessed on a network-wide basis. Without a naming service, each system has to maintain its own copy of the system information in the local /etc files. Sun supports the following naming services: LDAP, NIS, and NIS+.
network installation	A way to install software over the network from a system with a CD-ROM or DVD-ROM drive to a system without a CD-ROM or DVD-ROM drive. Network installations require a *name server* and an *install server*.
networked systems	A group of systems (called hosts) that are connected through hardware and software so that they can communicate and share information. Referred to as a local area network (LAN). One or more servers are usually needed when systems are networked.
NIS	The SunOS 4.0 (minimum) Network Information Service. A distributed network database that contains key information about the systems and the users on the network. The NIS database is stored on the master server and all the slave servers.

NIS+	The SunOS 5.0 (minimum) Network Information Service. NIS+ replaces NIS, the SunOS 4.0 (minimum) Network Information Service.
non-global zone	A virtualized operating system environment created within a single instance of the Solaris Operating System. One or more applications can run in a non-global zone without interacting with the rest of the system. Non-global zones are also called zones. See also *Solaris Zones* and *global zone*.
nonnetworked systems	Systems that are not connected to a network or do not rely on other systems.
`/opt` **file system**	A file system that contains the mount points for third-party and unbundled software.
OS server	A system that provides services to systems on a network. To serve diskless clients, an OS server must have disk space set aside for each diskless client's root (/) file system and swap space (`/export/root`, `/export/swap`).
package	A collection of software that is grouped into a single entity for modular installation. The Solaris software is divided into *software groups*, which are each composed of *clusters* and packages.
panel	A container for organizing the contents of a window, a dialog box, or applet. The panel might collect and confirm user input. Panels might be used by wizards and follow an ordered sequence to fulfill a designated task.
patch analyzer	A script that you can run manually or as part of the Solaris installation program. The patch analyzer performs an analysis on your system to determine which (if any) patches will be removed by upgrading to a Solaris update.
platform group	A vendor-defined grouping of hardware platforms for the purpose of distributing specific software. Examples of valid platform groups are i86pc and sun4u.
platform name	The output of the `uname -i` command. For example, the platform name for the Ultra 60 is SUNW,Ultra-60.
Power Management	Software that automatically saves the state of a system and turns it off after it is idle for 30 minutes. When you install the Solaris software on a system that complies with Version 2 of the U.S. Environmental Protection Agency's Energy Star guidelines, the Power Management software is installed by default. A `sun4u` SPARC based system is an example of a system that has Power Management installed by default. After a subsequent reboot, you are prompted to enable or disable the Power Management software. Energy Star guidelines require that systems or monitors automatically enter a "sleep state" (consume 30 watts or less) after the system or monitor becomes inactive.
primary boot archive	A boot archive that is used to boot the Solaris OS on a system. This boot archive is sometimes called the primary boot archive. See *boot archive*.
private key	The decryption key used in public-key encryption.
probe keyword	A syntactical element that extracts attribute information about a system when using the custom JumpStart method to install. A probe keyword does not require you to set up a matching condition and run a profile as required for a rule. See also *rule*.

