



SunOS 4.1 Release Manual



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Introduction/Guide to SunOS Publications

1.1. The SunOS Release 4.1 Documentation - Where to Start

As with every SunOS™ release, the first manual you should read is the *Read This First* (Part Number 800-3845-10) packed in the box that the release 4.1 software CDs, tapes, or diskettes came in. This is especially important for subsequent SunOS releases which use this set of documentation as a base. The *Read This First* for each future release will inform you if new functionality will require modification or replacement of SunOS 4.1 documents.

After the *Read This First*, the *SunOS 4.1 Release Manual* (this manual) is the next one to read. Chapters 3 and 4 (*Special Notes* and *Known Problems*) are particularly important; you should read and understand those chapters before installing or using SunOS release 4.1. After this manual, there are many different routes you can take through the 4.1 documentation. The *Roadmap to the SunOS Release 4.1 Documentation* (Part Number 800-3873-10) is designed to help guide you through. The *Roadmap* is packed in the same box this manual came in.

1.2. Purpose of This Manual

Generally, this manual assumes that you are already familiar with the SunOS and want to find out what software and hardware has been added or improved since SunOS release 4.0. This manual provides concise descriptions of those changes and enhancements in SunOS release 4.1. It does *not* give full details on those enhancements, but describes each briefly and indicates which of the other SunOS release 4.1 documents provides complete details.

1.3. Guide to Publications

Sun Microsystems, Inc. ® provides an extensive collection of software manuals for use with release 4.1. The software manuals are shipped in the following binders (in general order of use):

Media Box: *Read This First*

The *Read This First* is discussed above.

Binder: *SunOS Release and Install*

This binder contains the *SunOS 4.1 Release Manual*, which you are reading now. The most important parts of this manual are the “Special Notes For SunOS Release 4.1” and “Known Problems” chapters. Those chapters *must* be read and understood before using SunOS release 4.1. In addition, this manual contains brief descriptions of the new release 4.1 features, and points to where details can be found.

The *Quick Install Guide* describes a fast new utility for booting a standalone system. The *Installing SunOS 4.1* manual contains detailed descriptions of how to install release 4.1 on all systems.

Books: User's Guides

These brief manuals are easy to read, written for the user with little or no UNIX† experience. *Getting Started* is for those new to the Sun environment. Other titles are *Doing More with SunOS*, *Basic Troubleshooting*, *SunView User's Guide*, and *Customizing Your Environment*. The *SunDiag User's Guide* is in the same box, but is written for users who will be testing memory, drives, boards, and board-level devices with SunDiag. It is the only User's Guide that is strictly for advanced users.

Binder: System and Network Administration

The *System and Network Administration* manual is written for system administrators, but is a valuable resource for *all* SunOS users. It deals with adding hardware, disk maintenance, networking and electronic mail service, and advanced UNIX administration.

Binders: SunOS Reference Manual (3 Volumes)

This set of binders contains the SunOS release version of the Berkeley UNIX "Manual Pages," alphabetically arranged descriptions of commands, functions and other aspects of SunOS release 4.1. These manual pages are divided by numbered tabs into a range of subjects listed below:

1. User Commands
2. System calls and error numbers
3. User-level library functions
4. Devices, drivers, protocols and network interfaces
5. File formats used or read by various programs
6. Games and demos
7. Public files, tables and TROFF macros
8. System maintenance and operations commands

Binder: Global Index

Provides an index to all SunOS release 4.1 software documentation (except this manual and the *Read This First*).

Binder: SunOS Documentation Tools

Editing Text Files covers the editors *vi*, *ex*, *ed*, and *sed*. *Formatting Documents* explains special formatting macros that work with TROFF such as *refer*, indexing, table formatting and equation setting. *Using TROFF and NROFF* explains the use of those text processing utilities.

† UNIX is a registered trademark of AT&T.

Binder: *Programmers Guides*

This group of manuals focuses on programming within the Sun environment, for both systems and applications level interests.

C Programmers Guide describes how to write C programs that interface with SunOS. *Assembly Language Reference Manual for Sun-3* and *Assembly Language Reference Manual for Sun-4* covers syntax and usage of the assembler for some of the microprocessors used in Sun workstations and servers. *A RISC Tutorial* looks at the aspects of RISC and open systems architectures as they pertain to SPARC architecture. *Porting Software to SPARC Systems* briefly describes machine level SPARC architecture, and porting C, FORTRAN, and Pascal programs to a SPARC system. The *Debugging Tools Manual* describes the debuggers `dbx`, `dbxtool`, and `adb` for experienced programmers.

