Getting Started With OpenSolaris 2008.11

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Contents

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Introduction to the OpenSolaris 2008.11 Release

This guide provides instructions for installing or upgrading the OpenSolaris™ 2008.11 release.

Start Here

Insert the OpenSolaris 2008.11 Live CD in your laptop and reboot. This procedure assumes, as is usually the case, that the CD drive is booted before the hard drive in the BIOS boot order.

Note – If you do not have the OpenSolaris 2008.11 Live CD, you can download the ISO image for the Live CD. See `http://www.opensolaris.com/get/`.

The Live CD boots to a minimal OpenSolaris 2008.11 OS. You can explore the OpenSolaris OS on the CD without affecting the existing operating system on your laptop.

For information about the Live CD desktop, see "Live CD and Installer" on page 9.

Installation Options

With the OpenSolaris 2008.11 Live CD, you have the following installation choices:

- You can install the OpenSolaris 2008.11 release as the only operating system on your laptop.
- You can install the OpenSolaris 2008.11 OS inside a virtual machine.
- You can install the OpenSolaris 2008.11 OS in a separate partition from your existing OS.

For instructions, see "Installation Roadmap" on page 15.

Note – This release also includes new, advanced installation options. For information, see "New Installation Features in OpenSolaris 2008.11" on page 12.

Overview of OpenSolaris 2008.11

The OpenSolaris 2008.11 release is an OpenSolaris binary distribution. This release provides a Live CD for x86 platforms. This Live CD includes a basic core operating system and GNOME desktop environment, with the option to install the OpenSolaris operating system from the Live CD. Or, you can mount the OpenSolaris OS on a VirtualBox.

After the OpenSolaris OS has been mounted or installed, additional packages, including developer tools, can be downloaded to the system by using the Image Packaging System (IPS). IPS also enables you to upgrade your entire system. The `beadm` utility enables you to manage multiple boot environments.

The OpenSolaris 2008.11 release includes new installation features and enhancements, including zones support in the `beadm` utility, a new automated installer application, and an enhanced distribution constructor. For information, see "New Installation Features in OpenSolaris 2008.11" on page 12.

Live CD and Installer

The Live CD boots to a functional GNOME desktop. The desktop includes Firefox, Thunderbird, and other core applications. `nwamd(1M)` is enabled to automatically manage your network interfaces. See "`nwamd(1M)`" on page 61.

For a general description of the purpose and function of a Live CD, see "What Is a Live CD?" (`http://en.wikipedia.org/wiki/Live_CD`)

To download the Live CD image, go to the `http://www.opensolaris.com/get/` site and select the link to download the current OpenSolaris release.

Note the following Live CD options:

- You can choose another language for the Live CD. OpenSolaris has language support for more than 40 languages. Input and output support for these additional languages can be activated on the Live CD as follows:
  1. Log out of the Live CD desktop.
  2. Use the Option button on the login screen to choose a language.
  3. Log in to the Live CD.
- If you are prompted to log in to the Live CD, both the user name and password are **`jack`**.

- Root login is not enabled either on the Live CD or on the installed system. You must log in as the user that you created during the installation. After you log in, you can then become superuser to configure the system. Because root is a role, open a terminal window and use the `su` command to assume the role, or the `pfexec sh` command to run commands in a privileged shell. The root password for the Live CD is **`opensolaris`**.

  For further information, see "Login and Root Specifications" on page 19.

- You can install the OpenSolaris 2008.11 release from the Live CD.

  Start the installer by selecting the Installer icon on the Live CD desktop. The installer enables an initial installation of the CD's contents on an x86 system. The installed `root(/)` file system is ZFS.

Caution – The installer can perform an initial installation into a Solaris partition or use an entire disk. The installation overwrites all software and data on the selected target.

See the installation instructions at "Installation Roadmap" on page 15.

Package Manager

The Package Manager is a graphical user interface that enables you to install, update, and manage packages on your installed system. Packages that are not included in the initial installation image can be downloaded after the installation.

For information, see "The Package Manager (IPS GUI)" on page 67.

Image Packaging System (IPS CLI)

You can use the Package Manager GUI as described previously to easily add, update, and manage packages on your installed system. Or, you can use the Image Packaging System (IPS) command-line interface (CLI) to perform these tasks.

You can select versioned builds of components to manage or create your own custom OpenSolaris distribution. IPS commands access packages from network repositories and install them to your image. Both IPS packages and SVR4 packages are supported.

For further information about the IPS CLI, see Chapter 6, "Image Packaging System (IPS) For New Users."

For instructions about installing developer applications, including developer tools such as NetBeans 6.1, OpenOffice.org, GlassFish v2 Application Server, and Sun Studio Express 5/08, see the *OpenSolaris 2008.11 Developer Environment* (`http://dlc.sun.com/osol/docs/content/>2008.11/OSDEV/wits0.html`).

Upgrade Your Installed System

To upgrade from the OpenSolaris 2008.05 release to the OpenSolaris 2008.11 release, you must use a particular procedure described at "Updating Your System to OpenSolaris Development Builds" (`http://www.opensolaris.org/os/>project/indiana/resources/relnotes/200805/>image-update/`).

For information about upgrading the OpenSolaris 2008.11 release, see "Upgrading An Image" on page 56.

Manage Boot Environments

In the OpenSolaris 2008.11 release, you can use the `beadm` utility to create and manage snapshots and clones of your boot environments. This utility is particularly useful for managing multiple OpenSolaris boot environments on a single system.

For information, see Chapter 8, "Introduction to Boot Environments."

New Installation Features in OpenSolaris 2008.11

The OpenSolaris 2008.11 release includes the following new installation features and enhancements.

- Zones support in the `beadm` utility
- A new automated installer application
- An enhanced distribution constructor

For information about the `beadm` utility, see Chapter 8, "Introduction to Boot Environments."

The new automated installer application enables you to install the OpenSolaris 2008.11 release on multiple x86 platforms, using new enhanced and simplified installation tools. The OpenSolaris automated installer is a new enterprise installation technology. The automated installer provides support for network and local installations, where one installation specification can be applied to multiple systems.

For information, see the *OpenSolaris 2008.11 Automated Installer Guide* (`http://dlc.sun.com/osol/docs/>content/2008.11/AIinstall/`).

The distribution constructor is a command-line tool for building preconfigured, bootable OpenSolaris images. In the OpenSolaris 2008.11 release, this tool takes a manifest file as input, and outputs an ISO image that is based on the parameters specified in the manifest. Optionally, a USB image can be created, based on the generated ISO image.

The default ISO image created by the Distribution Constructor is comparable to the Live CD image that is included in the OpenSolaris 2008.11 release. However, you can modify the content of the ISO image, selecting and adding additional packages to the image. And, you can revise the default settings for the resulting booted environment to create a custom, redistributable, ISO or USB image.

For information, see the *OpenSolaris 2008.11 Distribution Constructor Guide* (`http://dlc.sun.com/osol/docs/>content/2008.11/DistroConst/`).

◆ ◆ ◆ CHAPTER 2

Preparing for Installation

Review the following installation options and requirements for the OpenSolaris 2008.11 release.

Installation Roadmap

You have a number of options for installing the OpenSolaris 2008.11 release.

1. Choose one of the following options:
   - To run, and optionally to install, the OpenSolaris ISO image as a "guest" in a VirtualBox, go to the instructions for "Running OpenSolaris Using VirtualBox" on page 39.

     Note – For this option, you must first install the VirtualBox application. After VirtualBox is installed, reboot your existing operating system. Then, insert the OpenSolaris Live CD in the CD/ROM drive, open VirtualBox and set the Live CD to run "in the box."

   - To install an OpenSolaris "guest" on a hypervisor, based on the Xen open source project, go to "Installing OpenSolaris on Xen" (`http://blogs.sun.com/mrj/`).

For further information about the OpenSolaris xVM hypervisor, see "OpenSolaris xVM Documentation" (`http://www.opensolaris.org/os/community/xen/docs/`).

- If you already have the OpenSolaris 2008.05 release installed on your system, go to "Upgrading An Image" on page 56 for instructions about how to upgrade to the OpenSolaris 2008.11 release.
- To install the OpenSolaris 2008.11 release from the Live CD onto your system, continue to steps 2 and 3.

Note – If you do not have the OpenSolaris 2008.11 Live CD, you can download the ISO image for the Live CD. See `http://www.opensolaris.com/get/`.

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2. Check the requirements and limitations for running the installer on your x86 system:
   a. Verify that your x86 system meets the "System Requirements" on page 19.
   b. Review the "Login and Root Specifications" on page 19 and the "Limitations for the OpenSolaris 2008.11 Release" on page 18.
   c. Verify that you have installed all necessary device drivers by using the "Using Device Driver Utility Version 1.1" on page 22.
3. Choose one of the following alternatives for installing from the Live CD on your system:
   - If the OpenSolaris OS will be the only operating system installed on your x86 system, see instructions for "Installing OpenSolaris 2008.11 from the Live CD" on page 30.

- If you will be setting up a multiboot environment, review the specifications in "Preparing for a Multiboot Environment" on page 24.

  a. Back up your system. This step is strongly recommended when repartitioning your system. See the backup instructions in step one for "Partitioning a Multiboot System" on page 26.

  b. Continue with the steps for "Partitioning a Multiboot System" on page 26. If you already have a Solaris `fdisk` partition on your system, the installation overwrites this partition.

  c. After you have partitioned your system, see the instructions for "Installing OpenSolaris 2008.11 from the Live CD" on page 30.

For troubleshooting help, see the "OpenSolaris 2008.11 Release Notes" (`http://opensolaris.org/os/project/indiana/>resources/relnotes/200811/x86/`).

Or, email questions to `indiana-discuss@opensolaris.org`.

Limitations for the OpenSolaris 2008.11 Release

The OpenSolaris 2008.11 release, has the following limitations:

- At this time, the OpenSolaris 2008.11 release is for 32-bit or 64-bit x86 platforms only. This release is not yet available for SPARC platforms.
- The installer cannot upgrade an existing operating system. The installer can perform an initial installation into a Solaris partition or use an entire disk.

  The installation overwrites all the software and data on the selected target. However, you can upgrade all installed packages on your installed system by using the Image Packaging System. See "Upgrading An Image" on page 56.
- The entire content of a preexisting Solaris partition is overwritten during the installation. Existing file systems cannot be preserved.
- The OpenSolaris OS installs a ZFS root file system, not a UFS root file system, on the disk selected during installation. The ZFS pool installed initially consists of the entire Solaris fdisk partition on the selected disk. After the initial installation is complete, you can add additional disks to this pool to create a mirrored pool configuration. For further information, see the ZFS documentation at `http://opensolaris.org/os/community/zfs/docs`.
- A maximum of 2Tbytes on a disk or on a partition is usable for installing the OpenSolaris 2008.11 release, even if the disk or partition is larger than 2 Tbytes.

System Requirements

Requirement	Description
Memory	The minimum requirement is 512 MB.
Disk space	Recommended size is at least 8 GB. A minimum of 2.6 GB is required.
Multiboot capability	If you are installing OpenSolaris on a system that will have more than one OS, use the `fdisk` command or a third-party partitioning tool to create a new partition or to make adjustments to preexisting partitions. See "Partitioning a Multiboot System" on page 26. For multibooting information about specific operating systems, see "Preparing for a Multiboot Environment" on page 24.

In addition to these system requirements, also review "Login and Root Specifications" on page 19 and "Limitations for the OpenSolaris 2008.11 Release" on page 18.

Login and Root Specifications

During the OpenSolaris 2008.11 installation, you are prompted to create a user account and a root password for your system.

Review the following login, user account, and root specifications.

- Root login is not enabled either on the Live CD or on the installed system. You must log in as the user that you created during the installation. After you log in, you can then become root to configure the system. Because root is a role, open a terminal window and use the `su` command to assume the role, or the `pfexec sh` command to run commands in a privileged shell.

  Note – If you try to log in to the installed system as root, an error message displays. Click OK and log in as the local user that you created during the installation.

- Root is a role per Role-Based Access Control (RBAC) specifications. However, if you do not create a user account during the installation, root is set up as a normal account on the installed system, instead of as a role. This is the only situation where you can log in to the installed system as root without manually changing the role assignment for root.
- After you install the OpenSolaris 2008.11 release, if you wish to manually change the installed system to permit root logins, remove root as an assigned role for users. Then, type the following at the command line:

  ```
  # rolemod -K type=normal root
  ```

  This command converts root to a normal account.
- If you forget the local user name or password that you entered during the installation, you must boot the system into Maintenance Mode as described in "How to Troubleshoot OpenSolaris Login" on page 21.

For additional instructions, see the following resources.

TABLE 2–1 RBAC Documentation

Resource	Topic
`rbac(5)` man page	Instructions for Role-Based Access Control
"RBAC: An Alternative to the Superuser Model" `(http://dlc.sun.com/osol/docs/>content/SYSADV6/prbac-1.html)`	Introduction to roles in the OpenSolaris environment
"Using RBAC (Task Map)" `(http://dlc.sun.com/osol/docs/>content/SYSADV6/>rbactask-1.html#rbactask-14)`	Instructions about using existing roles or customizing roles

▼ How to Troubleshoot OpenSolaris Login

If you are unable to log in to your installed system, use the following procedure.

1 **Boot the system in single user mode.**

For instructions, see "x86: How to Boot a System to Run Level S (Single-User Level)" `(http://dlc.sun.com/osol/docs/>content/SYSADV1/hbx86boot-68676.html#fvzqr)`.

Use the following two instruction changes that are specific to the OpenSolaris 2008.11 release.

- In the instructions at this URL, use the `kernel$` line option in the instructions instead of `kernel` line option.
- Before you are prompted to enter the root password using these instructions, you will need to enter an account name. The account name can be root, or any other privileged account, such as "jack" on the Live CD, or an account that you created during the installation.

2 *Optional:* **To view the existing users and roles, type:**

```
-bash-3.2#  cat /etc/user_attr
```

3 *Optional:* **To delete a user, type:**

```
-bash-3.2# userdel username
```

4 **Create the user name that you want.**

```
-bash-3.2# useradd username
```

5 **Assign a password for the user name.**

```
-bash-3.2# passwd username
```

You will be prompted to type the password twice.

6 **Assign the root role to that user.**

```
-bash-3.2# usermod -R root username
```

7 **Type Exit to return to the installed system.**

Using Device Driver Utility Version 1.1

In the OpenSolaris 2008.11 release, the Device Driver Utility 1.1 is an application that provides information about the devices of your native system. The Device Driver Utility enables you to connect to the Image Packaging System (IPS) repositories and to search the device drivers on your system to find devices that do not have drivers attached to them. IPS has repositories of OpenSolaris packages. You can find suitable drivers for the devices that you need in these repositories.

