Upgrading to the Solaris™ 8 Operating Environment

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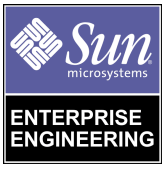

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Upgrading to the Solaris™ 8 Operating Environment

Today system administrators are faced with ever increasing complexity and larger numbers of systems to support. An effective operating system upgrade strategy can help simplify administrative workloads by minimizing the management of multiple operating system releases and the different sets of bugs, patch levels, and software dependencies they imply. Administrators need to be able to move aggressively but prudently to new releases — allowing them to take advantage of new features and powerful new systems without breaking critical applications.

The Solaris™ 8 Operating Environment represents an evolutionary release that provides a foundation for future hardware along with numerous enhancements and new functionality. This article supplies specific information to help system administrators identify potential issues and move quickly to the Solaris 8 Operating Environment from earlier releases. Advice is provided to help qualify systems and test applications as well as customize the installation process.

This article also provides an overview of some of the new features in the Solaris 8 Operating Environment with a focus on differences important to administrators such as evolving network services and file changes which may affect existing scripts. A complete overview of new features can be found in the document *What's New in the Solaris 8 Operating Environment*.

Providing a Smooth Upgrade to the Solaris 8 Operating Environment

Any operating system upgrade requires careful planning on the part of system administrators. The Solaris 8 Operating Environment offers significant opportunities to proactively test applications and automate the installation or upgrade process.

Identifying Qualified Systems

The Solaris 8 Operating Environment system requires at least 64MB of memory and 600MB of disk space for desktop systems (at least 1GB of disk space for servers). The low cost of memory and disk space means that today most new systems are shipped with ample capacities to run the Solaris 8 Operating Environment — some older systems may be more constrained in these areas. Administrators can test existing disk configurations for their ability to support given Solaris configuration profiles (see *Qualifying Disks* below).

Sun SPARC™ systems with a kernel subarchitecture of Sun-4™c are not supported under the Solaris 8 Operating Environment. Sun-4c systems include the SPARCStation™ 1, SPARCstation 1+, SPARCstation 2, SPARCstation SLC, SPARCstation IPC, and the SPARCstation IPX. The Solaris 7 Operating Environment is the final release that supports Sun-4c systems.

Testing on the Current Release

Before any operating system upgrade, existing applications should be tested to make sure that they run correctly in the new environment. Like previous releases, the Solaris 8 Operating Environment supports the Solaris application binary interface (ABI) for both the SPARC and Intel architectures. Adherence to the Solaris ABI provides a binary compatible environment between releases and avoids potential problems — for instance:

- Applications that access private or undocumented interfaces may break when those interfaces change between releases.
- Applications that access system database files rather than using the corresponding library functions can break if those database files change or are obsoleted with a new release.
- Applications that are statically linked can break because the statically linked libraries they include are obsoleted with a new release.

Sun provides tools to help developers and administrators test compliance with the Solaris ABI and ease migration to the Solaris 8 Operating Environment.

`appcert`

`appcert` is a freely distributed application that tests application binaries for the use of non-standard interfaces. `appcert` works by consulting databases containing the private and Book Title public symbols for each Solaris release from Solaris 2.3 to the current Solaris 8 Operating Environment. Symbols that are private, or non-existent, or otherwise problematic are flagged for attention.

`appcert` also identifies applications which are statically linked — sometimes a necessity for security applications. Applications which require static linking will need to be re-linked on the Solaris 8 Operating Environment in order to integrate the latest versions of the libraries they reference.

`appcert` runs on previous Solaris Operating Environment releases because it is written as a perl script. Perl support is provided along with the `appcert` distribution for those environments where it is not extant. For more information on appcert see the April 2000 ediiton of Sun BluePrints™ OnLine article titled *Building Longevity into Solaris 8 Operating Environment Applications* (http://www.sun.com/blueprints/0400/s8long.pdf). `appcert` can be obtained free-of-charge from `http://www.sun.com/developers/tools/appcert`.

Testing on the Solaris 8 Operating Environment

Deploying a pilot system to test a new operating system release gives administrators valuable first-hand experience with the new operating environment and the opportunity to test and validate applications before making a more public commitment. In addition to running applications, the Solaris 8 Operating Environment provides additional run-time tools which can be used to debug problematic applications as they execute.