profile	A text file that defines how to install the Solaris software when using the custom JumpStart method. For example, a profile defines which software group to install. Every rule specifies a profile that defines how a system is to be installed when the rule is matched. You usually create a different profile for every rule. However, the same profile can be used in more than one rule. See also *rules file*.
profile diskette	A diskette that contains all the essential custom JumpStart files in its root directory (JumpStart directory).
profile server	A server that contains all the essential custom JumpStart files in a JumpStart directory.
public key	The encryption key used in public-key encryption.
public-key cryptography	A cryptographic system that uses two keys: a public key known to everyone, and a private key known only to the recipient of the message.
RAID-0 volume	A class of volume that can be a stripe or a concatenation. These components are also called submirrors. A stripe or concatenation is the basic building block for mirrors.
RAID-1 volume	A class of volume that replicates data by maintaining multiple copies. A RAID-1 volume is composed of one or more RAID-0 volumes called *submirrors*. A RAID-1 volume is sometimes called a *mirror*.
Reduced Network Support Software Group	A software group that contains the minimum code that is required to boot and run a Solaris system with limited network service support. The Reduced Networking Software Group provides a multiuser text-based console and system administration utilities. This software group also enables the system to recognize network interfaces, but does not activate network services.
removable media services	A program that provides a mechanism to administer and obtain access to the data on DVD-ROMs, CD-ROMs, and diskettes.
root	The top level of a hierarchy of items. Root is the one item from which all other items are descended. See *root directory* or *root* (/) *file system*.
root (/) file system	The top-level file system from which all other file systems stem. The root (/) file system is the base on which all other file systems are mounted, and is never unmounted. The root (/) file system contains the directories and files critical for system operation, such as the kernel, device drivers, and the programs that are used to start (boot) a system.
root directory	The top-level directory from which all other directories stem.
rule	A series of values that assigns one or more system attributes to a profile. A rule is used in a custom JumpStart installation.
rules **file**	A text file that contains a rule for each group of systems or single systems that you want to install automatically. Each rule distinguishes a group of systems, based on one or more system attributes. The rules file links each group to a profile, which is a text file that defines how the Solaris software is to be installed on each system in the group. A rules file is used in a custom JumpStart installation. See also *profile*.
rules.ok **file**	A generated version of the rules file. The rules.ok file is required by the custom JumpStart installation software to match a system to a profile. You *must* use the check script to create the rules.ok file.
Secure Sockets Layer	(SSL) A software library establishing a secure connection between two parties (client and server) used to implement HTTPS, the secure version of HTTP.

server	A network device that manages resources and supplies services to a client.
SHA1	(Secure Hashing Algorithm) The algorithm that operates on any input length less than 2^{64} to produce a message digest.
shareable file systems	File systems that are user-defined files such as `/export/home` and `/swap`. These file systems are shared between the active and inactive boot environment when you use Solaris Live Upgrade. Shareable file systems contain the same mount point in the `vfstab` file in both the active and inactive boot environments. Updating shared files in the active boot environment also updates data in the inactive boot environment. Shareable file systems are shared by default, but you can specify a destination slice, and then the file systems are copied.
slice	The unit into which the disk space is divided by the software.
software group	A logical grouping of the Solaris software (clusters and packages). During a Solaris installation, you can install one of the following software groups: Core, End User Solaris Software, Developer Solaris Software, or Entire Solaris Software, and for SPARC systems only, Entire Solaris Software Group Plus OEM Support.
Solaris DVD or CD images	The Solaris software that is installed on a system, which you can access on the Solaris DVDs or CDs or an install server's hard disk to which you have copied the Solaris DVD or CD images.
Solaris Flash	A Solaris installation feature that enables you to create an archive of the files on a system, called the *master system*. You can then use the archive to install other systems, making the other systems identical in their configuration to the master system. See also *archive*.
Solaris installation program	A graphical user interface (GUI) or command-line interface (CLI) installation program that uses wizard panels to guide you step-by-step through installing the Solaris software and third-party software.
Solaris Live Upgrade	An upgrade method that enables a duplicate boot environment to be upgraded while the active boot environment is still running, thus eliminating downtime of the production environment.
Solaris Zones	A software partitioning technology used to virtualize operating system services and provide an isolated and secure environment for running applications. When you create a non-global zone, you produce an application execution environment in which processes are isolated from all other zones. This isolation prevents processes that are running in a zone from monitoring or affecting processes that are running in any other zones. See also *global zone* and *non-global zone*.
standalone	A computer that does not require support from any other machine.
state database	A database that stores information about the state of your Solaris Volume Manager configuration. The state database is a collection of multiple, replicated database copies. Each copy is referred to as a *state database replica*. The state database tracks the location and status of all known state database replicas.
state database replica	A copy of a state database. The replica ensures that the data in the database is valid.
submirror	See *RAID-0 volume*.
subnet	A working scheme that divides a single logical network into smaller physical networks to simplify routing.
subnet mask	A bit mask that is used to select bits from an Internet address for subnet addressing. The mask is 32 bits long and selects the network portion of the Internet address and 1 or more bits of the local portion.