To invoke the Device Driver Utility from the OpenSolaris desktop, go to the menu bar and click Application> System Tools> Device Driver Utility.

Use the Device Driver Utility application to perform the following functions:

- Get information about devices installed on your native system, and check whether their corresponding device drivers exist.
- Search the IPS repositories for your system devices that do not have corresponding drivers attached.
- Download and install the device drivers from the IPS repositories for devices on your system.
- Get the details of the third-party drivers that exist for your system devices, and install them manually from the corresponding third-party web site.
- Submit system configurations to the OpenSolaris OS Hardware Compatibility List (HCL).

Python version 2.4 and Perl version 5.8 are needed to run this utility and are integrated in the OpenSolaris 2008.11 release.

You must have an internet connection to use the Device Driver Utility, in order to connect your system to the IPS repositories which contain OpenSolaris packages. By connecting your system to these repositories, you can get the device driver that is suitable for the devices of your system. By having an internet connection, you can also submit your system configuration to the OpenSolaris OS HCL.

To get more information about working with the Device Driver Utility tool, refer the online help in the tool menu. If you have any questions, send an email to `driver-utility-feedback@sun.com`.

Preparing for a Multiboot Environment

If you are installing OpenSolaris 2008.11 as part of a multiboot environment, review the following multibooting specifications for various operating systems.

Note – If you choose to mount the OpenSolaris OS in a VirtualBox, see the instructions for "Running OpenSolaris Using VirtualBox" on page 39. If you are installing on a system that is running the Mac OS X, and you have installed Parallels, see "Installing on a Mac OS X System and Parallels" on page 50.

TABLE 2–2 Multiboot Environments

Existing OS	Description
Microsoft Windows	If you have Windows installed, and you set up enough space to install the OpenSolaris OS, the installation should be straightforward. All versions of the OpenSolaris OS release use the GRUB bootloader. These OpenSolaris releases recognize Windows and ensure that the Windows partitions remain unchanged by default. When the OpenSolaris installation is finished, the GRUB menu gives you the option to boot either the Windows system or the OpenSolaris system. If you are using VMware, see "Test-driving OpenSolaris 2008.11 (B99) With VMware Workstation 6" (http://www.deviantptr.net/blog/opensolaris/>20081027/). See also "Getting Started With OpenSolaris Using VMWare" (http://www.genunix.org/wiki/index.php/>Getting_Started_with_OpenSolaris_using_VMWare).

TABLE 2–2 Multiboot Environments *(Continued)*

Existing OS	Description
Linux, or Windows and Linux	If you have Linux installed, or Linux and Windows installed, and you are currently booting through GRUB, save and print out your `/boot/grub/menu.lst` GRUB menu file from the Linux system before installing the OpenSolaris OS. You must replace this information in the `/boot/grub/menu.lst` file when you finish booting. See `grub(5)` man page. **Note –** If you are installing the OpenSolaris OS on a multiboot system that also contains the Linux OS, the Solaris partition must precede the Linux swap partition.
Solaris 10 OS	The installer cannot be used to multiboot the OpenSolaris OS. However, the installer can be used to replace instances of Solaris 10 1/06 and later, and instances of Solaris Express, in an existing multiboot Solaris system.
Extended Partitions	If you have another OS on an extended partition, the existing extended partition is not changed and is not lost during an OpenSolaris release installation. Existing extended partitions are not visible during the OpenSolaris release installation, but the primary `fdisk` partition in which the extended partition resides is visible. No data in these partitions is lost due to the installation. The OS on an extended partition is not displayed on the GRUB menu. To update the GRUB menu, see the GRUB overview "x86: Administering the GRUB Bootloader" `(http://docs.sun.com/app/docs/doc/819-2379/>grubtasks-1?a=view)`. See also `menu.lst` file specifics at "x86: Booting a Solaris System with GRUB" `(http://docs.sun.com/app/docs/doc/>819-2379/hbx86boot-68676?a=view)`.

Partitioning a Multiboot System

The installer uses the open source GRUB bootloader, which supports installing multiple operating systems on one drive. Prior to installing, you need to create a partition for installing the OpenSolaris software. After partitioning and installing the operating systems, one of the operating systems can be deployed by choosing between the different operating systems at boot time.

▼ How to Partition a System

1 **Back up your system!**

Backing up your system is strongly recommended before repartitioning your hard drive. See the demo "Backing Up the Disk Media Content" (`http://frsun.downloads.edgesuite.net/sun/>07C00892/media/demos/>OpenSolarisDualBoot-Step1-Backup.html`).

The G4U open source tool was designed to back up x86–based operating systems. This demo provides sample step-by-step instructions for using the G4U open source tool to back up a system that has Windows XP installed on it.

2 **Create a partition on your hard drive for installing the OpenSolaris OS.**

If you are installing OpenSolaris on a system that will have more than one OS, use the `fdisk` command or a third-party

partitioning tool to create a new partition or to make adjustments to preexisting partitions. Choose one of the following options:

- **Use the `fdisk` command to create or modify a Solaris `fdisk` partition.**

  For instructions, see "x86: How to Create a Solaris fdisk Partition" (`http://docs.sun.com/app/docs/doc/>819-2723/disksxadd-19036?a=view`).

  See, also, the `fdisk(1M)` man page.

- **Use commercial products or open-source tools to partition your hard drive.**

  GParted is an open-source tool for disk partitioning. The ISO image for the GParted tool can be downloaded from the GParted Web site (`http://gparted.sourceforge.net/>download.php`). Use this download to burn a CD that includes the GParted tool.

  See the Dual-Boot Partitioning Video (`http://frsun.downloads.edgesuite.net/sun/>07C00892/media/demos/OpenSolarisDual>Boot-Step2-Partition.html`). This video provides sample step-by-step instructions that explain how to shrink a Windows XP system in order to make room for a Linux swap partition.

  Linux-swap is the same partition ID that Solaris uses. During the installation, in the disk partitioning step, you can change this Linux-swap partition to a Solaris partition.

3. **Use the installer to install the OpenSolaris OS to the Solaris `fdisk` partition as described in the next section.**

See Also The demos that are referenced in this section show you how to partition a system that has Windows XP installed on it. See

"Backing Up the Disk Media Content" (http://frsun.downloads.edgesuite.net/>sun/07C00892/media/demos/>OpenSolarisDualBoot-Step1-Backup.html)

See, also, "Dual-Boot Partitioning" (http://frsun.downloads.edgesuite.net/sun/>07C00892/media/demos/OpenSolarisDualBoot->Step2-Partition.html).

Additional sample instructions are posted in the OpenSolaris community for the following dual-boot procedures:

- "OpenSolaris with MacOS on MacBook Pro" (http://www.genunix.org/wiki/index.php/>OpenSolaris_Dual_Boot)
- "OpenSolaris and Ubuntu Linux Dual-Boot Installation Instructions" (http://www.opensolaris.org/os/community/>documentation/reviews/Dual_Boot_Install_Doc_Plan/>Dual-Booting-OpenSolaris-with-Ubuntu-Linux)
- "OpenSolaris and Microsoft Vista Dual-Boot Installation Instructions" (http://www.opensolaris.org/os/>community/documentation/reviews/>Dual_Boot_Install_Doc_Plan/>Dual-Booting-OpenSolaris-with-Vista)
- "Recovering OpenSolaris/Solaris/Linux After Windows Installation" (http://salmanjamali.blogspot.com/>2008/04/>recovering-opensolarissolairslinux.html)

◆ ◆ ◆ CHAPTER 3

Installing the OpenSolaris 2008.11 Release

Select an installation procedure from one of the following options:

- To install the OpenSolaris 2008.11 release on your system, see the instructions in "Installing OpenSolaris 2008.11 from the Live CD" on page 30.
- To run the OpenSolaris ISO image as a "guest" in a VirtualBox, see instructions for "Running OpenSolaris Using VirtualBox" on page 39.
- If you are installing on a system that is running the Mac OS X, and you have installed Parallels, see "Installing on a Mac OS X System and Parallels" on page 50.
- If you are using VMware, see "Test-driving OpenSolaris 2008.11 (B99) With VMware Workstation 6" (`http://www.deviantptr.net/blog/opensolaris/>20081027/`).

  See also "Getting Started With OpenSolaris Using VMWare" (`http://www.genunix.org/wiki/index.php/>Getting_Started_with_OpenSolaris_using_VMWare`).
- To install an OpenSolaris "guest" on a hypervisor, based on the Xen open source project, see "Installing OpenSolaris on Xen" (`http://blogs.sun.com/mrj/`).

  For further information about the OpenSolaris xVM hypervisor, see "OpenSolaris xVM Documentation" (`http://www.opensolaris.org/os/community/>xen/docs/`).

Installing OpenSolaris 2008.11 from the Live CD

This OpenSolaris release provides an initial installation of the OpenSolaris OS from the Live CD. An existing Solaris `fdisk` partition is overwritten during the initial installation.

Review the "OpenSolaris 2008.11 Release Notes" (`http://opensolaris.org/os/project/indiana/>resources/relnotes/200811/x86/`).

▼ How to Install OpenSolaris 2008.11 from the Live CD

Before You Begin

Before installing the OpenSolaris OS, review the system requirements and limitations described in the preceding sections of this document.

Note – Before you install the OpenSolaris OS on a system that is running the Linux OS, save a copy of the `menu.lst` file. The contents of the GRUB `menu.lst` file dictate what is displayed in the GRUB menu when you boot the system. You will need to update the GRUB menu after the installation.

For further information, see `menu.lst` file specifics in "x86: Booting a Solaris System with GRUB" (`http://docs.sun.com/app/docs/doc/819-2379/>hbx86boot-68676?a=view`).

The following default settings are used for this release.

- The installation uses an existing partition or a new created Solaris `fdisk` partition to create a ZFS storage pool. If a second disk is available, you can add a second disk to the ZFS pool to create a mirrored configuration.
- This release installs an OpenSolaris system that is automatically networked by using DHCP with DNS name resolution.
- The `nwamd` daemon is enabled by default. `nwamd` introduces an alternate instance of the network or physical SMF service that enables automated network configuration.

  For further information, see the "`nwamd(1M)`" on page 61. The `nwamd`(1M) man page provides instructions about how to disable or enable the network/physical:`nwam` instance.
- IPv6 is disabled.
- The DNS domain and server IP addresses are retrieved from the DHCP server.
- The NFSv4 domain is dynamically derived.
- Kerberos is disabled.

1 To start the installer from the Live CD desktop, select the Installer icon on the Live CD desktop.

Note – If you are prompted to log in to the Live CD, both the user name and password are **`jack`**. The root password is **`opensolaris`**.

A text prompt enables you to select an installer language before the installer begins. The default language is English.

The installer begins.

2 Complete any additional selections in the preliminary installation panels.

Note the following important considerations:

- The installation overwrites the whole disk layout if one of the following is true:
  - The disk table cannot be read.
  - The disk was not previously partitioned.
- If an existing Solaris `fdisk` partition is on a multiboot system, and the user makes no modifications to the existing partitions, the installation overwrites the Solaris `fdisk` partition only. Other existing partitions are not changed.

3 In the Disk panel, select disk and partition location for the OpenSolaris OS.

a. In the top portion of the Disk panel, select the disk where the OpenSolaris OS will be installed.

The top portion of this panel displays the internal disks, external disks, and solid-state drives that are available on the system. This panel also displays the size of each disk in gigabytes.

Note – To be recognized by the installer, the disks and solid-state drives must be plugged in before the installer begins.

The recommended size and minimum size for the OpenSolaris OS installation are displayed. Disks that are too small for a successful installation are labeled as such. The recommended size is at least 8 Gbytes.

Note – A maximum of 2Tbytes on a disk or on a partition is usable for installing the OpenSolaris 2008.11 release, even if the disk or partition is larger than 2 Tbytes.

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b. In the bottom portion of the Disk panel, click either Use the whole disk or Partition the disk.

The bottom portion of this panel displays the existing disk partitioning.

Caution – If the existing partition table cannot be read, a warning is displayed, and the panel displays proposed partitioning. In this case, all data on the disk is destroyed.

- **If you choose to partition the disk, review the following partitioning guidelines, then revise the partitioning panel settings as needed.**
  - Only one Solaris partition is allowed. If an existing Solaris partition is available, that Solaris partition will be the target for the installation. Or, if you do not have an existing Solaris partition, you can change any existing partition to a Solaris partition.
  - You can resize existing partitions, delete partitions, and create new partitions in this panel. For this option, one existing Solaris partition must be available as the target for the installation.

Caution – The partitions are displayed in physically sequential order as they are laid out on the disk. Resizing a Solaris partition destroys the data on that partition and all physically subsequent partitions. Existing data is not moved to conform to a new partition layout. However, resizing the last partition or appending a new partition does not affect the data that already exists in other partitions. Non-Solaris partitions cannot be resized.

Caution – To make additional space available, you can change an existing partition to Unused. However, if you change an existing partition to Unused, all subsequent non-Solaris partitions are also changed to Unused.

Caution – New partitions can only use the available space that follows the last defined partition. The installer cannot utilize unallocated chunks of space between existing defined partitions. Use the `fdisk(1M)` command to create new partitions that use the free space between exiting partitions.

- If you used a third-party partitioning tool such as GParted, then the Disk panel displays a partition named Linux-swap on which you can install the OpenSolaris OS.

Note – In this panel, use the drop-down list for the Linux-swap partition name to change the partition name to Solaris.

Note – Manual control of the OpenSolaris file system layout is not supported. During the installation, the Solaris `fdisk` partition is reformatted with a default ZFS file system layout. All existing file systems on the Solaris partition are destroyed.

The installation uses a Solaris `fdisk` partition to create a ZFS storage pool.

If a second disk is available, you can, after the installed system has been booted, add a second disk to the ZFS pool to create a mirrored configuration. To create a mirrored configuration, use the ZFS `attach` command to add a second disk to the storage pool. For example:

```
# zpool attach rpool c0t2d0s0 c0t4d0s0
```

The following example illustrates a ZFS file system setup with a redundant configuration:

```
# zpool status
  pool: rpool
 state: ONLINE
 scrub: none requested
config:

NAME          STATE     READ WRITE CKSUM
rpool         ONLINE       0     0     0
mirror        ONLINE       0     0     0
c0t2d0s0      ONLINE       0     0     0
c0t4d0s0      ONLINE       0     0     0

errors: No known data errors
```

- **In the same panel, you can choose instead to install the OpenSolaris OS on the whole disk.**

Caution – This option erases the existing disk. The entire disk is overwritten with the new OpenSolaris OS.

When you have revised the partitioning as needed, click Next.