- `apptrace` is a run-time tool similar to `truss`*(1)* except that `apptrace` traces library functions (section 3 of the UNIX® Reference Manual) while `truss`*(1)* only traces system calls (section 2 of the UNIX Reference Manual).
- `appcheck` is unsupported run-time software currently under development by Sun Microsystems, Inc. `appcheck` captures calls to known problematic interfaces and looks for complications that may inhibit binary compatibility. Like `appcert`, `appcheck` will be available from Sun's Web site.

Deploying a Solaris Install Server

A helpful approach to managing large numbers of systems is to classify them — by the hardware and capacities they represent — and by needs of the individuals using the systems. Given this basic classification, the Solaris JumpStart™ software provides a mechanism to automatically and remotely provide customized Solaris 8 Operating Environment installations.

An install server is very useful for loading the Solaris Operating Environment. This is especially true for the Solaris 8 Operating Environment since all installations will require multiple CD changes if installed from local CD-ROM drives. The `setup_install_server`*(1M)* command is used to copy the SPARC and/or Intel Solaris 8 Software and Solaris 8 Language CD images to the server. Systems which are booted with an "install" flag in their boot command search for an install server.

Once the booting system identifies an install server, it is then compared with a set of rules and the Solaris 8 Operating Environment is installed according to flexible pre-defined profiles and scripts.

A brief overview of Jumpstart operation is provided here. Consult the *Solaris 8 Advanced Installation Guide* and the December 1999 edition of the Sun BluePrints™ Online article titled *Setting up a Solaris Operating Environment Install Server and the Solaris Jumpstart Feature* (`http://www.sun.com/blueprints/1299/settingup.pdf`) for more information.

The Rules File

The rules file associates booting systems with desired installation profiles and scripts — it includes the following information:

- *Rule keywords and values* — Rule keywords are predefined and describe a general system attribute such as system types, host names, networks or others. Rule values provide the specific system attribute that is a match for the rule, either as text or a range of values. When a system matches a rule, it uses the Jumpstart profile associated with the rule along with any scripts.
- *Profiles* — The profile is the name of a text file that is used as a template for a particular class of system. The profile defines the configuration of the Solaris Operating Environment that is installed on the booting system.
- *Begin and finish scripts* — Begin and finish scripts are custom Bourne shell scripts that performs tasks before and after the Solaris installation is started. For instance, the begin script can be used to backup important files before installation or upgrade. A finish script can be used to add files, packages or patches, and set the newly-installed system's root password.

Profiles

Profiles allow administrators considerable flexibility in determining how different systems are installed. FIGURE 1 shows a profile which does an initial installation (as opposed to an upgrade) of a standalone system, uses the default JumpStart disk partitioning, and installs the end-user cluster of Solaris 8 Operating Environment

packages. The installation then specifically deletes the *SUNWCown, SUNWCtltk, SUNWCxgl,* and *SUNWxil* packages and inserts a line in `/etc/vfstab` to mount `/usr/openwin` from the server named `srvr`.

```
install_type  initial_install
system_type   standalone
partitioning  default
cluster   SUNWCuser
cluster   SUNWCown   delete
cluster   SUNWCtltk  delete
cluster   SUNWCxgl   delete
cluster   SUNWCxil   delete
filesys   srvr:/usr/openwin - /usr/openwin ro,intr
```

FIGURE 1. A sample Jumpstart profile

Qualifying Disk Space

In addition to providing for automatic installation, the Solaris 8 Operating Environment also allows administrators to test Jumpstart profiles against existing disk configurations. The `pfinstall`*(1M)* command checks a given profile against existing disks to help ensure that the intended Solaris 8 Operating Environment configuration will fit — thereby avoiding failed installations due to inadequate disk space.

First, the `prtvtoc`*(1M)* command is used to direct disk configuration information results into a file.

```
# cd /jumpstart
# prtvtoc /dev/dsk/c0t3d0s0 > 535_test
```

Next the disk configuration is tested against a specific system memory configuration (established by the SYS_MEMSIZE environment variable) and a specific profile — in this case, named `basic_profile` in the `/jumpstart` directory.

```
# SYS_MEMSIZE=64; export SYS_MEMSIZE
# /usr/sbin/install.d/pfinstall -d 535_test -c
```

For initial installations, disk configurations can be copied from other systems. For upgrades, `pfinstall` must be run on the system being upgraded by booting from the *Solaris Software 1 of 2 CD* and setting up the install environment.