Binder: *Programmer's Overview Utilities and Libraries*

The *System Services Overview* contains details of various specialized aspects of SunOS operating system, including internationalization, security features, networking, and UNIX standards compatibility. *Programming Utilities and Libraries* is written primarily for applications programmers to provide an overview of the Sun environment, and the system facilities, utilities, and libraries supported.

Binder: *Network Programming Guide*

The *Network Programming Guide* provides an overview of NFS, pipes, sockets, network commands, Sun on-line database service, and network managers and monitors.

Binder: *Writing Device Drivers/STREAMS Programming*

Writing Device Drivers is a guide to adding drivers for new hardware devices to the SunOS kernel. The *STREAMS Programming* manual covers the theory of STREAMS programming, the SunOS-specific implementation, and catalogs STREAMS functions and data structures.

Binder: *SunView Programmer's Guide*

SunView 1 Programmer's Guide is written for applications programmers to support interactive, graphics-based applications running within windows. The *SunView 1.80 Update Appendix* updates the *SunView 1 Programmer's Guide* with the latest information.

Binder: *SunView 1 System Programmer's Guide*

The *SunView 1 System Programmer's Guide* describes how SunView works from the inside, and how to structure applications. The *Pixrect Reference Manual* describes the *Pixrect* graphics library routines that manipulate arrays of pixel values, and *RasterOps* used by applications programs to manipulate bit-mapped displays.

NOTE: Documentation of security features has been taken out of the *Security Features Guide* and divided among several other manuals. See the next chapter for details.

Compatibility and Performance Issues

5.1. Purpose of This Chapter

The purpose of this chapter is threefold: First, to address the compatibility issues that must be considered when migrating to a new release. Second, it discusses ways of improving performance in SunOS release 4.1. Third, this chapter describes the international standards the SunOS operating system is now compatible with.

5.2. Compatibility Issues

Binary Compatibility

User executables (including shared libraries), sources, and object files from 4.0.x releases should move to SunOS release 4.1 with no change. This includes many Sun and 3rd party unbundled products. There are exceptions to this that should, in practice, be encountered rarely. These are programs (in any of source, object, or executable forms) that:

- a) depend upon the internal implementation of the kernel and its data structures (and their size and shape);
- b) depend upon the object file format in a way that can be confused by extra information now appearing at the end of some object files in support of `#ident` directives in C source programs;
- c) rely upon implementation attributes, such as the location, existence, or format of certain files not documented as part of the system's programming interface (such as temporary files created by library functions or utilities).

Programs that use the `kvm` library are likely to be in class a as described above, although the programs may still function, the data they access through the library may have changed in ways that will affect the function of the program. Examples of such data include the `proc` and `user` structures of the system.

Further, programming that modifies the implementation of the system, in particular kernel extensions or modifications, may require some conversion. Most drivers should work simply through recompilation, although other kinds of changes should be inspected to verify that whatever aspect of the system implementation they rely upon for their operation has not been altered.

It is important to know that, as always, while it is possible to move programs (their sources, objects, and executables) forward to release 4.1, it is *not* possible to move 4.1 programs back to prior releases. In 4.1, this extends to newly created filesystems, which incorporate updates from the Berkeley 4.3BSD “Tahoe” release that change the on-disk format of the filesystem. Such filesystems can not be directly connected to pre-4.1 systems, though network access to them is unaffected by this change, and tapes made via `dump` and `tar` and similar utilities are also unaffected. See the “Moving Disk Drives From SunOS 4.1 Systems to Systems Running Earlier Releases” section of chapter 2 for a description of this change

Client-Server Relationships

In SunOS release 4.1, services operate correctly among all combinations of architectures for client and server. In many cases, however, a high-powered client can *overwhelm* a low-powered server. It is therefore recommended that the server be more capable than any of its clients. This means that the server should have a CPU with higher MIPS rating. Some consideration should also be given to the amount of memory, speed of disks, number of disks, number of disk controllers, and layout of data among disks on the server. Review the following list for information on particular client-server relationships:

- Diskless and Dataless Clients

The client and server should both run SunOS release 4.1. It is *not* advisable for a server running SunOS release 4.1 to support a client running an earlier release.

- General NFS[™] Service

There are no restrictions on general NFS access among machines and releases.

- RFS Service

RFS should operate between all systems configured for RFS, including systems not provided by Sun.

- NIS (was YP) Clients and Servers

There are some minor differences in the administration of the `/etc/hosts` database. This will not be visible to applications, but could change the results seen by users unless the system has been administered to be compatible.