4 **Complete time zone, date, and time settings.**

The next panel enables you to type the correct time zone, date, and time for the system to be installed. The top half of the panel displays a world map with major cities marked. The bottom half of the panel provides drop-down selections. You can choose the time zone either from the map or from the drop-down list.

- **If you select the time zone from the map, click on a city or click anywhere on the map.**

  If you click on the map, but not on a city, the map automatically magnifies that area. You can click on a location within that magnified area. You can drag the cursor to move the magnified area to a different location on the map. When you select a site on the map, the drop-down selections automatically populate with the time zone, date, and current time for that map selection. You can right-click to deselect magnification.

- **Instead of using the map, you can make your selections in the drop-down fields.**

  Select your region, then select Location. Finally, select time zone. The options for each drop-down field are determined by the selection made in the prior drop-down field.

Note – You can edit the default date and time that is provided.

When the settings are correct, click Next.

5 Select language and locale, then click Next.

The next panel enables you to select a language and locale. These selections determine the language support, the default date and time, and other data formats for the installed system.

- You can accept the default language selection or change the selection.
- A language selection is required. You can select "no default language support."
- The language chosen automatically determines the available locales in the drop-down list. Only one locale can be selected.

Note – Any time that you log in to the installed system, you can change either the locale for that particular session or the default locale by using the Options button in the Login dialog box.

---

6 Complete the user settings and click Next.

Review the following guidelines:

- Root login is not enabled either on the Live CD or on the installed system. You must log in as the user that you create in this panel. After you log in, you can then become root to configure the system.

  Note – If you do not create a user account in this panel, root is set up as a normal account on the installed system, instead of as a role. This is the only situation where you can log in to the installed system as root.

  For further information, see "Login and Root Specifications" on page 19.

- Both the root password and user account are optional. However, for better security, do complete these fields.

If the root password is not defined, a reminder is displayed when you click Next. If you do not want to define a root password, you can proceed.

- A user account requires only a Login name for the account to be valid. For better security, however, do complete all fields.

  If the user account information is not valid, a reminder is displayed when you click Next. If you do not want to define a user account, you can proceed.
- Type a computer name or accept the default. The computer name field cannot be blank.

7 In the Install panel, review and confirm installation specifications.

Caution – The installation begins when you click Install. Do not interrupt an installation in progress.

During the installation, a progress bar is displayed.

The final panel displays completion messages. You can review the installation log in this panel. You can either quit or reboot from this panel.

- **After a successful installation, to start the installed system, select Reboot. The reboot process might take a few minutes.**

  Note – Eject the Live CD as the next boot begins. Or, select the "Boot from Hard Disk" option on the GRUB menu.
- **To exit, select Quit and shut down your system.**

Next Steps After you have installed the OpenSolaris OS, if you have another operating system on your system, you might need to update the GRUB menu. The GRUB menu displays a list of

operating systems that can be booted. Solaris and Windows operating systems are displayed automatically on the GRUB menu. The contents of the GRUB `menu.lst` file define what is displayed in the GRUB menu when you boot the system. If you have an additional OpenSolaris OS or a Linux OS that is not displayed on the menu, you need to edit the GRUB `menu.lst` file. For further information, see `menu.lst` file specifics in "x86: Booting a Solaris System with GRUB" (`http://docs.sun.com/app/docs/doc/819-2379/>hbx86boot-68676?a=view`).

If you are unable to log in to your installed system, or if you want to customize the roles that were set up during the installation, see "Login and Root Specifications" on page 19.

Review the additional features that are available for your use after installation at "Next Steps After Installation" on page 53.

Running OpenSolaris Using VirtualBox

The VirtualBox™ software runs as an application in your operating system, providing an environment called a *virtual machine*, which enables you to install other operating systems as "guests" inside the virtual machine.

The VirtualBox software supports the following host operating systems.

TABLE 3–1 VirtualBox Hosts

Host Operating Systems	Supported Versions
Windows	■ Windows XP – All service packs ■ Windows Server 2003 ■ Windows Vista – 32-bit and 64-bit

TABLE 3–1 VirtualBox Hosts *(Continued)*

Host Operating Systems	Supported Versions
Linux on 32-bit and 64-bit systems	■ Debian GNU/Linux 3.1 at minimum ■ Fedora Core 4 at minimum ■ Gentoo Linux ■ Red Hat Enterprise Linux 3 at minimum ■ SuSE Linux 9 at minimum ■ OpenSuSE 10.1 at minimum ■ Ubuntu 5.10 at minimum ■ Mandriva 2007.1 and 2008.0
Apple Mac OS X (Intel)	All

Before running OpenSolaris inside your existing operating system (OS), you must first install the VirtualBox application. After VirtualBox is successfully installed on your computer, you can run the OpenSolaris ISO image or the Live CD as a virtual guest "in the box." You do not need to burn a DVD.

To run a "host" operating system inside VirtualBox, do the following:

1. Download VirtualBox to your computer.
2. Configure VirtualBox for your "host" OS.
3. Start the OpenSolaris OS or another operating system from inside VirtualBox.

Note – A minimum of 10 GB of disk space or virtual disk space is recommended in order to install the VirtualBox and to install the OpenSolaris release inside the VirtualBox.

See the following specific instructions for each step.

▼ How to Download the VirtualBox Application

VirtualBox is available at the Sun Download Center at `http://www.sun.com/download/`.

1. **Download xVM VirtualBox, selecting the option for your host operating system**
2. **Save the file to your desktop or local disk.**
3. **When the download is complete, close the browser.**

▼ How to Download the OpenSolaris ISO Image

Before You Begin

You can go to `http://www.opensolaris.com/get/` and either download the current OpenSolaris ISO image or order a free OpenSolaris 2008.11 Live CD. The following procedure describes the download option.

Note – The ISO image requires about 685 Mbytes on your hard drive.

---

1. **Select the link to download the OpenSolaris 2008.11 image file.**
2. **Save the OpenSolaris image file to a location on your computer.**

   For convenience, download to the same disk drive or partition where you placed your VirtualBox files.

   Depending on the speed of your Internet connection, the download takes several minutes.

▼ How to Install VirtualBox on a Windows Machine

1. **Navigate to the downloaded VirtualBox installation files or folder.**
2. **To start the installation, double-click the VirtualBox installation file and click Next on the pop-up window.**
3. **Accept the license agreement and click Next.**
4. **In the pop-up window, choose a location for the VirtualBox software.**

Note – You need 10 Gbytes or more disk space to install both VirtualBox and the OpenSolaris image.

---

5. **Accept the default location, or click the Browse button and type your preferred location. Then click Next.**
6. **Click the Install button.**
7. **When the completion message is displayed, click Finish.**

How to Install VirtualBox on a Linux Machine

Note – Download the latest version of VirtualBox as described previously, even if your Linux distribution comes with a VirtualBox version preinstalled. The preinstalled VirtualBox software is usually the Open Source Edition (OSE), which might not be suitable for running the OpenSolaris 2008.11 release.

1. **Open a terminal window and become the root user.**
2. **Navigate to the downloaded VirtualBox installation file.**
3. **Depending on your Linux distribution, start the installation process by using one of the following commands:**

   - **On rpm-based systems, such as Fedora, SuSE, or Red Hat, type the following:**

     ```
     rpm -ihv filename
     ```

     Replace *filename* with the name of the downloaded installation file.

   - **On deb-based systems, like Debian, or Ubuntu, type the following:**

     ```
     dpkg -i filename
     ```

     Replace *filename* with the name of the downloaded installation file.

Note – You might need to install additional packages to fulfill dependencies.

The installer searches for a precompiled kernel module. If no kernel module is available that is precompiled for your system, the installer attempts to compile and install a kernel module.

Note – You need to have basic build utilities, such as `gcc`, `make`, `binutils`, and `kernel header`, installed for the installer to be able to build the kernel module. Usually, these utilities are part of the standard installation of your Linux system. If these utilities are not present, the installer will be unable to build the kernel module. In this case, install the build utilities and manually start the kernel module compilation later by running `/etc/init.d vboxdrv setup` as root user.

---

4 **Add the current user to the vboxusers group.**

   a. **In a terminal window, type:**

      ```
      sudo usermod -G vboxusers -a username
      ```

      Replace *username* with the name of the current user.

   b. **Log out and log in again to apply the changes.**

5 **Open a terminal window, type `VirtualBox`, and press Enter to start the VirtualBox.**

6 **Accept the license agreement.**

▼ How to Install VirtualBox on a Macintosh (Intel) Machine

1 **Navigate to and mount the downloaded VirtualBox `.dmg` disk image file.**

2. **To start the installation, double-click the VirtualBox `.mpkg` file and click Continue.**

3. **Accept the license agreement and click Continue.**

4. **Select the destination volume and click Continue**

5. **Click Install to install VirtualBox in the default Applications folder, or click Change Install Location to install in another location.**

6. **Enter your user password.**

7. **When the completion message displays, click Close.**

▼ How to Set up VirtualBox for Use With OpenSolaris

Before You Begin If you have the OpenSolaris Live CD, boot to your host operating system, then insert the Live CD. Then, open the VirtualBox application.

1. **Start VirtualBox by using one of the following steps:**

   - **On Windows, click the Start button, and select VirtualBox from the list of programs.**
   - **On Linux, open a terminal window, type `VirtualBox`, and press Enter.**
   - **On Mac OS X, open Applications in the Finder and double-click VirtualBox.**

2. **On the first start of VirtualBox, type your registration information and click Confirm.**

   The main VirtualBox window appears.

3. **Click the New icon on the left side of the GUI, and click Next in the pop-up window.**

4. **Type a name for your virtual machine, and select OpenSolaris as the operating system, from the drop-down list. Click Next.**

5. **Select the amount of RAM to allocate to the OpenSolaris installation inside VirtualBox. Click Next.**

   Note – 512 Mbytes is the recommended minimum size. If you have 2 Gbytes or more of memory on your machine, you should choose 1 Gbyte for optimum performance. See substep C in the following step.

   ---

6. **Add a Virtual Disk Image (vdi) by selecting a name or adding a new name to the list. For the initial installation, follow these substeps:**

   a. **Select New and click Next.**

   b. **Accept the default Dynamically Expanding Image and click Next.**

   c. **Accept the default name, or type a path and name, and allocate space for the image.**

   d. **When you've completed the settings, click Next.**

   e. **Click Finish to create the disk image.**

7. **When the initial Virtual Disk Manager GUI appears with your new vdi file selected, click Next.**

8. **In the Summary screen, click Finish.**

   The main VirtualBox window appears. Your virtual OpenSolaris machine is displayed in the left panel, and is ready to use as a virtual machine.

9. **Click the CD/DVD-ROM link on the right-hand side, in the Details tab.**

10. **Check Mount CD/DVD Drive and select one of the following:**

    - If you are using the OpenSolaris Live CD, select Host CD/DVD Drive and close the Settings screen. Skip step 11.
    - If you are using a downloaded OpenSolaris ISO image, select ISO Image File and go to step 11.

11. **In the drop-down list, select the downloaded OpenSolaris ISO image. If the ISO image is not in the list, add the image as follows:**

    a. **Click the Select icon in the right of the drop-down list.**

    b. **Click the CD/DVD Images tab.**

    c. **Click the Add icon.**

    d. **Navigate to the downloaded OpenSolaris ISO image file and click Open.**

    e. **Click Select and close the Settings screen.**

    f. **Close the Settings screen.**

▼ How to Start OpenSolaris 2008.11 Using VirtualBox

1 **Start VirtualBox by using one of the following options:**

- **On Windows, click the Start button and select VirtualBox from the list of programs.**
- **On Linux, select VirtualBox from the System Tools menu (GNOME desktop) or from the System menu (KDE desktop).**
- **On Mac OS X, open Applications in the Finder and double-click VirtualBox.**

2 **Double-click your virtual machine icon or select it and click Start.**

Note – Unless you have the ISO on a CD, click the CD/DVD-ROM link and verify that the OpenSolaris ISO image file is selected.

The GRUB boot menu with three options is displayed. Then a SunOS Release message is displayed. Finally, a list of languages appears.

3 **When the list of keyboard layouts appears, press Enter to accept the English default. Or, type the number for your keyboard layout and press Enter.**

Note – When you click inside the VirtualBox window with your virtual machine running, the mouse cursor is trapped inside the virtual desktop. Use the Host Key to release the mouse cursor again. The Host Key is indicated at the lower right corner of the VirtualBox window. By default, the Host Key is the right Ctrl key on Windows and Linux, and the left Cmd key on Mac OS X.

4 **When the list of desktop languages appears, press Enter to accept the English default, or type the number to select another language and then press Enter.**

The application takes one or two minutes to load.

When the desktop screen appears, you are "in the box," running the OpenSolaris 2008.11 release.

Note – You should install OpenSolaris to your virtual hard drive in order to be able to install programs and save configurations.

5 **To install OpenSolaris 2008.11 on your virtual hard disk, click the Install OpenSolaris icon on the OpenSolaris desktop.**

See "Installing OpenSolaris 2008.11 from the Live CD" on page 30 for installation instructions.

Next Steps Review the additional features that are available for your use after installation at "Next Steps After Installation" on page 53.

See Also The following resources provide supplemental information about how to use OpenSolaris in a VirtualBox environment.

- Sun xVM VirtualBox Best Practices (http://wikis.sun.com/display/Appliance/>Sun+xVM+VirtualBox+Best+Practices)
- "OpenSolaris VirtualBox on MacOS" (http://www.genunix.org/wiki/index.php/>OpenSolaris_Virtual_Box)

See the following blogs for specific instructions for setting up an OpenSolaris OS in a VirtualBox on Ubuntu.

- "Install VirtualBox on Ubuntu" (http://amitksaha.blogspot.com/2008/03/>innotek-virtual-box-on-ubuntu-704.html)
- "Getting Started With OpenSolaris on Ubunto and VirtualBox" (http://amitksaha.blogspot.com/2008/03/>getting-started-with-indiana->on-ubuntu.html)
- "Installing OpenSolaris on Ubuntu using VirtualBox" (http://amitksaha.blogspot.com/2008/03/>installing-indiana-on-ubuntu-704-using.html)

Installing on a Mac OS X System and Parallels

If you are installing on a system and are running the Mac OS X and have installed Parallels, use the following procedure to install an OpenSolaris OS.

▼ How to Install When Using Parallels

Before You Begin See "Solaris Network Driver Installation" instructions in the *Parallels Desktop for Mac User Guide*

(http://www.parallels.com/files/upload/
>Parallels_Desktop_for_Mac_User_Guide.pdf).

1. **During the Parallels pseudo environment setup, set the networking choice to Ethernet bridge.**

2. **Using Parallels, boot the Live CD.**

3. **Continue the installation of the OpenSolaris OS.**

   For installation instructions, see "Installing OpenSolaris 2008.11 from the Live CD" on page 30.