The Solaris 8 Operating Environment Installation Environment

The Solaris 8 Operating Environment provides a number of changes to the installation model which may be new to administrators.

New CD Model

The Solaris 8 Operating Environment features a new organization for installation CDs. Among other advantages, this packaging approach greatly simplifies the distribution of different language versions of the Solaris 8 Operating Environment. For instance, administrators can install a system in one language while the final installed system uses another.

- *Solaris 8 Installation CD*

A separate bootable Installation CD is provided for both the SPARC and Intel platform architectures.

- *Solaris 8 Software CDs*

Labeled *1 of 2* and *2 of 2*, the Solaris 8 Software CDs contain the Solaris software packages. A two CD set is provided for each platform architecture.

- *Solaris 8 Documentation CD*

The single documentation CD contains documentation for both the SPARC and Intel platform editions in *Answerbook2* format and also contains the Answerbook2 server software distribution.

- *Solaris 8 Languages CD*

Localization information for all of the languages that Sun supports is provided on the Solaris 8 Languages CD (localization for the English language is provided on the installation CD).

- Bonus Software Pack

Several bonus CDs are provided with the Solaris 8 Operating Environment distribution including StarOffice™ 5.1 CDs, the Solaris Software Companion CD (freeware), the iPlanet Advantage Software CD, and several Oracle CDs including an evaluation copy of the full Oracle 8i Enterprise Edition database.

New Default Disk Layout

The Solaris 8 Operating Environment implements a new default disk layout different from previous Solaris releases. As a part of a full installation, operating system disks are reformatted and re-partitioned to provide better utilization of disk resources.

In particular, when using Solaris™ Web Start installation the Solaris 8 Operating Environment locates the swap partition (disk slice 1) at the beginning of the disk starting at disk cylinder 0. Earlier Solaris Operating Environment releases placed the root partition (slice 0) before the swap partition. See the March 2000 edition of the Sun BluePrints Online article *Operating Environments: Solaris 8 Operating Environment Disk Layout* (`http://www.sun.com/blueprints/0300/soe8layout.pdf`) for more information.

The new disk layout strategy coupled with the higher rotational speeds of today's disk drives can drastically improve transfer rates for data written in the low-numbered sectors of the disk (near the outer edge of the disk platters). Modern disks employ a technique known as Zone Bit Recording (ZBR) in which tracks in different concentric zones contain differing numbers of sectors per track. Outer disk tracks contain larger numbers of sectors than those near the center of the disk platter enabling faster transfer rates without repositioning read / write heads. Virtual memory systems like the Solaris 8 Operating Environment can benefit directly from even small improvements in paging and swapping performance gleaned from faster disk transfer rates.

To avoid confusion with the new disk layout, it is important to remember that the disk slice names are *logical* and retain their traditional roles — namely slice 0 contains the root file system while slice 1 contains swap space. FIGURE 2 illustrates

a sample `prtvtoc`*(1M)* call. In this case, slice 1 (swap) contains 1049220 sectors starting from sector 0. Slice 0 is *physically* located after slice 1 on the disk starting at sector 1049220 and contains the root file system (along with `/usr`, `/var`, etc.)

```
* /dev/dsk/c0t2d0s0 partition map
*
* Dimensions:
*     512 bytes/sector
*     116 sectors/track
*       9 tracks/cylinder
*    1044 sectors/cylinder
*    4020 cylinders
*    4018 accessible cylinders
*
* Flags:
*   1: unmountable
*  10: read-only
*
*                          First     Sector    Last
* Partition  Tag  Flags    Sector     Count    Sector  Mount
Directory
       0      2    00     1049220   2798964    3848183   /
       1      3    01           0   1049220    1049219
       2      5    00           0   4194792     194791
      7     8    00     3848184    346608    4194791   /export/home
```

FIGURE 2. Swap space is located at the beginning (outer edge) of the disk

New Solaris Web Start Kiosk Interface for Interactive Installations

The new Solaris Web Start kiosk interface adds an installation wizard to the Solaris 8 Operating Environment interactive installation process. The wizard simplifies the specification of installation parameters and allows other activities while the installation proceeds. FIGURE 3 illustrates the Solaris Web Start kiosk interface.