superuser	A special user who has privileges to perform all administrative tasks on the system. The superuser has the ability to read and write to any file, run all programs, and send kill signals to any process.
swap space	A slice or file that temporarily holds the contents of a memory area till it can be reloaded in memory. Also called the /swap or swap file system.
sysidcfg **file**	A file in which you specify a set of special system configuration keywords that preconfigure a system.
system configuration file	(system.conf) A text file in which you specify the locations of the sysidcfg file and the custom JumpStart files you want to use in a WAN boot installation.
time zone	Any of the 24 longitudinal divisions of the earth's surface for which a standard time is kept.
truststore **file**	A file that contains one or more digital certificates. During a WAN boot installation, the client system verifies the identity of the server that is trying to perform the installation by consulting the data in the truststore file.
unmount	The process of removing access to a directory on a disk that is attached to a machine or to a remote disk on a network.
update	An installation, or to perform an installation, on a system that changes software that is of the same type. Unlike an upgrade, an update might downgrade the system. Unlike an initial installation, software of the same type that is being installed must be present before an update can occur.
upgrade	An installation that merges files with existing files and preserves modifications where possible.
	An upgrade of the Solaris OS merges the new version of the Solaris OS with the existing files on the system's disk or disks. An upgrade saves as many modifications as possible that you have made to the previous version of the Solaris OS.
upgrade option	An option that is presented by the Solaris installation . The upgrade procedure merges the new version of Solaris with existing files on your disk or disks. An upgrade also saves as many local modifications as possible since the last time Solaris was installed.
URL	(Uniform Resource Locator) The addressing system used by the server and the client to request documents. A URL is often called a location. The format of a URL is *protocol://machine:port/document*.
	A sample URL is http://www.example.com/index.html.
/usr **file system**	A file system on a standalone system or server that contains many of the standard UNIX programs. Sharing the large /usr file system with a server rather than maintaining a local copy minimizes the overall disk space that is required to install and run the Solaris software on a system.
utility	A standard program, usually furnished at no charge with the purchase of a computer, that does the computer's housekeeping.
/var **file system**	A file system or directory (on standalone systems) that contains system files that are likely to change or grow over the life of the system. These files include system logs, vi files, mail files, and UUCP files.
volume	A group of physical slices or other volumes that appear to the system as a single logical device. A volume is functionally identical to a physical disk for the purposes of an application or file system.

In some command-line utilities, a volume is called a metadevice. Volume is also called *pseudo device* or *virtual device* in standard UNIX terms.

WAN   (wide area network) A network that connects multiple local area networks (LANs) or systems at different geographical sites by using telephone, fiber-optic, or satellite links.

WAN boot installation   A type of installation that enables you to boot and install software over a wide area network (WAN) by using HTTP or HTTPS. The WAN boot installation method enables you to transmit an encrypted Solaris Flash archive over a public network and perform a custom JumpStart installation on a remote client.

WAN boot miniroot   A miniroot that has been modified to perform a WAN boot installation. The WAN boot miniroot contains a subset of the software in the Solaris miniroot. See also miniroot.

WAN boot server   A web server that provides the configuration and security files that are used during a WAN boot installation.

wanboot-cgi **program**   The CGI program that retrieves and transmits the data and files that are used in a WAN boot installation.

wanboot.conf **file**   A text file in which you specify the configuration information and security settings that are required to perform a WAN boot installation.

wanboot **program**   The second-level boot program that loads the WAN boot miniroot, client configuration files, and installation files that are required to perform a WAN boot installation. For WAN boot installations, the wanboot binary performs tasks similar to the ufsboot or inetboot second-level boot programs.

zone   See *non-global zone*

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