4. **After installation of the OpenSolaris 2008.11 release, install the network driver.**

   For a sample installation that includes instructions for installing the network driver, see "OpenSolaris in Parallels VM on Mac OS X" (http://blogs.sun.com/lr/entry/
   >opensolaris_in_parallels_vm_on).

Next Steps Review the additional features that are available for your use after installation at "Next Steps After Installation" on page 53.

◆ ◆ ◆ CHAPTER 4

Next Steps After Installation

After installing the OpenSolaris 2008.11 release, you can customize your installed system as described in this section.

Next Steps After Installation

The following table summarizes the options you have after installation.

TABLE 4–1 Next Steps

Options	Documentation
Set up and administer system.	See "OpenSolaris System Administration" (`http://www.genunix.org/wiki/index.php/>Osoladmin:_Topics`). Topics include: ■ Set up audio and video ■ Set up printing ■ Using basic commands ■ Introduction to file systems ■ Troubleshooting

TABLE 4–1 Next Steps *(Continued)*

Options	Documentation
Install and update software packages on your system.	See "The Package Manager (IPS GUI)" on page 67. The Package Manager enables you to install, update, and manage packages on your installed system. For instructions about installing developer applications, such as the current version of NetBeans, OpenOffice.org, GlassFish v2 Application Server, and Sun Studio Express 11/08, see *OpenSolaris 2008.11 Developer Environment* (`http://dlc.sun.com/osol/docs/content/2008.11/>OSDEV/wits0.html`).
Explore the OpenOffice word processing and spreadsheet applications.	See "Getting Started With OpenOffice.org 2.x" (`http://documentation.openoffice.org/manuals/>oooauthors2/0100GS-GettingStarted.pdf`).
Explore the new installation features in the OpenSolaris 2008.11 release.	The OpenSolaris 2008.11 release includes the following new installation features and enhanced functionality: ■ The `beadm` utility includes support for non-global zones. ■ The new automated installer application enables you to install this release on multiple x86 systems. ■ The distribution constructor enables you to build preconfigured, bootable OpenSolaris™ images. For information about these features, see "New Installation Features in OpenSolaris 2008.11" on page 12.
Set up a web application developer environment.	See the *OpenSolaris 2008.11 Developer Environment* (`http://dlc.sun.com/osol/docs/content/2008.11/>OSDEV/wits0.html`). See also the *Web Stack Getting Started Guide for OpenSolaris 2008.11* (`http://wikis.sun.com/display/>WebStack/Web+Stack+Getting+Started+Guide`).

TABLE 4–1 Next Steps *(Continued)*

Options	Documentation
Explore additional developer's documentation.	See the *OpenSolaris 2008.11 Memory and Thread Placement and Optimization Developer's Guide* (`http://dlc.sun.com/osol/docs/content/>2008.11/MTPODG`). See also the *OpenSolaris 2008.11 Programming Interface Guide* (`http://dlc.sun.com/osol/docs/content/>2008.11/NETPROTO`).
Explore the Sun Studio developer software.	See *Getting Started With Sun Studio Software* (`http://docs.sun.com/source/820-3999`).
Set up and explore NetBeans.	See *NetBeans IDE Java Quick Start Tutorial* (`http://www.netbeans.org/kb/60/java/>quickstart.html`).
Develop Java SE applications in NetBeans IDE 6.0.	See the Introduction to Developing General Java Applications (`http://www.netbeans.org/kb/>60/java/javase-intro.html`).
Develop a simple device driver.	See the Device Driver Tutorial (`http://dlc.sun.com/osol/docs/content/>DRIVERTUT/drivertutp.html`).
Explore DTrace.	Dtrace is a dynamic tracing facility that can display relevant information about kernel or user processes. See the OpenSolaris 2008.11 Dynamic Tracing Guide (`http://dlc.sun.com/osol/docs/content/2008.11/>DYNMCTRCGGD`).
Upgrade an installed OpenSolaris release.	See "Upgrading An Image" on page 56.

TABLE 4–1 Next Steps *(Continued)*

Options	Documentation
Explore the OpenSolaris project and community.	The OpenSolaris 2008.11 release was developed as a project of the OpenSolaris community. You can explore this ongoing project. And, you can join the OpenSolaris community as they develop future releases of the OpenSolaris operating system. See Introduction to Operating Systems: A Hands-On Approach Using the OpenSolaris Project (`http://opensolaris.org/os/community/edu/>curriculum_development/`). See also OpenSolaris.org - the OpenSolaris community Web site (`http://opensolaris.org`).
Explore additional OpenSolaris documentation.	See any of the following OpenSolaris documentation sites: ■ OpenSolaris Documentation Hub (`http://www.opensolaris.org/os/community/>documentation`) ■ ZFS Documentation Hub (`http://opensolaris.org/os/community/>zfs/docs`) ■ xVM Hypervisor Documentation Hub (`http://www.opensolaris.org/os/community/>xen/docs/`)

Upgrading An Image

In the OpenSolaris releases, you upgrade an entire image or boot environment by using the `pkg image-update` command to update all the packages in that image that have available updates.

Note – To upgrade from the OpenSolaris 2008.05 release to the OpenSolaris 2008.11 release, you must use a particular procedure described at Updating Your System to OpenSolaris Development Builds (http://www.opensolaris.org/os/>project/indiana/resources/relnotes/200805/>image-update/).

Use one of the following methods to upgrade an image or boot environment:

- You can use the Package Manager graphical user interface (GUI) to update all installed the packages in your image to the latest available version for each package. You accomplish this task by selecting the Update All option in the GUI.

  For information, see The Package Manager (http://dlc.sun.com/osol/docs/content/>2008.11/IMGPACKAGESYS/pkg_mgr.html).

- The OpenSolaris 2008.11 release includes an Update Manager tool on the desktop that notifies users when updates are available for the packages that are installed on their system. You can use this tool to update all the packages in your image.

  On the desktop menu bar, click System->Administration->Update Manager to manually start the Update Manager.

  For information, see The Update Manager (http://dlc.sun.com/osol/docs/content/>2008.11/IMGPACKAGESYS/update_mgr.html).

- Alternately, you can use the `pkg image-update` command to perform that same task.

  ```
  pkg image-update [-nv]
  ```

The `pkg image-update` command updates all packages installed on your image that have available updates. Use the `-n` option to perform a test run of the updates. With the `-n` option, the command executes, but makes no persistent changes to the image. Or, you can use the `-v` option. With the `-v` option, the update is performed with progress messages displayed during the operation.

Note – The `pkg image-update` command does not support zones in boot environments prior to the OpenSolaris 2008.11 release. Delete these zones before you upgrade your image to the OpenSolaris 2008.11 release. If you are using the OpenSolaris developmental builds, the `pkg image-update` command has no support for zones prior to build 98.

Using either the Package Manager or the `pkg image-update` command, the process of updating all the packages automatically creates a clone: a new, bootable environment. The process of updating all the packages applies the changes to the clone instead of to the original boot environment. After the successful completion of the changes to the clone and reboot of the system, the new clone is provided as the default, active boot environment in the GRUB menu. The original boot environment remains on the GRUB menu as an alternate selection.

A clone of the boot environment includes everything hierarchically under the main root dataset of the original boot environment. Shared file systems are not under the root dataset and are not cloned. Instead, the boot environment accesses the original shared file systems.

Note – In the OpenSolaris 2008.11 release, the `pkg image-update` process does not upgrade zones. If you have included zones in your OpenSolaris 2008.11 environment, the `pkg image-update` process clones these existing zones into the new boot environment, but these zones are not upgraded. You must manually upgrade each of these zones.

After upgrading an image or boot environment, you can use the `beadm list` command to see a list of the boot environments on the system, including the new boot environment that was created by the `pkg image-update` command. See the following example.

```
os# pkg image-update
A clone of opensolaris exists and has been updated and activated.
On next boot the Boot Environment opensolaris-1 will be mounted on '/'.
Reboot when ready to switch to this updated BE.

os# beadm list

BE            Active Active on Mountpoint Space
Name                 reboot               Used
----          ------ --------- ---------- -----
opensolaris   yes    no        legacy     57.5K
opensolaris-1 no     yes       -          2.59G
```

In this example, the initial boot environment created by the installer is named "opensolaris." The boot environment created by the `pkg image-update` command is automatically named "opensolaris-1."

After rebooting to the changed boot environment, any inactive boot environment can be destroyed to save space by running the `beadm destroy` command. For instructions, see Chapter 8, "Introduction to Boot Environments."

For further information about the pkg command, see Chapter 6, "Image Packaging System (IPS) For New Users."

See, also, the pkg(1) man page (http://opensolaris.org/sc/src/pkg/gate/src/man/>pkg.1.txt).

Updating Specific Packages

As an alternative to upgrading an entire image or boot environment, you can update specific installed packages or package groups in the image or in the active boot environment by using either the Package Manager GUI or the `pkg install` command. Either method automatically checks for newer versions of specific packages or package groups, and installs them if they are available. Any dependent packages are also automatically updated.

For further information about updating specific packages, see "The Package Manager (IPS GUI)" on page 67 or Chapter 6, "Image Packaging System (IPS) For New Users."

See, also, the pkg(1) man page (http://opensolaris.org/sc/src/pkg/gate/src/man/>pkg.1.txt).

◆ ◆ ◆ CHAPTER 5

nwamd(1M) Man Page

In this OpenSolaris release, the nwamd daemon is enabled by default. nwamd introduces an alternate instance of the network or physical SMF service that enables automated network configuration.

nwamd(1M)

NAME: nwamd - network auto-magic daemon

SYNOPSIS: /lib/inet/nwamd

DESCRIPTION: nwamd is a system daemon to manage network interfaces. This daemon is started automatically and should not be invoked directly. It does not constitute a programming interface.

OPERATION: Whether this daemon is enabled or not depends on your installation medium. To check, enter the following at the command line:

```
% svcs svc:/network/physical
```

The two instances will be listed: one as disabled, the other as online. If the nwam instance is online then this daemon will be running. The two instances correspond to the two modes of network configuration: the default instance is for manual mode, while the nwam instance is for auto-magic mode.

To go from manual mode to auto-magic mode:

```
% svcadm disable svc:/network/physical:default
% svcadm enable svc:/network/physical:nwam
```

To go from auto-magic mode to manual mode:

```
% svcadm disable svc:/network/physical:nwam
% svcadm enable svc:/network/physical:default
```

CAUTION: When switching modes like this, all network interfaces will be brought down then back up, thus if a different IP address is configured in this process, existing applications and sessions may be disrupted.

Note – In auto-magic mode, there is a limitation that only one link is active at a time. This mode is thus not recommended for machines which use more than one link at once. For machines with wired and wireless links, wired is preferred by default, although this can be adjusted by altering the order of the lines in the plain text file `/etc/nwam/llp`. Note, however, that this interface is Volatile and may change in a future release.

PROFILES: Note that all interfaces listed in this section are Volatile and may change in a future release. They are documented here so that those wishing to experiment with this may do so. Profiles are a mechanism for making multiple related changes to the system configuration after IP service is available.

There is not direct support for them yet, but a “roll your own” mechanism is provided for now. Once an interface is brought up and an IP address is configured for it, the daemon looks for `/etc/nwam/ulp/check-conditions`; if it exists and is executable, it is run. This is expected to print a single line of output, which is the name of the profile which the user wishes

to be activated based on the current conditions. If such a line is read successfully (`foo` in this example), then `/etc/nwam/ulp/foo/bringup` is executed. Likewise, when the interface gets torn down for whatever reason, `/etc/nwam/ulp/foo/teardown` is executed. The `bringup` and `teardown` scripts are invoked via `pfexec`(1) with default basic privileges. Samples for each of these scripts can be found at:

- `http://opensolaris.org/os/project/nwam/prototype/check-conditions`
- `http://opensolaris.org/os/project/nwam/prototype/bringup`
- `http://opensolaris.org/os/project/nwam/prototype/teardown`

WIRELESS: When no wired link is available, a scan for wireless LANs will be done, and the resulting list offered via a GUI pop-up to prompt the console user to select his/her preference. If a successful connection is made, the WLAN in question will be stored in the plain text file `/etc/nwam/known_wifi_nets` and subsequently the daemon may connect to any WLAN in that list without prompting again. Should a user wish to revoke his/her preference for a WLAN in that list, editing the file and deleting the line with the entry should suffice. Note, however, that this interface is Volatile and may change in a future release.

ATTRIBUTE: See `attributes`(5) for descriptions of the following attributes:

ATTRIBUTE TYPE	ATTRIBUTE VALUE
Availability	SUNWcsr
Interface Stability	Volatile

SEE ALSO: `svcs`(1), `svcadm`(1M), `attributes`(5), `smf`(5)

NOTES: The networking service is managed by the service management facility, smf(5), under the service identifier:

```
svc:/network/physical
```

Administrative actions on this service, such as enabling, disabling, or requesting restart, can be performed using svcadm(1M). The service's status can be queried using the svcs(1) command.

◆ ◆ ◆ CHAPTER 6

Image Packaging System (IPS) For New Users

If you are new to Image Packaging System, go to the following sections to gain a basic understanding of IPS and the tasks that can be accomplished with IPS.

- If you have not installed the OpenSolaris 2008.11™ release on your system, read the Chapter 1, "Introduction to the OpenSolaris 2008.11 Release," to install and get started on OpenSolaris 2008.11.
- Read the "Introduction to IPS" on page 66 for a brief overview of IPS.
- IPS provides a graphical user interface to install and manage packages. If you are trying out OpenSolaris and IPS for the first time, read the "The Package Manager (IPS GUI)" on page 67 section and use the GUI to get started with installing packages.
- The Update Manager is a graphical user interface which provides an easy way to update all installed packages. See "The Update Manager" on page 68 for more information.
- Don't see any developer tools on your OpenSolaris system? See "Setting up Your OpenSolaris Development Environment" on page 68 to learn how to get the tools you need.

For complete information about IPS, see *OpenSolaris 2008.11 Image Packaging System Guide* (`http://dlc.sun.com/osol/>docs/content/2008.11/IMGPACKAGESYS/new-user.html`).

Introduction to IPS

After an initial installation of OpenSolaris 2008.11 operating system, you will find that many of the software applications that you use on a regular basis are not immediately available to you. These software applications are available as packages in a repository for downloading and installing over the internet. A repository is a source for packages.

The Image Packaging System enables users to connect to the repository and download and install packages.

The OpenSolaris 2008.11 release uses IPS for its packaging system. Besides installing packages from a repository, users can create and publish their own IPS packages, set up an OpenSolaris repository, mirror an existing repository, and publish existing packages to a repository.