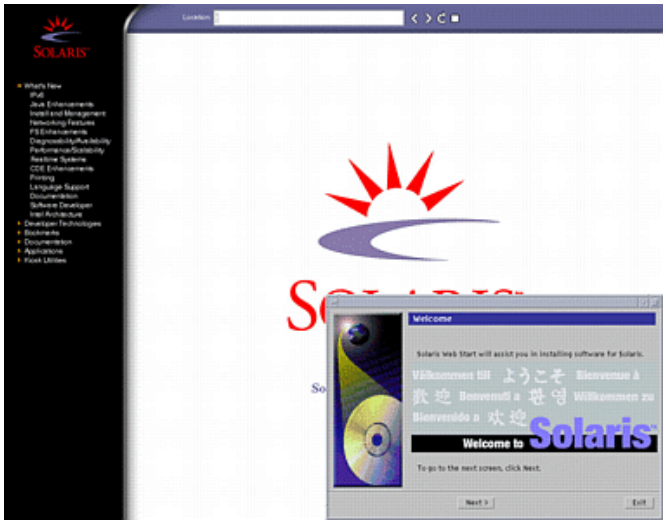

FIGURE 3. Solaris Web Start kiosk interface for interactive installations

New Live Upgrade Support

Live Upgrade provides capabilities that can potentially reduce upgrade downtime to that required for a system reboot — useful for systems which have stringent availability requirements. Live Upgrade works by installing an *upgraded* Solaris 8 Operating Environment image on a spare disk. While the upgraded disk image is being produced, the system continues to run its existing operating environment. In the event of problems, the upgrade can be easily and immediately backed out by rebooting from the original disk.

Live Upgrade can upgrade SPARC systems from either the Solaris 2.6 or Solaris 7 Operating Environments to the Solaris 8 Operating Environment. Intel systems can use Live Upgrade to upgrade from the Solaris 7 to the Solaris 8 Operating Environment.

Live Upgrade works by first making an alternate copy of the existing boot environment (BE) on a spare disk. The copy is then upgraded to the Solaris 8 Operating Environment while the system continues to run normally. Live Upgrade software is provided on the *Solaris 8 Software Disk 2 of 2 CD*.

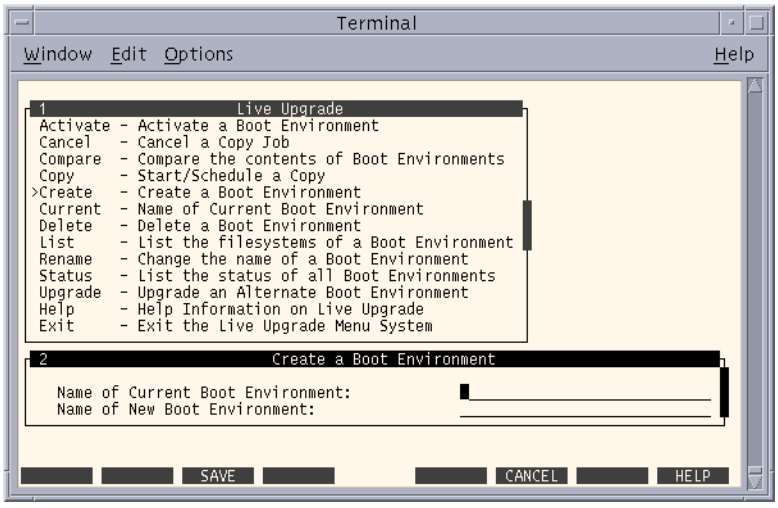

FIGURE 4. Live Upgrade GUI

The *lu(1M)* command provides a convenient GUI (FIGURE 4 and FIGURE 5).