See *System and Network Administration* manual (Part Number 800-3805-10) for details.

5.3. Performance Tuning in SunOS release 4.1

The interactive performance of this release is 17% *better* than in SunOS release 4.0, *and* there is functionality inherent in SunOS release 4.1 which allows you to improve your performance even more. Performance tuning efforts in SunOS release 4.1 have two foci:

- Improving interactive performance on 4MB configurations. Standard SunView applications such as `mailtool` and `textedit` now run faster than they did in SunOS release 4.0.
- Maintaining non-interactive performance. Even with its many functional enhancements, SunOS release 4.1 performs at least as well as 4.0.

A large performance tuning effort was undertaken to achieve these goals, encompassing most areas of our bundled software, including:

- Tuning algorithms and data structures in SunView applications like `mailtool`.
- Tuning algorithms and data structures in the SunView libraries, and ordering the text of these libraries to reduce the working set sizes.
- Tuning the UNIX file system buffer cache management code.
- Tuning the kernel directory name lookup cache management algorithm.
- Converting many kernel data structures from static to dynamic allocation to provide a net kernel size decrease.
- Downsizing kernel data structures to reduce kernel size.
- Improving the kernel swap algorithms.
- Tuning the `pixrect` library.
- Eliminating code that provided compatibility with obsolete hardware and software options.
- Tuning Ethernet drivers.
- Revising the u-area management code to improve performance on machines with virtual address caches.

Improving Performance with `tmpfs`

A `tmpfs` filesystem allows a system's virtual memory resources to be used as a filesystem. Files and directories can be created and deleted with normal UNIX semantics. These `tmpfs` filesystems do not require any additional disk space and the data can be accessed quickly. `tmpfs`-mounted directories appear identical to standard UNIX filesystems to users and most UNIX utilities.

For details and limitations, see the *System and Network Administration* manual (Part Number 800-3805-10) and the `tmpfs(4S)` manual page in the *SunOS Reference Manual* (Part Number 800-3827-10).

Performance Tips

The recommendations in this chapter will not solve every performance problem, but many can be eliminated by following these suggestions.

Kernel Configuration

Configuring the kernel, or using one of the preconfigured kernels or small kernels supplied with SunOS release 4.1 is an easy method of significantly improving performance. See chapter 6 of this manual for more information, and the *System and Network Administration* (Part Number 800-3805-10) and *Installing SunOS 4.1* (Part Number 800-3803-10) manuals for details.

Routing

Workstations that have only one Ethernet interface and do not act as NFS servers do not need to do dynamic routing with `in.routed`. Instead, you can make them route statically by commenting out (add a number sign # in column 1) the following lines in `/etc/rc.local`:

```
#if [ -f /usr/etc/in.routed ]; then
#   in.routed; echo -n ' routed'
#fi
```

Routing table entries will still be added or modified by the kernel as a result of ICMP redirect messages.

Diskless clients have a route provided automatically by the server. On other workstations, a command of this form can be added to `rc.local` just after the `in.routed` information. (*router* is the hostname of an IP router—also called a gateway—on the local network):

```
/usr/etc/route add default router 1
```

This action frees up both the pages used by `in.routed` and most of the memory allocated for routing table entries.

Accounting

Do not enable process accounting. If accounting is not configured into the kernel (`options SYSACCT`), or the file `/var/adm/acct` does not exist at boot time, accounting is not enabled. See `rc(8)` in the *SunOS Reference Manual* (Part Number 800-3827-10).

Eliminating Unnecessary Server Processes

Workstations typically only require these server processes: `portmap`, `ybind`, `biod` (there are four of them), `syslogd`, `update`, `inetd`, and `lpd` (also `keyserver` if you use secure NFS and `sendmail`). Eliminating additional server processes will increase performance.

Miscellaneous

Do not enable file-system quotas. (By default, quotas are not enabled.) Replacing `/usr/ucb/quot` with `/usr/bin/true` will prevent possible delays at login time due to calls to `rpc.rquotad` on each NFS server from which you have a file system mounted.

Use the default SunView background, and do not use retained windows.

Do not enable `in.rwhod`.

5.4. Standards Compatibility

A summary of the standards with which SunOS release 4.1 is now compatible is below; see the *System Services Overview* (Part Number 800-3846-10) for a detailed discussion of the subject.

System V Compatibility**System V Accounting**

System V changes in SunOS release 4.1 include modifications to the kernel and programs/commands to provide the System V accounting record format. A compatibility issue that arises from these changes is that old files of accounting records cannot be preserved and used across an installation.