Once you have installed packages, IPS enables you to search, update, and manage packages on your system.

With IPS , you can upgrade your system to a newer build of OpenSolaris, install and update your software to the latest available versions in a repository, and retrieve packages from mirror repositories.

If the system on which IPS is installed is on the network, IPS can automatically access the OpenSolaris repository. For the OpenSolaris 2008.11 release, your IPS client can access the packages from `http://pkg.opensolaris.org`.

OpenSolaris 2008.11 Repositories

The following repositories are available for the OpenSolaris 2008.11 release:

- `http://pkg.opensolaris.org` – Users can access this repository to download and install software that is specifically built to run on OpenSolaris 2008.11.
- See the table in "Repositories That Require Keys and Certificates (Overview)" on page 99 for a list of repositories that contain security fixes, access to encumbered packages and third-party nonredistributable packages. Access to these repositories may require a key and a certificate. See "Using Keys and Certificates for Repositories" on page 99 to learn more.

The Package Manager (IPS GUI)

The Package Manager application is a graphical user interface (GUI) for the IPS software. The Package Manager allows you to search, install, and remove packages; add, and modify repositories; and create and remove boot environments.

Note – For a complete list of the tasks and commands that can be performed with IPS, see the IPS man pages (`http://opensolaris.org/sc/src/pkg/gate/src/man/`).

See also the "`pkg(1)` Command Reference" on page 105.

You can start the Package Manager in the following ways:

Desktop Menu Click System->Administration—>Package Manager.

Command line Execute the following command at the prompt:

```
$ gksu packagemanager &
```

The Package Manager documentation is available in the `Help` menu of the application. Choose About->Help to learn how to use the Package Manager.

View the screencast (`http://webcast-west.sun.com/>interactive/09B01790/index.html`) to learn how to use the Package Manager.

The Update Manager

The Update Manager is a desktop application that enables users to update all installed packages in an image. Learn more about images in the "Introduction to IPS" on page 66 and Chapter 7, "Using IPS CLI," sections.

The Update Manager notifies the user when updates to the installed packages are available.

From the desktop, click System->Administration->Update Manager to manually start the Update Manager.

Read the Package Manager online help to learn how to use the Update Manager. Click About->Help in the Package Manager to access the help documentation.

Setting up Your OpenSolaris Development Environment

The OpenSolaris 2008.11 release offers complete support for developing and deploying applications for the web. The applications needed for development of web applications are available as packages in the `pkg.opensolaris.org` repository.

Use the Package Manager application to search and install packages on your system.

If you prefer to use the command-line to work with the packages, see the "IPS Commands" on page 74 section for a list of available commands and their usage.

To learn how to download and install applications such as Sun Studio compilers, NetBeans, and get the tools required to set up a Web Stack Development environment, see the *Setting up Your OpenSolaris Development Environment* (`http://wikis.sun.com/display/OpenSolarisInfo/>OpenSolaris+2008.11+Development+Environment+Guide`).

◆ ◆ ◆ CHAPTER 7

Using IPS CLI

The Image Packaging System software is a network-centric packaging system written in Python.

Note – Both IPS and SVR4 packages are supported for the OpenSolaris 2008.11 release.

With IPS, users can perform the following basic tasks:

- You can create your own image.
- After you have created your own image, you can install new packages and update existing packages from an IPS repository to your image.
- You can manage and search the packages on your image by using IPS commands that reference package attributes.

  See "IPS Commands" on page 74.

With IPS, developers can perform the following additional tasks:

- You can create your own network repository.
- Create and submit your own packages to an existing network repository.

  See Advanced IPS Commands (`http://dlc.sun.com/osol/>docs/content/2008.11/IMGPACKAGESYS/>ips_dev_cmds.html`).

See, also, IPS For Developers (http://dlc.sun.com/osol/docs/content/2008.11/>IMGPACKAGESYS/ips_dev_tasks.html).

- Mirror a repository.
- Download the contents of a package and republish the package.

What is an IPS Package?

An IPS package is defined as a collection of files, directories, links, drivers and dependencies in a defined format.

Note the following points about IPS packages :

- There is no standard on-disk format for an IPS package. Hence, unlike a `.rpm` file, an SVR4 package, or a `.nbm` file, an IPS package cannot be transferred from system to system. The repository where the IPS package is published or mirrored is the only source for the package.
- An IPS package consists of a set of actions. Actions are defined when an IPS package is being created.

  Actions are used for defining the files and directories of the package, setting package attributes, declaring dependencies on other packages, creating users and groups, and installing device drivers. Some actions may optionally have tags that provide meta information about the action such as locale information and debug configuration.

  For more information, see Actions in IPS (http://dlc.sun.com/osol/docs/content/2008.11/>IMGPACKAGESYS/actions.html).

Why Should I Create an Image?

An image is a location on your system where packages and their associated files, directories, links, and dependencies can be installed.

After you have completed the installation of OpenSolaris 2008.11 on your system, an image is automatically made available to you. You can install packages without explicitly creating an image.

However, creating images are necessary to provide a logical separation for different software applications, and especially required if you are working with zones.

To learn about zones, see the Zones section in the *Solaris Containers - Resource management and Solaris Zones* (`http://docs.sun.com/app/docs/doc/817-1592/>zone?l=en&a=view&q=zones`).

Authority vs Repository

An authority and a repository definition are sometimes used interchangeably in IPS and have different meanings at other times. The following points expound upon the definitions and clarify their usage.

- An authority is a person, groups of persons, or a corporation that publishes a package.
- A repository is a location from where packages are downloaded from. The location constitutes an address (URL) of a machine.
- A repository can contain packages from many authorities. Conversely many repositories can contain packages from a single authority.

- A default or preferred authority is similar to a default catalog. Any package chosen for installation is first searched for in the preferred authority's catalog. This package may be available for download from different repositories.
- You can have many repositories and one default authority. In this case, the default authority becomes the default repository.
- If there is only one default repository, it also becomes the default authority.

IPS Commands

The Image Packaging System software provides the following commands:

`pkg(1)`	Use the `pkg(1)` command to create an image, to install packages to your image, and to manage packages on your image.
`pkgsend(1)`	Use the `pkgsend(1)` command to publish packages from your image to an existing repository.
`pkg.depotd(1M)`	Use the `pkg.depotd(1M)` command to create and manage your own network repository or set up a mirror repositories.
`pkgrecv`	Use the `pkgrecv` command to download the **contents** of a package from a server. The user can then modify the contents by adding additional package attributes and republish the package with the `pkgsend` command.

Note – The pkg(5) man page describes the overall Image Packaging System. The pkg(1) man page describes the image packaging retrieval client.

Using IPS Commands (Tasks)

The following section provides information for end users to install, upgrade, search, and manage packages in the IPS repository.

Installing, Upgrading, and Managing Packages

The `pkg(1)` command is the retrieval client for the image packaging system.

`pkg(1)` can be invoked to perform the following actions :

- Create an image – `pkg image-create`.
- Display image property – `pkg property`
- Update an existing image property or add a new image property – `pkg set-property`.
- Remove an existing image property – `pkg unset-property`.
- Install new packages or update existing packages – `pkg install`.
- Verify packages have been installed correctly – `pkg verify`.
- Fix packages — `pkg fix`
- Search for packages – `pkg search`.

- Update all existing packages within an image – `pkg image-update`.
- "How to Display the State of Packages" on page 88 – `pkg list`.
- Display attributes of actions or the contents of a package – `pkg contents`.
- Display information about a package – `pkg info`.
- Uninstall packages – `pkg uninstall`.
- Update an existing authority or add additional package authority – `pkg set-authority`.
- Remove the configuration associated with the given authority – `pkg unset-authority`.
- Display authority information – `pkg authority`.
- View Command History– `pkg history`
- Delete Command History – `pkg purge-history`
- List Available Commands – `pkg help`

Refer to the "`pkg(1)` Command Reference" on page 105 to learn more about the subcommands and options for the `pkg(1)` command.

See, also, the pkg(1) man page (`http://opensolaris.org/>sc/src/pkg/gate/src/man/pkg.1.txt`).

pkg(1) Uses FMRIs

Each IPS package is represented by a Fault Management Resource Identifier (FMRI). The `pkg(1)` command uses valid FMRI package information to perform its command actions.

The FMRI includes descriptive information about the package, such as the package name, version information, and date.

For example, the FMRI, `pkg://opensolaris.org/library/>libc@5.11,5.11-0.75:20071001T163427Z`, consists of the following sequence of information :

- Scheme – pkg
- Authority – opensolaris.org
- Package Name – libc
- Version String – Consists of four components :
  - Component Version – 5.11
  - Build Version – 5.11
  - Branch Version – 0.75
  - Timestamp – 20071001T163427Z

Creating Images

The `pkg(1)` command is used to create an image.

An installed OpenSolaris 2008.11 release on your system, constitutes an image. Packages can be installed directly within this image. New images are created to mark a boundary between the packages installed in different images.

The `image-create` command sets up a relationship between the image and a server that can be accessed to add packages to the image.

Images can be of three types:

- Full images, capable of providing a complete system.
- Partial images, which are linked to a full image (parent image), but do not provide a complete system on their own.
- User images, which contain only relocatable packages.

Note – Refer to the table in "pkg(1) Command Reference" on page 105 for all the options and descriptions associated with the `pkg(1)` commands.

How to Create an Image

Before You Begin Ensure that you have write privileges to the directory where you are attempting to create an image.

- **Use the following command to create an image. A user image is created by default.**

  ```
  $ pfexec pkg image-create -[R]-[FfPUz] -a
  prefix=repository_url  directory_location
  ```

Example 7–1 Creating a Full Image

In this example, a full image is created with a repository server, `http://pkg.example.com` set as the preferred authority. The image is created in the directory, `/aux0/example_root`. The `-a` option is used to specify a server such as *http://pkg.example.com:10000*.

```
$ pfexec pkg image-create -F -a
example.com=http://pkg.example.com:10000 /aux0/example_root
```

Image Creation: Important Considerations

- It is recommended that users do not create multiple images in the same directory.
- It is recommended that users do not create an image under root (/).
- A preferred authority must be set when creating an image. Use the `-a` option to set the preferred authority.

- When you have multiple images on your system, use the `PKG_IMAGE` environment variable to specify what image you're operating on.
- The current design of IPS assumes that only one version of a package is installed at once in a single image. To install multiple versions of the same package, the name of the package should include the version number, and dependencies should reflect the version number and bind to the appropriate package version.

How to Display Image Property

- **Use the following command to view the properties of an image.**

  ```
  $ pkg property [-H] [propname]
  ```

  The following properties are displayed :

Property Name	Description
send-uuid	This property causes the client to include a UUID (Universally Unique Identifier) in transactions to servers for the image. This allows the server to uniquely identify clients.
require-optional	This property forces packages that are listed as an optional dependency of another one to be installed for the image.
flush-content-cache-on-success	If a package action such as an install or uninstall is successful, a value of `True` will cause the download cache to be purged for the image.

display-copyrights	Read—only for OpenSolaris 2008.11 release.
preferred-authority	Read—only for OpenSolaris 2008.11 release.
pursue-latest	Read—only for OpenSolaris 2008.11 release.

Example 7–2 Displaying Image Property

```
$ pkg property
PROPERTY                        VALUE
send-uuid                       False
require-optional                False
lush-content-cache-on-success   False
display-copyrights              True
preferred-authority             opensolaris.org
pursue-latest                   True
```

▼ How to Set An Image Property

- **Use the following command to set the property of an image:**

  `pfexec pkg set-property` *propname*

Note – The following properties are read-only and cannot be set using this command.

- display-copyrights
- preferred-authority
- pursue-latest

Example 7–3 Set the Value of an Image Property

This example sets the value of the `send-uuid` property.

```
pkg  property
PROPERTY                        VALUE
send-uuid                       False
require-optional                False
flush-content-cache-on-success  False
display-copyrights              True
preferred-authority             opensolaris.org
pursue-latest                   True

pkg -R set-property send-uuid True
pkg property
PROPERTY                        VALUE
send-uuid                       True
require-optional                False
flush-content-cache-on-success  False
display-copyrights              True
preferred-authority             local
pursue-latest                   True
```

▼ How to Remove an Image Property

- **Use the following command to remove a property of an image.**

  `$ pfexec pkg unset-property` *propname*

  The `pkg unset-property` command removes the specified property and resets the property to the default value the next time a `pkg(1)` command is executed.

Note – The following properties are read-only and cannot be removed using this command.

- display-copyrights
- preferred-authority
- pursue-latest

Example 7–4 Remove an Image Property

This example removes the `send-uuid` property.

```
$ pkg unset-property send-uuid
$ pkg property
PROPERTY                        VALUE
send-uuid                       False
require-optional                False
flush-content-cache-on-success  False
display-copyrights              True
preferred-authority             local
pursue-latest                   True
```

How to Perform a Dry-Run Installation Inside a New Image

Before installing packages, you have the option to perform a *dry run* installation. A dry run enables you to execute the command without making persistent changes to the image. The *dry run* option does not install any packages and only shows the changes that are made if the packages are installed.

- **Use the following command to execute a dry-run installation.**

  ```
  $ pkg install -n [-v] pkg_fmri
  ```

Note – *pkg_fmri* refers to a package name along with a version number and a subversion number, if applicable.

Example 7–5 Performing a Dry-Run Installation of the `SUNWzsh` Package

The following example shows a dry-run installation of the *SUNWzsh* package with verbose (`-v`) output.

```
$ pkg install --nv SUNWzsh

UNEVALUATED:+pkg:/SUNWzsh@4.2.5,5.11-0.75:20071019T203321Z
```

```
one -> pkg:/SUNWlibms@0.5.11,5.11-0.75:20071024T204210Z
[dir, file, link, and other actions for each resource delivered by
this package and succeeding packages omitted]
None -> pkg:/SUNWzlib@1.2.3,5.11-0.75:20071024T204906Z
None -> pkg:/SUNWlxml@2.6.23,5.11-0.75:20071024T204221Z
None -> pkg:/SUNWpool@0.5.11,5.11-0.75:20071024T204717Z
None -> pkg:/SUNWpr@0.5.11,5.11-0.75:20071024T204720Z
None -> pkg:/SUNWlibsasl@0.5.11,5.11-0.75:20071024T204217Z
None -> pkg:/SUNWtls@0.5.11,5.11-0.75:20071024T202854Z
None -> pkg:/SUNWopenssl@0.9.8,5.11-0.75:20071024T204623Z
None -> pkg:/SUNWcsl@0.5.11,5.11-0.75:20071024T202529Z
None -> pkg:/SUNWlibC@0.5.11,5.11-0.75:20071024T204202Z
None -> pkg:/SUNWpcre@7.0,5.11-0.75:20071019T202909Z
None -> pkg:/SUNWzsh@4.2.5,5.11-0.75:20071019T203321Z
```

▼ How to Install a Package

- **Use the following command to install a package.**

  `$ pfexec pkg install [-v]` *pkg_fmri*

Note – The `pkg install` command is also used to update specific packages on the system. The `pkg install` command automatically checks for newer versions of specific packages or package groups and installs them if they are available. Any dependent packages are also automatically updated.