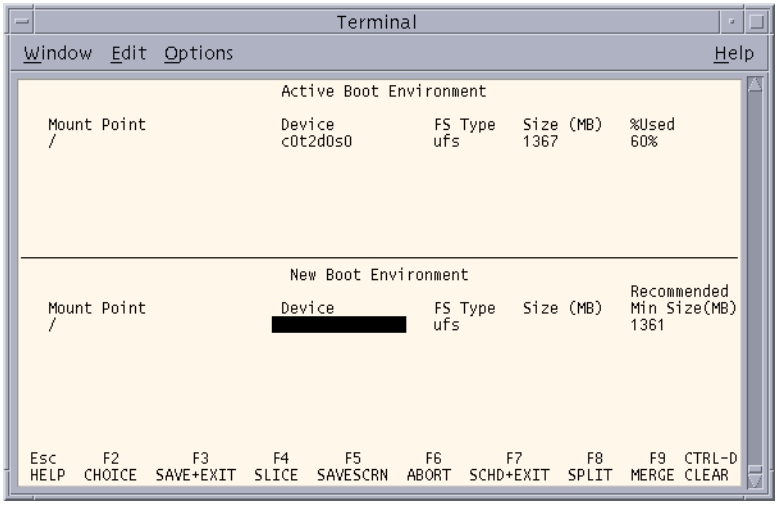

FIGURE 5. Building an alternate boot environment with Live Upgrade

New Interactive Installation Options

In addition to the new Solaris Web Start kiosk user interface, the Solaris 8 Operating Environment interactive installation provides several new options:

- *Internet Protocol Version 6 (IPv6)*

The Solaris 8 Operating Environment provides support for version 6 of the Internet protocol (IPv6) and the Solaris 8 installation wizard allows the option of configuring 128-bit version 6 IP addresses. Support for IPv6 is provided through a dual-stack implementation which provides both current IPv4 and IPv6 simultaneously. Most administrators will want to select the default IPv4 configuration — IPv6 can be configured at a later time.

- *Proxy Server*

During interactive installations the administrator can select between a direct Internet connection or may specify a proxy server by hostname and port.

- *DNS*

The Solaris Web Start install wizard also allows the selection and configuration of client-side DNS parameters. By selecting DNS as a name service in the GUI, the DNS domain name and name servers are entered into `/etc/resolv.conf` file.

- *Root Password*

The interactive installation now asks for and confirms the new root password for the system. Previously the root password was set upon the initial reboot of the configured system.

Enhanced Network Services

The Solaris 8 Operating Environment provides a number of enhancements to network services — several of these are of particular interest to administrators.

Dynamic Host Configuration Protocol (DHCP)

The Dynamic Host Configuration Protocol (DHCP) was first bundled with the Solaris 2.6 Operating Environment. The Solaris 8 Operating Environment adds a Java™ technology based DHCP configuration manager (*dhcpmgr(1M)*) which greatly simplifies the administration of DHCP parameters. `dhcpmgr` is located in an the `/usr/sadm/admin/bin` directory which may need to be added to the PATH for system administrators.

DHCP booting is now also supported. UltraSPARC™ based system (*Sun-4u*) and Intel architecture systems can now acquire their boot parameters and network configuration information via DHCP in addition to traditional RARP based booting.

Light-weight Directory Access Protocol (LDAP)

The Light-weight Directory Access Protocol (LDAP) is emerging as a new industry standard for directory services. Administrators contemplating new directory server roll-outs may want to consider LDAP as a viable alternative to NIS or NIS+ directory servers. Administrators with NIS or NIS+ directory servers may want to explore pilot projects involving LDAP. For more information on migrating NIS/NIS+ to LDAP services, please see the February 2000 edition of the Sun BluePrints OnLine article titled *NIS to LDAP Transition: Exploring* (`http://www.sun.com/blueprints/0200/ldap.pdf`).

The Solaris 8 Operating Environment co-packages the industry leading *iPlanet Directory Server* which implements LDAP server functionality. The directory server includes a license for 200,000 entries and a license is also included for the Solaris Directory Extensions product. Together these products provide a very comprehensive LDAP directory server with access to legacy directory services.

From a client perspective, the Solaris 8 Operating Environment provides the back-end and name service switch selection of LDAP from the `/etc/nsswitch.conf` file. For more information, see the iPlanet Directory Server documentation and `/etc/nsswitch.ldap` template file.

Sendmail Version 8.9.3

The Solaris 8 Operating Environment includes Sendmail version 8.9.3 — sendmail version 8.9 was originally provided in the Solaris 7 Operating Environment. Those upgrading from earlier Solaris Operating Environment releases will want to familiarize themselves with Sendmail 8.9.3 in the *Setting up and Administering Mail Services* section of the *Solaris Administrator's Guide*.