Example 7–6 Install a Package

This example installs a `SUNWphp524-mysql` package. The output displays the status of the download, number of packages that were installed, number of files that were installed and the size (in megabytes) of the download.

```
$ pfexec pkg install SUNWphp524-mysql
DOWNLOAD      PKGS       FILES     XFER (MB)
Completed     3/3      301/301     123.70/123.70
```

```
PHASE                 ACTIONS
Update Phase            2/2
Install Phase         404/404
```

Example 7–7 Install a Package From a Different Repository

When an image is created, a preferred authority is set and this is the default authority from which packages are downloaded and installed.

To set an authority, see "How to Add or Update an Authority" on page 93. The package is then installed from the set authority.

This example installs the `SUNWphp524-mysql` package from the *http://example.opensolaris.org* authority.

```
$ pfexec pkg install pkg:/example.opensolaris.org/SUNWphp524-mysql
```

Example 7–8 Install a package in a Mounted, Inactive Boot Environment

This example installs a package in a boot environment that is mounted at `/mnt`.

```
# beadm mount BE1 /mnt
# pkg -R /mnt  install SUNWphp524-mysql
```

See Chapter 8, "Introduction to Boot Environments," to learn about the `beadm` command and boot environments.

▼ How to Verify a Package Installation

- **Use the following command to verify the installation of a package. Use the `-v` option for verbose output.**

  `$ pkg verify [-fv]` *pkg_fmri*

Example 7–9 Verify Package Installation

In this example, the installation of `SUNWphp524-mysql` package is verified.

```
$ pkg verify -v SUNWphp524-mysql
PACKAGE                         STATUS
pkg:/SUNWphp524-mysql           OK
```

▼ How to Fix a Package

- **Use the following command to fix any errors reported by the `pkg verify` command. Specify a *pkg_fmri* to fix errors in a specific package. If no arguments are given, the command will try to fix every package that fails to verify on the system.**

  `$ pfexec pkg fix` *[pkg_fmri]*

Example 7–10 Fix a Package

In this example, the package *SUNWfreetype2* does not install correctly and `pkg verify` reports the errors in the package contents.

```
$ pkg verify SUNWfreetype2

 PACKAGE                                                 STATUS
 pkg:/SUNWfreetype2                                       ERROR

    [ ... some lines removed ... ]

 file: usr/include/freetype2/freetype/ftxf86.h
    Group: 'root' should be 'bin'
    Mode: 0644 should be 0444
 file: usr/include/freetype2/freetype/t1tables.h
    Group: 'root' should be 'bin'
    Mode: 0644 should be 0444
 file: usr/include/freetype2/freetype/ttnameid.h
```

```
    Group: 'root' should be 'bin'
    Mode: 0644 should be 0444
 file: usr/include/freetype2/freetype/tttables.h
    Group: 'root' should be 'bin'
    Mode: 0644 should be 0444
 file: usr/include/freetype2/freetype/tttags.h
    Group: 'root' should be 'bin'
    Mode: 0644 should be 0444
 file: usr/include/freetype2/freetype/ttunpat.h
    Group: 'root' should be 'bin'
    Mode: 0644 should be 0444
 file: usr/include/ft2build.h
    Group: 'root' should be 'bin'
Mode: 0644 should be 0444
  file: usr/lib/amd64/libfreetype.so.6
    Elfhash: c1a90b38212c745d0698adfa66e4b644aefef154 should be
    efd14575d6af7df5dd8022d03d4766a8e6129c08
 file: usr/lib/libfreetype.so.6
    usr/lib/libfreetype.so.6 is not a regular file
    Group: 'root' should be 'bin'
    Mode: 0777 should be 0755
    Elfhash: 1db8340c2119903fad4833579b7187e671c96ba6 should be
10a061f9241ce83d86369cef4f7d174b61cb5021
 file: usr/lib/pkgconfig/freetype2.pc
    Group: 'root' should be 'bin'
    Size: 278 bytes should be 284
    Hash: b7d784e06c03bd90d87cf96f79f6753b9e683390 should be
    ee16a04987cbb9f0b5c4d21cf1333e167427917a
 file: usr/share/aclocal/freetype2.m4
    Group: 'root' should be 'bin'
    Mode: 0644 should be 0444
```

```
$ pfexec pkg fix SUNWfreetype2
```

How to Search for Packages

- **Use the following command to search for packages based on the various properties indexed by the packaging system.**

  `$ pkg search [-lr] [-s` *repository_url*`] token`

  The search command searches in the installed image if no options are specified. With the `-r` option, the command searches for the package in the repository or repositories associated with the current image.

Example 7–11 Search for a Package in the Installed Image

The following example searches and locates the `SUNWbash` package in the installed image.

```
$ pkg search SUNWbash
INDEX      ACTION    VALUE        PACKAGE
fmri       set       fmri         pkg:/SUNWbash@3.2.25-0.99
legacy_pkg legacy    SUNWbash     pkg:/SUNWbash@3.2.25-0.99
```

Example 7–12 Search For a Package in a Remote Repository

If you want to install the WebStack development package , search for the `amp` package in the remote (`-r`) repository associated with the **current** image.

```
$ pkg search -r amp
INDEX      ACTION    VALUE        PACKAGE
description set       AMP        pkg:/amp@0.5.11-0.86
description set       AMP        pkg:/amp@0.5.11-0.86
description set       AMP        pkg:/amp-dev@0.5.11-0.86
description set       AMP        pkg:/amp-dev@0.5.11-0.86
description set       AMP        pkg:/amp-dev@0.5.11-0.86
description set       AMP        pkg:/amp-dev@0.5.11-0.86
description set       AMP        pkg:/amp-dev@0.5.11-0.86
description set       AMP        pkg:/amp-dev@0.5.11-0.86
```

How to Update An Image (Update All Installed Packages)

This task will update all installed packages in the current image to the latest available version.

Note – All packages that have been updated in the repository will be downloaded and installed.

- **Use the following command to update all packages in the current image to the latest version.**

```
$ pfexec pkg image-update
```

Example 7–13 Update an Image in a Mounted, Inactive Boot Environment

This example updates an image in a boot environment that is mounted at `/mnt`. See Chapter 8, "Introduction to Boot Environments," to learn about the `beadm` command and boot environments.

```
# beadm mount BE1 /mnt
# pkg -R /mnt image-update
```

See Also The `pkg image-update` command can also be used to upgrade an installed boot environment. For more information, see "Upgrading An Image" on page 56.

How to Display the State of Packages

- **Use the following command to see the state of packages.**

```
$ pkg list [-aHsuvf] pkg_fmri
```

By default, the `pkg list` shows the most recent version of a package, and, if the package is installed, the installed version.

Example 7–14 Displaying the State of an Installed Package

The following example shows the status of the `SUNWbash` package with the `-v` option, which displays the full FMRI information. This example shows information only about the installed `SUNWbash` package.

```
$ pkg list -v SUNWbash
FMRI                                                  STATE      UFIX
pkg:/SUNWbash@3.2.25,5.11-0.79:20080205T152506Z     installed  ----
```

Example 7–15 Displaying the State of All Instances of a Package

This example shows the state of all instances of the `SUNWbash` package.

```
$ pkg list -a SUNWbash
NAME (AUTHORITY) VERSION         STATE      UFIX
SUNWbash         3.2.25-0.86     installed  ----
SUNWbash         3.2.25-0.79     known      u---
SUNWbash         3.2.25-0.75     known      u---
SUNWbash         3.2.25-0.75     known      u---
```

▼ How to List the Contents of a Package

- **Use the following command to list the action attributes of a package.**

  `$ pkg contents [-Hm] [-o` *attribute*`] [-s` *sort_key*`] [-t` *action_type*`]` *pkg_fmri*

Example 7–16 Listing the Contents of a Package

In this example, we will list the name, mode of the file, size, path and the target of the following actions in the `zfs` package:

- `dir`
- `file`

- link
- hardlink

```
$ pkg contents -t dir,file,link,hardlink -o
action.name,mode,pkg.size,path,target zfs

NAME  MODE   SIZE PATH                      TARGET
dir   0755        etc
dir   0755        etc/fs
dir   0755        etc/fs/zfs
link              etc/fs/zfs/mount          ../../../sbin/zfs
link              etc/fs/zfs/umount         ../../../sbin/zfs
dir   0755        etc/zfs
dir   0755        lib
dir   0755        lib/amd64
link              lib/amd64/libzfs.so        libzfs.so.1
file  0755 469616 lib/amd64/libzfs.so.1
file  0644  62057 lib/amd64/llib-lzfs.ln
link              lib/libzfs.so              libzfs.so.1
     [ ... ]
```

Example 7–17 Displaying Complete Contents of a Package

This example uses the `-m` option with the `pkg contents` command to display all actions of the `SUNWbash` package.

```
$ pkg contents -m SUNWbash
set fmri = pkg://opensolaris.org
/SUNWbash@3.2.25,5.11-0.79:20080205T152506Z
dir owner=root path=usr group=sys mode=0755
dir owner=root path=usr/bin group=bin mode=0755
dir owner=root path=usr/gnu group=bin mode=0755
dir owner=root path=usr/gnu/bin group=bin mode=0755
depend fmri=pkg:/SUNWcsl@0.5.11-0.79 type=require
file 66d09735123ad3a7bdcf7640dd60acbe843d8a13
elfhash=28106285f73f97274cf99b1a7e63d7d73c31c153
elfarch=i386 mode=0555
pkg.size=730604 owner=root group=bin path=usr/bin/bash
elfbits=32
```

```
     legacy category=system vendor="Sun Microsystems, Inc."
     name="GNU Bourne-Again shell (bash)"
     version=11.11.0,REV=2007.11.29.14.44 hotline="Please
contact your local service provider"
     pkg=SUNWbash arch=i386 desc="GNU Bourne-Again shell
(bash) version 3.2"
     license ed881c52c54b67457db33ba23a1d53615e366440
path=copyright
     license=SUNWbash.copyright
     transaction_id=1202253906_pkg%3A%2FSUNWbash%
     403.2.25%2C5.11-0.79%3A20080205T152506Z pkg.size=1207
     link path=usr/gnu/bin/sh target=../../bin/bash
     set name=description value="GNU Bourne-Again shell
(bash)" set fmri = pkg://VERSION_1
     /SUNWbash@3.2.25,5.11-0.79:20080205T152506Z
     dir owner=root path=usr group=sys mode=0755
     dir owner=root path=usr/bin group=bin mode=0755
     dir owner=root path=usr/gnu group=bin mode=0755
     dir owner=root path=usr/gnu/bin group=bin mode=0755
     depend fmri=pkg:/SUNWcsl@0.5.11-0.79 type=require
     file 66d09735123ad3a7bdcf7640dd60acbe843d8a13
     elfhash=28106285f73f97274cf99b1a7e63d7d73c31c153
     elfarch=i386 mode=0555 pkg.size=730604 owner=root
group=bin path=usr/bin/bash elfbits=32
     legacy category=system vendor="Sun Microsystems, Inc."
     name="GNU Bourne-Again shell (bash)" version=11.11.0,
REV=2007.11.29.14.44
     hotline="Please contact your local service provider"
     pkg=SUNWbash arch=i386 desc="GNU Bourne-Again shell
(bash) version 3.2"
     license ed881c52c54b67457db33ba23a1d53615e366440
path=copyright
     license=SUNWbash.copyright
     transaction_id=1202253906_pkg%3A%2FSUNWbash%403.2.25
     %2C5.11-0.79%3A20080205T152506Z
     pkg.size=1207
     link path=usr/gnu/bin/sh target=../../bin/bash
     set name=description value="GNU Bourne-Again shell
(bash)"
```

▼ How to List Information About a Package

- **Use the following command to view information about a package. If no *pkg_fmri* is specified, information about all installed packages are displayed.**

  ```
  $ pkg info [--license] pkg_fmri
  ```

Example 7–18 Display Package Information

This example displays information about the SUNWbash package.

```
Name: SUNWbash
Summary: GNU Bourne-Again shell (bash)
Authority: pkg.com (preferred)
Version: 3.2.25
Build Release: 5.11
Branch: 0.79
Packaging Date: Tue Feb  5 15:25:06 2008
Size: 714 kB
FMRI: pkg:/SUNWbash@3.2.25,5.11-0.79:20080205T152506Z
```

Example 7–19 Display Copyright and License Information About a Package

This example displays the copyright and license information about the SUNWGlib package.

```
$ pkg info --license -r SUNWGlib
Copyright (C) 1995-1997  Peter Mattis and Josh MacDonald

 This library is free software; you can redistribute it and/or
 modify it under the terms of the GNU Library General Public
 License as published by the Free Software Foundation; either
 version 2 of the License, or (at your option) any later version.

 This library is distributed in the hope that it will be useful,
```

```
but WITHOUT ANY WARRANTY; without even the implied warranty of
MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.  See the GNU
Library General Public License for more details.

You should have received a copy of the GNU Library General Public
License along with this library; if not, write to the Free Software
Foundation, Inc., 59 Temple Place, Suite 330, Boston, MA 02111-1307,
USA.

Modified by the GLib Team and others 1997-1999.  See the AUTHORS
file for a list of people on the GLib Team.  See the ChangeLog
files for a list of changes.  These files are distributed with
GLib at ftp://ftp.gtk.org/pub/gtk/.
```

▼ How to Uninstall Packages

- **Use the following command to uninstall existing packages.**

  `$ pfexec pkg uninstall [-nvr]` *pkg_fmri*

Example 7–20 Uninstalling a Package

This example uninstalls the `SUNWphp524-mysql` package.

```
$ pfexec pkg uninstall SUNWphp524-mysql

PHASE        ACTIONS
Removal Phase  39/39
```

▼ How to Add or Update an Authority

- **Type the following command to update an existing authority or add an additional package authority.**

  `$ pfexec pkg set-authority [-P] [-k` *ssl_key*`] [-c` *ssl_cert*`] [-O` *origin_url*`]` *authority*

Note – The option `-O` should be specified in upper case.

Example 7–21 Adding an Additional Package Authority

```
$ pfexec pkg set-authority -O  http://pkg.sunfreeware.com:80
sunfreeware.com

$ pkg authority
AUTHORITY                       URL
opensolaris.org (preferred) http://pkg.opensolaris.org:80/
sunfreeware.com               http://pkg.sunfreeware.com:80/
```

Example 7–22 Setting a Preferred Authority

Use the `-P` option along with the `-O` option to set an authority as the preferred authority. This is the default authority from which packages are downloaded and installed.

```
$ pfexec pkg set-authority -P -O http://pkg.sunfreeware.com:80
sunfreeware.com

$ pkg authority
AUTHORITY
opensolaris.org                       http://pkg.opensolaris.org:80/
sunfreeware.com (preferred)        http://pkg.sunfreeware.com:80/
```

See Also The `pkg set-authority` command is also used to add and remove mirror repositories. For more information, see Mirroring Repositories (`http://dlc.sun.com/osol/docs/content/2008.11/>IMGPACKAGESYS/repo_mirror.html`).

How to Remove Authority Configuration

- **Type the following command to remove the configuration information associated with a given authority.**

  ```
  $ pfexec pkg unset-authority authority
  ```

Example 7–23 Removing an Authority

```
$ pfexec pkg unset-authority sunfreeware.com
```

```
$ pkg authority
AUTHORITY                       URL
opensolaris.org (preferred)     http://pkg.opensolaris.org:80/
```

How to Display Authority Information

- **Type the following command to display information about an authority. If no arguments are specified, a list of configured authorities and their associated URLs is displayed.**

  ```
  $ pkg authority [-H] authority
  ```

Example 7–24 Displaying Authority Information

```
$ pkg authority
AUTHORITY                     URL
opensolaris.org (preferred)   http://pkg.opensolaris.org:80/
```

How to View the Command History

- **Type the following command to view the command history in the current image.**

  ```
  $ pkg history [-Hl]
  ```

Example 7–25 View Detailed Command History

```
$ pkg history -l
      Operation: purge-history
        Outcome: Succeeded
         Client: pkg
        Version: 71eab3488987
           User: root (0)
     Start Time: 2008-10-28T09:00:35
       End Time: 2008-10-28T09:00:35
        Command: /usr/bin/pkg -R /export/home/dc/build_data/pkg_image \
                 purge-history

      Operation: uninstall
        Outcome: Succeeded
         Client: pkg
        Version: 71eab3488987
           User: jack (65432)
     Start Time: 2008-10-29T11:15:09
       End Time: 2008-10-29T11:16:41
        Command: /usr/bin/pkg -R /a uninstall -q SUNWslim-utils
    Start State:
UNEVALUATED:
-pkg:/SUNWslim-utils@0.5.11,5.11-0.100:20081025T020505Z

      End State:
pkg:/SUNWslim-utils@0.5.11,5.11-0.100:20081025T020505Z -> None


      Operation: install
        Outcome: Failed (Unknown)
         Client: packagemanager
        Version: 71eab3488987
           User: jack (101)
     Start Time: 2008-10-29T11:31:13
       End Time: 2008-10-29T11:32:04
        Command: /usr/bin/packagemanager
```

▼ How to Delete The Command History Information

- **Type the following command to delete all the existing history information.**

```
$ pfexec pkg purge-history
```

▼ How to View The List of Available Commands

- **Type the following command to view the list of available commands.**

```
$ pkg help
```

Basic Rules of pkg(5) Command Multi-Repository Support

When multiple repositories are associated with an installation image and when using the pkg command-line interface (CLI) with only package names, the following rules apply. These rules can be overridden in the CLI by using explicit authorities and package version numbers.

TABLE 7–1 Rules for Multi-Repository Support

Package Installation Type	Rules When Only Package Names Are Provided
New package installations	The latest available version of new packages are always installed from the preferred authority unless the authority is provided in the FMRI during installation. Even if later versions of the package are available in other authorities, those later versions are not installed by default. The FMRI includes descriptive information about the package, such as the package name, version information, and date. See "pkg(1) Uses FMRIs" on page 76.
Package updates: package originally installed from preferred	If the package was originally installed from the preferred authority, then the latest available update of the package can be installed from the `_current_ preferred` authority. The package can be install from the `_current_ preferred` even if the preferred authority designation had been moved to another authority after the package had been originally installed. Even if later versions of the package are available in other authorities, those later versions are not installed by default.
Package updates: package originally installed from non-preferred	If the package was originally installed from a non-preferred authority, then the latest available update of the package is installed from the authority from which the package was originally installed. Even if later versions of the package are available in other authorities, those later versions are not installed by default.

Using Keys and Certificates for Repositories

This section provides the procedures for the repositories that require keys and certificates for access.

Repositories That Require Keys and Certificates (Overview)

Some repositories require that you obtain keys and certificates for access to packages. The following table describes those repositories.

Repositories either publish a complete catalog of packages for a complete installation of an operating system or publish a small set of packages for specific purposes. The following repositories contain a small set of packages that rely on a preferred authority that can provide the bulk of the operating system content. A preferred authority has a sufficiently complete catalog to enable an installation of the operating system.

Repository/Preferred Authority	Description	Requires Support Contract?

`pkg.opensolaris.org/release`
 	
`opensolaris.org`
	This repository contains the package versions at the time of the operating system release and contains only those newer versions of packages required to address severe defects or security fixes in the released product. When you obtain access to the `/release` repository, you also obtain access to the `/extra` repository.	No support contract required

`pkg.sun.com/opensolaris/support`
 	
`opensolaris.org`
	This repository is regularly updated with newer versions of the packages, based on the discovery and remedy of defects in the released product. This repository requires a support contract and an SSL certificate for access. You also can obtain access to the `/extra` repository.	Requires a support contract, which provides a Sun Online Account

`pkgs.sun.com/opensolaris/extra`
 	
`extra.opensolaris.org`
	This repository contains software made available under end-user license terms that does not allow further distribution. This repository requires a key and certificate that you acquired for either the `/release` or `/support` repositories.	Does not require a support contract, but you are required to accept specific license terms

Obtaining Keys and Certificates

At the `pkg.sun.com` site, you can obtain the keys and certificates needed to access packages at the various repositories. After you obtain keys and certificates, the site also provides a history of the keys and certificates that you have obtained.

▼ How to Obtain Keys and Certificates

1. **Obtain your Sun ID and password for access to `pkg.sun.com`.**

   You obtain your Sun ID and password by registering at `pkg.sun.com`.

2. **At the `pkg.sun.com` site, log in.**

   The Certificate Requests page is displayed with two repositories: `pkg.opensolaris.org/release` and `pkg.sun.com/opensolaris/support`.

3. **Choose the repository that contains the packages you need.**

   For the `/support` repository, you must have a support contract. You will be asked to type your contract ID.

4. **Save the key and certificate on your file system for safekeeping.**

   a. **Create the directory where you will place the key and certificate.**

      ```
      $ pfexec mkdir path_to_dir
      ```

      path_to_dir specifies the name of the new directory and the location. In the following example, the new directory is `/cred`.

      ```
      $ pfexec mkdir /var/pkg/cred
      ```

b. Save the key to the directory

```
$ pfexec mv key_file path_to_dir
```

key_file Specifies the file that contains the key.

path_to_dir Specifies the location of the key file.

In this example, the `key_file` is the name of the file and the path to the file is `/var/pkg/cred/sun_com_key`.

```
$ pfexec mv key_file /var/pkg/cred/sun_com_key
```

c. Save the certificate to the directory.

```
$ pfexec mv cert_file path_to_dir
```

cert_file Specifies the file that contains the certificate.

path_to_dir Specifies the location of the *cert_file*.

In this example, `cert_file` is the name of the certification file and `/sun_com_cert` is the directory where the file is located.

```
$ pfexec mv cert_file /var/pkg/cred/sun_com_cert
```

Next Steps You now can associate your key and certificate with a repository.

Associating a Key and Certificate With a Repository

After you have obtained your key and certificate, you can choose a repository as the default authority for `pkg` commands.

How to Associate a Key and Certificate With a Repository

1 (Optional) Switch to a new authority or add a new authority.

- If you want to associate a key and certificate to the `/release` repository, skip to the next step. By default, the installed product has a preferred authority of `opensolaris.org` served by the repository at the URL: `http://pkg.opensolaris.org/release`.
- If you want to have access to the `/support` and `/extra` repositories, you must switch to that authority.

```
$ pfexec pkg set-authority -O path_to_authority authority
```

-O *path_to_authority*	Specifies the repository that you want to access.
authority	Specifies the preferred authority.

2 Associate a key and certificate with a repository.

```
$ pfexec pkg set-authority -k key_file_path -c cert_file_path authority
```

-k *key_file_path*	Specifies the path to the key file and the key file name.
-c *cert_file_path*	Specifies the path to the certificate and the certificate file name.
authority	Specifies the preferred repository.

Example 7–26 How to Associate a Key and Certificate With the `/release` Repository

In this example, the `/release` repository is associated with the `opensolaris.org` preferred authority.

```
$ pfexec pkg set-authority -k key_file -c cert_file opensolaris.org
```

Example 7–27 How to Associate a Key and Certificate With the `/support` Repository

In this example, the repository's default location is switched to the `/support` repository. Then, the key and certificate are associated with the `opensolaris.org` preferred authority.

```
$ pfexec pkg set-authority -O https://pkg.sun.com/opensolaris/support \
opensolaris.org
$ pfexec pkg set-authority -k key_file -c cert_file opensolaris.org
```

Example 7–28 How to Associate a Key and Certificate With the `/extra` Repository

In this example, a new repository is added, `extra.opensolaris.org`. Then, the key and certificate are associated with the `opensolaris.org` preferred authority.

```
$ pfexec pkg set-authority -O https://pkg.sun.com/opensolaris/extra \
extra.opensolaris.org
$ pfexec pkg set-authority -k key_file -c cert_file opensolaris.org
```

Next Steps

- If you want to retrieve updated catalogs for the new repositories, use the `pkg refresh` command.
- If you want to install additional packages, use the `pkg install` command. See "How to Install a Package" on page 83.
- If you want to update an image use the `pkg image-update` command. See "How to Update An Image (Update All Installed Packages)" on page 88.

pkg(1) Command Reference

The pkg(1) command enables users to create images, install, search, and manage packages on their system.

For the OpenSolaris 2008.11 release, the pkg command has the following sub-commands and options.

All the pkg commands accept -R *dir* as an option, which instructs the command to operate on the image rooted at *dir*, rather than the one discovered automatically.

TABLE 7–2 pkg(1) Commands

Subcommands	Description	Privileges Required to Run Command?
pkg image-create	Creates an image suitable for package operations at the specified directory. Syntax : pkg image-create [-FPUz] -a -F– Creates a Full image -f– Force the command to create an image over an existing image **Caution –** Use this option with care. See "*Image Creation: Important Considerations*" on page 78 section. -P – Creates a partial image -U – Creates a user image (default) -z – Run the image in a non-global zone context -a– Specify a repository server	Yes

TABLE 7–2 pkg(1) Commands *(Continued)*

Subcommands	Description	Privileges Required to Run Command?
`pkg image-update`	Updates all installed packages in the current image to the latest available version. Syntax: `pkg image-update [-nv]` `-n` - Execute the requested operation but make no persistent changes to the image. `-v` - Issue verbose progress messages during the requested operation. `-q` - No message are shown during command execution. `--no-refresh` - Do not attempt to contact the image's authorities to retrieve their catalogs.	Yes
`pkg refresh`	Retrieves updated catalogs for each authority registered within the image. Syntax: `pkg refresh [-full]` *[authority..]* `-full` - Retrieve full catalog. ■ When no authority is specified, the command retrieves updates for all authorities registered within the image.	No
`pkg install`	Installs a package. Syntax: `pkg install [-nv] pkg_fmri` `-n` - Execute the requested operation but make no persistent changes to the image. `-v` - Issue verbose progress messages during the requested operation. `--no-refresh` - Do not attempt to contact the image's authorities to retrieve their catalogs.	Yes

TABLE 7–2 pkg(1) Commands *(Continued)*

Subcommands	Description	Privileges Required to Run Command?
`pkg uninstall`	Uninstalls a package. Syntax: `pkg uninstall [-nrvq]` *pkg_fmri* `-n` - Execute the requested operation but make no persistent changes to the image. `-v` - Issue verbose progress messages during the requested operation. `-r` - Recursively uninstall any packages which are dependent on the initial package. `--no-refresh` - Do not attempt to contact the image's authorities to retrieve their catalogs.	Yes
`pkg info`	Displays information about a package. Syntax : `pkg info [-lr] [--license]` *pkg_fmri* ■ `-l` – Display the data available from locally installed packages. This is the default option. ■ `-r` – Use this option to retrieve information about a package. A package FMRI must be specified with this option. ■ `--license` – Display License and copyright information for a package.	No

TABLE 7–2 pkg(1) Commands *(Continued)*

Subcommands	Description	Privileges Required to Run Command?
pkg contents	Display the contents (action attributes) of packages in the current image. Syntax : `pkg contents [-Hmr] [-o` *attribute*`] [ -s` *sort_key*`] [-t` *action_type*`]` `-m` - Shows complete contents of the action as represented in the package manifest. `-o` - Specify the attribute you are searching for. Multiple attributes may be specified with a single `-o` option by separating the attributes with commas. **If this option is not specified, only the path attribute is displayed.** `-r` - Retrieves the contents of a package from the server. This is used in cases where the package is not already installed. A package FMRI must be specified when using this option. `-s` - Sort the display based on the specified attribute. `-t` - Display information only pertaining to the specified action. `-H` - Do not display any headers.	Yes

TABLE 7–2 pkg(1) Commands *(Continued)*

Subcommands	Description	Privileges Required to Run Command?
`pkg search`	Search for *token*, and display the FMRIs in which *token* was found. Syntax: `pkg search [-lrI] [-s server] token` `-l` - Search the installed packages on the image. This is the default option. `-r` - Search the repository corresponding to the image's authorities. This option can be combined with the `-l` option. `-s` - Search for packages in the specified server, a pkg(5) repo. Multiple servers can be specified. This option can be combined with the `-l` option. `-I` - Search for packages in a case sensitive manner. **Note –** The `-I` option can only be used with the default option, `-l` at this time.	No

TABLE 7–2 pkg(1) Commands *(Continued)*

Subcommands	Description	Privileges Required to Run Command?
`pkg list`	Displays most recent version information about the state of packages in the current image. Syntax: `pkg list [-aHsuvf]` *pkg_fmri* `-a` - Display information on **all** known packages, whether they are installed or not installed. `-H` - Do not display any headers. `-s` - Display only package name and description of the package. `-u` - Show information only about packages which have newer versions available. `-v` - Show detailed package FMRIs. `-f` - List all known versions of a package.	No
`pkg verify`	Validate the installation of packages in the current image. Syntax: `pkg verify -[Hqv]` *pkg_fmri* `-v` - Display verbose information. `-q` - Do not report anything but return failure if there are any verification problems. `-H` - Remove headers from the listing.	Yes
`pkg fix`	Fix any errors reported by `pkg verify` Syntax : `pkg fix` *pkg_fmri*	Yes
`pkg set-property` *propname propvalue*	Update an existing image property or add a new image property.	Yes