One of the more significant changes is that sendmail now uses the `m4`*(1)* macro processor to build `sendmail.cf` files. Configuration files are now equipped with "`.mc`" extensions and must be run through `m4` to produce a "`.cf`" file as follows:

```
# cd /usr/lib/mail/cf
# cp main-v7sun.mc myhost.mc
# /usr/ccs/bin/make myhost.cf
```

With version 8.9.3, sendmail has also tightened the rules used for opening files. Sendmail now checks the modes and ownership of files and the directory path leading up to them to prevent users from taking advantage of overly permissive file modes. During a migration to sendmail 8.9.3 administrators will need to change lax permissions including non-root owned directories containing maps or group-writable directories and files. For instance, there are stricter rules about `.forward` and `:include:` files in directories that are group- or world-writable. It is possible to over-ride the stricter file permissions by setting the appropriately named `DontBlameSendmail` flag. However, this flag exposes the mail to potential risk and is not recommended.

Printing

The printing subsystem was rewritten and simplified in the Solaris 2.6 Operating Environment to provide a centralized `/etc/printers.conf` configuration file. The Solaris 8 Operating Environment builds on this foundation by providing a Java™ technology based graphical user interface (`printmgr`*(1M)*) to manage local and remote printer access. `printmgr` is now the recommended management interface rather than the Admintool Printer tool. In addition, the printers database is now available through the name service switch. An NIS environment might define the search order as follows in `/etc/nsswitch.conf`:

```
printers: user files nis
```

For this example, `user` represents the user's `$HOME/.printers` file, files represents the `/etc/printers.conf` file, and `nis` represents the `printers.conf.byname` NIS table. The `$HOME/.printers` file is a simplified, user-configurable version of the `/etc/printers.conf` file that allows users to set personal aliases for print commands, default printers, and the interest list for lp commands.

Changes to Files and Systems

Though binary compatibility is preserved with the Solaris 8 Operating Environment, a number of changes were made to files and systems which can adversely affect scripts and other administrative tools:

- `/var/run`

`/var/run` is a new tmpfs-mounted file system that acts as a repository for temporary system files that are not needed across reboots. `/var/run` is restricted to be writable only by the root user. This allows temporary files used by the system to be located away from other temporary files. The `/tmp` directory continues to be a repository for non-system temporary files.

- `/etc/utmp`

The `/etc/utmp` and `/etc/wtmp` files are now obsolete and are superseded by `/var/adm/utmpx`. Applications should use the library function `getutxent`*(3)* instead of parsing files.

- `/etc/mnttab`

In the Solaris 8 Operating Environment the file `/etc/mnttab` is really a file system that provides read-only access to the table of mounted file systems for the current host. In previous releases `/etc/mnttab` was a text file written by the operating system. Applications which read this file may need to be altered.

- Keywords for Jumpstart

Jumpstart profiles can now use the new *GEO* keyword to specify locale. Also, because systems with a kernel subarchitecture of *Sun-4c* are not supported in the Solaris 8 Operating Environment, the *Sun-4c* keyword value for the *karch* keyword is no longer recognized. Servers running Solaris 8 Operating Environment *can* support automated installation of *Sun-4c* systems by building a separate jumpstart area using the Solaris 7 Operating Environment release CDs.

- Tighter Security

In addition to other security enhancements like smart card support, Role Based Access Control (RBAC), and Kerberos V5 client support, many system files and directories in the Solaris 8 Operating Environment have different default ownership and stricter permissions than in previous releases. Default file and directory ownership has been changed from `bin` to `root`, files and directories with previous default permissions of 775 are now defaulted to 755 and the default umask for the system is 022.

- Syslog Message Format Changes

Message IDs (`msgid`*(1M)*) have been added to `syslog`*(3)* and are configurable via `log`*(7D)*. A typical message in `/var/adm/messages` now includes this ID information. This change may affect programs and scripts which parse `/var/adm/messages`.

- SGML Man pages

The Solaris 8 Operating Environment man pages are provided in SGML source.

- `/proc`

The `/proc` file system which provides access to the state of each process and light-weight process (`lwp`) has been changed to a hierarchical directory structure. While the name of each entry in the `/proc` directory is still a decimal number corresponding to the process-ID, these entries are themselves subdirectories. Beneath each process-ID subdirectory are a variety of files (mostly read-only) which correspond to various types of process information (see the `proc`*(4)* man page for more information).

Summary

The Solaris 8 Operating Environment provides new functionality and a strong foundation for future SPARC and Intel hardware platforms. For most environments the Solaris 8 Operating Environment represents an evolutionary step and should present a straightforward upgrade. By proactively testing applications and utilizing Solaris JumpStart, most administrators should be able to upgrade quickly to the Solaris 8 Operating Environment.