TABLE 7–2 pkg(1) Commands *(Continued)*

Subcommands	Description	Privileges Required to Run Command?
`pkg unset-property` *propname propvalue*	Remove an existing image property or add a new image property.	Yes
`pkg property` *[propname..]*	Display image property information. `No argument` – Display name and values for all image properties. `-H` – Remove headers from the listing.	No
`pkg set-authority`	Update an existing authority or add an additional package authority. Syntax: `pkg set-authority [-P] [-k ssl_key] [-c ssl_cert] [-O origin_url] [--no-refresh] [--reset-uuid] authority` `-P` - Set the specified authority as the preferred authority. `-c` - Specify client SSL certificate. `-k` - Specify client key. `-O` - Set the URL prefix for the origin packaging repository for the authority. `--no-refresh` - Do not attempt to contact the specified authority to retrieve the catalog. `---reset-uuid` - Choose a new, unique identifier to identify this image to the authority.	Yes
`pkg unset-authority`	Remove the configuration associated with the given authority. Syntax: `pkg unset-authority` *authority*	Yes

TABLE 7–2 pkg(1) Commands *(Continued)*

Subcommands	Description	Privileges Required to Run Command?
`pkg authority`	Display authority information. If an authority is specified, configuration values associated with the authority is displayed. Syntax: `pkg authority [-HP]` *authority* No argument - Display the list of all configured authorities, and their origin URLs. `-H`- Remove headers from the listing. `-P`- Display only preferred authority information.	No
`pkg history`	Display the history of commands executed in the image. Syntax : `pkg history [-Hl]` `-H` – Remove headers from the listing. `-l` – Display detailed history information which includes the outcome of the command, when the command completed execution, version and name of the client used, identity of the user who performed the operation, and any errors encountered while executing the command.	No
`pkg purge-history`	Delete all existing history information.	Yes
`pkg help`	View a list of all available commands and their associated options.	No

◆ ◆ ◆ CHAPTER 8

Introduction to Boot Environments

A boot environment is a bootable instance of an OpenSolaris™ operating system image plus any other application software packages installed into that image. You can maintain multiple boot environments on your system, and each boot environment could have different software versions installed.

Upon the initial installation of OpenSolaris onto your system, a boot environment is created. Use the `beadm`(1M) utility to administer additional boot environments on your system.

Why Use Multiple Boot Environments?

With multiple boot environments, the process of updating software becomes a low risk operation because you can create backup boot environments before making any software updates to your system. If needed, you have the option of booting a backup boot environment.

Here are some specific examples where having more than one OpenSolaris boot environment, and managing them with the `beadm` utility, is useful:

- When you use either the Package Manager tool or the `pkg image-update` command to update all the packages in your active OpenSolaris boot environment, this process automatically creates a clone of that boot environment. The packages are updated in the clone rather than in the original boot environment. After successfully completing the updates, the new clone is activated. Then, the clone will become the new default boot environment on the next reboot. The original boot environment remains on the GRUB menu as an alternate selection.

  For more information, see "Upgrading An Image" on page 56.

  You can use the `beadm list` command to see a list of all the boot environments on the system, including the backup boot environment that still has its original, unchanged software. If you are not satisfied with the updates made to the environment, you can use the `beadm activate` command to specify that the backup will become the default boot environment on the next reboot.

- If you are modifying a boot environment, you can take a snapshot of that environment at any stage during modifications by using the `beadm create` command. A snapshot is a read-only image of a dataset or boot environment at a given point in time.

  You can create custom names for each snapshot that identify when or why the snapshot was created. For example, if you are doing monthly upgrades to your boot environment, you can capture snapshots for each monthly upgrade. You can use the `beadm list -s` command to view the available snapshots for a boot environment.

A snapshot is not bootable. But, you can create a boot environment, based on that snapshot, by using the `-e` option for the `beadm create` command. Then you can use the `beadm activate`command to specify that this boot environment will become the default boot environment on the next reboot.

- You can maintain more than one boot environment on your system, and perform various upgrades on each of them as needed. For example, you can clone a boot environment by using the `beadm create` command. A clone is a bootable copy of a boot environment. Then, you can install, test, and update different software packages on the original boot environment and on its clone.

  Although only one boot environment can be active at a time, you can mount an inactive boot environment by using the `beadm mount` command. Then you can use the `pkg image-update` command with the `-R` option to update all the packages in that inactive, mounted environment. Or, use the `pkg install` *packagename* with the `-R` option to update specific packages on that environment.

Features of `beadm` Utility

The `beadm` utility has the following features:

- The `beadm` utility aggregates all datasets in a boot environment and performs actions on the entire boot environment at once. You no longer need to perform ZFS commands to modify each dataset individually.
- The `beadm` utility manages the dataset structures within boot environments. For example, when the `beadm` utility clones a boot environment that has shared datasets, the utility automatically recognizes and manages those shared datasets for the new boot environment.

- The beadm utility enables you to perform administrative tasks on your boot environments. These tasks can be performed without upgrading your system.
- The beadm utility automatically manages and updates the GRUB menu. For example, when you use the beadm utility to create a new boot environment, that environment is automatically added to the GRUB menu.

The new beadm utility enables you to perform the following tasks:

- Create a new boot environment based on the active boot environment
- Create a new boot environment based on an inactive boot environment
- Create a snapshot of an existing boot environment
- Create a new boot environment based on an existing snapshot
- Create a new boot environment and add a custom title to the GRUB menu.
- Activate an existing, inactive boot environment
- Mount a boot environment
- Unmount a boot environment
- Destroy a boot environment
- Destroy a snapshot of a boot environment
- Rename an existing, inactive boot environment
- Display information about your boot environment snapshots and datasets

beadm Utility Requirements

To use the new beadm utility to manage your boot environments, your system must meet the following requirements.

TABLE 8–1 System Requirements

Requirement	Description
OpenSolaris 2008.05 or OpenSolaris 2008.11 release	You must have either the OpenSolaris 2008.05 release or the OpenSolaris 2008.11 release installed on your system. Prior OpenSolaris releases did not include the beadm utility. For information about installing the OpenSolaris 2008.11 release, see Chapter 1, "Introduction to the OpenSolaris 2008.11 Release."
ZFS file systems	All OpenSolaris Developer releases have ZFS file systems. The beadm utility is designed for ZFS file systems.

Limitations in Current Release

Note the following limitations in the OpenSolaris 2008.11 release.

- The installation of the OpenSolaris OS supports only one pool on one disk.
- The beadm utility is implemented with ZFS support only.
- The beadm utility manages boot environments and snapshots that were created by the beadm utility. If a user manually creates the datasets for a boot environment by using the zfs(1M) command, the beadm utility should recognize the boot environment, but management of this boot environment might be undefined.

beadm Command Reference

The beadm command, /usr/sbin/beadm, enables users to manage their boot environments. The following table summarizes the subcommands and options for the beadm utility.

TABLE 8–2 beadm Command

Subcommands	Description
beadm	Displays command usage.
beadm activate	Makes beName the active boot environment on next reboot. Syntax: beadm activate beName

TABLE 8–2 beadm Command *(Continued)*

Subcommands	Description
`beadm create`	Creates a new boot environment name, beName. Unless the `-e` option is provided, the new boot environment is created as a clone of the currently running boot environment. Syntax: `beadm create [-a] [-d description] [-e non-activeBeName | beName@snapshot] [-o property=value] beName` `-a` – Activate the newly created boot environment upon creation. The default is to not activate the newly created boot environment. ■ `-d description` – Use this description as the title in the GRUB menu that describes this new boot environment. If this option is not used, beName is used for the title. `-e non-activeBeName` – Create a new boot environment from an existing, inactive boot environment. The default is to create the boot environment from the active boot environment. `-e beName@snapshot` – Create a new boot environment from an existing snapshot of the boot environment named beName. `-o property=value` – Create the datasets for new boot environment with specific ZFS properties. Multiple `-o` options can be specified. See `zfs(1M)` for more information on the `-o` option. `beName` – Name of the boot environment to create. `beName@snapshot` – Name of an existing snapshot of the boot environment named beName.
`beadm create beName@snapshot`	Creates a snapshot of the existing boot environment named beName. Syntax: `beadm create beName@snapshot` `beName@snapshot` – The snapshot name must use the format, `beName@snapshotdescription`, where `beName` is the name of an existing boot environment that you want to make a snapshot from. Enter a custom `snapshotdescription` to identify the date or purpose of the snapshot.

TABLE 8–2 beadm Command *(Continued)*

Subcommands	Description
`beadm destroy`	Destroys the boot environment named `beName` or destroys an existing snapshot, `beName@snapshot`, of a boot environment. Prompts for confirmation before destroying the boot environment. Syntax: `beadm destroy [-fF] beName | beName@snapshot` `-f` – Forces destruction of the boot environment even if it is mounted. `-F` – Forces destruction of the boot environment without prompting for confirmation.

TABLE 8–2 beadm Command *(Continued)*

Subcommands	Description

`beadm list`	Lists information about the existing boot environment, which is `beName`, or lists information for all boot environments if `beName` is not provided. The default is to list boot environments without any additional information.
	
	Syntax: `beadm list [-a | [-ds] [-H] [beName]`
	`-a` – Lists all available information about the boot environment. This information includes subordinate datasets and snapshots.
	
	`-d` – Lists information about all subordinate datasets hat belong to the boot environment.
	
	`-s` – Lists information about the snapshots of the boot environment.
	
	`-H` – Prevents listing header information. Each field in the output is separated by a semicolon.
	The example is displayed without a header:
	
	`BE2:no:yes:mounted:/pool1/BE/BE2:6.2G;;;`
	`Without header information, the display information is identified by the following delimiters:`
	
	■ `;` – Delimits boot environments, datasets, zones, and snapshots.
	■ `:` – Delimits attributes for boot environments, datasets, zones, and snapshots.
	■ `,` – Delimits multiple datasets, zones, and snapshots.
	■ Multiple boot environments are delimited with a return, a blank line.
	
	Note – The `-p` option can be combined with the other options.
	
	`beName` – If `beName` is not provided, the command results display information for all boot environments.

`beadm mount`	Mounts a boot environment named `beName` at mount point. The mount point must be an already existing, empty directory. Syntax: `beadm mount beName mountpoint`

TABLE 8–2 beadm Command *(Continued)*

Subcommands	Description
beadm rename	Renames the boot environment named beName to newBeName. Syntax: beadm rename beName newBeName
beadm unmount	Unmounts the boot environment named beName. Syntax: beadm unmount [-f] beName -f – Forcefully unmounts the boot environment even if it is currently busy.

For detailed instructions about the beadm utility, see the beadm(1M) man page.

◆ ◆ ◆ CHAPTER 9

beadm Zones Support

Zones partitioning technology is used to virtualize operating system services and provide an isolated and secure environment for running applications. Each OpenSolaris system is a global zone. Within a global zone, specific non-global zones can be created.

For information about creating and administering non-global zones on your system, see the zones section in the *System Administration Guide: Virtualization Using the Solaris Operating System* (`http://dlc.sun.com/osol/docs/content/SYSADRM/>zones.intro-2.html`).

In the OpenSolaris 2008.11 release, the `beadm` utility introduces support for non-global zones.

Zones Support Limitations

Note the following limitations of support for non-global zones in the `beadm` utility and in related processes:

- In the OpenSolaris 2008.11 release, when you use the `pkg image-update` command, the command only upgrades ipkg branded zones.
- The `beadm` utility is not supported inside a non-global zone.
- Non-global zone support is limited to ZFS support. Zones are not supported unless they are on ZFS.

- Zones are not supported in the `rpool/ROOT` namespace. Non-global zones are cloned or copied only when the original zone is within the shared area for the global zone, for example, within `rpool/export` or within `rpool/zones`.
- Although the `beadm` utility affects the non-global zones on your system, the `beadm` utility does not display zones information. Use the `zoneadm` utility to view changes in the zones in your boot environment. For example, use the `zoneadm list` command to view a list of all current zones on the system.

  For further information, see the `zoneadm`(1M) man page.

Zones Support Specifications

The `beadm` command impacts the non-global zones in your boot environments as follows.

`beadm create`	When you clone a boot environment by using the `beadm create` command, all zones in that boot environment are copied into the new boot environment.
`beadm destroy`	When you destroy an inactive boot environment, the zones that belong to that boot environment are also destroyed.
`beadm mount`	When you mount a boot environment, the zones in that environment are mounted relative to the mount points for the environment.
`beadm unmount`	When you unmount a boot environment, the zones in that environment are also unmounted. All mount points are returned to their states prior to being mounted.

`beadm rename`	When you rename a boot environment, that change does not impact the names of the zones or the names of the datasets that are used for those zones in that boot environment. The change does not impact the relationships between the zones and their related boot environments.

Zones Naming Conventions

The `beadm` utility automatically handles all zones naming tasks related to the `beadm` processes. Just for your reference, this section describes the zones naming conventions that are automatically used by the `beadm` utility.

A zone root dataset name is stated in the following format:

```
<zonepath dataset>/ROOT/<zone root>
```

For example:

```
rpool/zones/zone1/ROOT
```

When a zone is copied from one boot environment to another boot environment, only the datasets that are under the zone's root dataset are copied.

A dataset can be shared between zone boot environments. A shared dataset is identified by using the following format:

```
<zonepath dataset>/export
```

For example:

```
rpool/zones/zone1/export
```

A shared dataset must be explicitly added during zones configuration. A shared dataset is not cloned when the zone dataset is cloned.

EXAMPLE 9–1 Non-Global Zones Example

This example shows the zones impact of the `beadm create` command when cloning a boot environment that contains two non-global zones.

- The original boot environment is named `opensolaris` with the dataset at `rpool/ROOT/opensolaris`.
- A zone named `z1` exists that uses the dataset, `rpool/zones/z1`, as its zonepath. The boot environment has a copy of `rpool/zones/z1`. The copy is `rpool/zones/z1/ROOT/zbe`.

Perform the following command to clone the boot environment and name the new boot environment `opensolaris-1`:

```
beadm create opensolaris-1
```

The root dataset for the new boot environment is at `rpool/ROOT/opensolaris-1`. The copy of zone `z1` for the new boot environment has its root dataset at `rpool/zones/z1/ROOT/zbe-1`.

Note – ZFS properties for each dataset track the relationships between original and cloned datasets, and track the relationships between non-global zones and their parent boot environments.