Compatibility Changes

The effort to make the SunOS system SVID compatible is not exclusive to SunOS release 4.1. Modifications and additions have occurred to provide SVID compatibility in every release since SunOS release 3.2, and have continued in SunOS release 4.1. The following list outlines the changes that have been made to achieve SVID 2 compatibility:

- System V style accounting has been implemented in SunOS release 4.1. This can cause possible client/server and system administration confusion, since old accounting files cannot be processed with the new accounting routines.
- Mandatory file and record locking has been added to SunOS release 4.1; it will have no impact on application programs. See *Mandatory File and Record Locking* in chapter 7 of this manual.
- Commands are following the same path; new flags have been added wherever possible to comply with SVID. If the syntax and semantics required by the SVID 2 were incompatible with those of the SunOS release 4.0, a new command was added in `/usr/5bin`.
- RFS is bundled. Therefore, there are more kernel configuration options.
- Library routines have been modified to offer SVID 2-compatible interface. `libsvdm.a` provides a SVID 2-compatible math library; `libm.a` supports IEEE standard floating point behavior; and `libmalloc.a` provides SVID 2-compatible versions of `malloc()`, `calloc()`, and `realloc()`.
- The “malloc” library provides SVID 2-compatible versions of `malloc()`, `calloc()`, and `realloc()`. The default versions of these routines in `libc.a` behave as in SunOS release 4.0. The `libmalloc.a` versions of these routines indicate an error when space of size zero is requested; the

`libc.a` version of these routines returns a pointer to an area that should not be used for storage of data.

- The system now supports equal access to NFS and RFS. This change results in differences in installation and administration for NFS. See the *System Services Overview* manual (Part Number 800-3846-10) for descriptions of the SunOS utilities that have changed, and the SVID 3 utilities that are available.
- STREAMS capability was added in SunOS release 4.0.
- `terminfo(5V)` capability was added in SunOS release 3.2.

NOTE: Some object files and links may change location causing a few binary applications, shell scripts, and makefiles with hardcoded path names to break. Where possible, symbolic links are provided for compatibility.

POSIX Conformance

The System V libraries have been updated to meet the requirements of IEEE Std. 1003.1-1988 (commonly known as POSIX.1) with Common Usage C Language-Dependent System Support.

Some minor interfaces have changed to conform to POSIX.1 requirements, but existing binaries should continue to work correctly.

- The types of several function return values and arguments are more specific, and `lint(1V)` will complain about the old usage. However, the underlying types are still compatible.
- Null pathnames are now always treated as an error when using the System V compatibility package C library.

X/Open Compatibility

The X/Open compatibility package allows programmers to write software that conforms to the base level of the X/Open 1987 standard. The System V versions of most required commands, system calls, library routines, and headers conform to the *X/Open Programmer's Guide* (1987) definition (XPG-2). For routines and headers that do not, Release 4.1 provides X/Open conforming versions in `/usr/xpg2lib`, and `/usr/xpg2include`.

To compile C programs that conform to the X/Open standard, you can use the `cc` executive script in `/usr/xpg2bin`. To use this as the preferred compiler, place `/usr/xpg2bin` ahead of `/usr/5bin` and `/usr/bin` in the shell's execution path.

See also *System V Compatibility Features*, in the *System Services Overview* (Part Number 800-3846-10) for more information about System V.

`pathconf`: New Interface

SunOS release 4.1 has a new interface, `pathconf()`, that answers questions about the file system. It is limited to SunOS release 4.1 versions of UFS and NFS file systems.

UFS file systems enable this interface by default. NFS filesystems must be mounted with the `-o posix` option in order to support this interface. The remote system must understand mount protocol version 2, which is new to SunOS release 4.1.

Mounts that specify POSIX fail if the server does not support the version 2 mount protocol.

If the root partition is an NFS partition (diskless client) the root partition is mounted without the POSIX option during the single user portion of the boot sequence. This insures that root can always be mounted. If a client changes from a server that understands version 2 mount protocol to one that does not, the multi user remount of `/` will fail. The machine may be booted to single user, `/etc/fstab` edited to remove `posix` from the mount options, and then the machine will come up multi user.

lint(1) Library Support for Some Environments

SunOS release 4.1 supports `lint` libraries for the following environments:

- ANSI C
- POSIX.1
- XPG2
- SVID 2
- SVID 3
- BSD 4.3

These libraries may be used with `lint` to check portability to the desired environment. For example, the following will check for portability to a POSIX.1 conforming system:

```
coffee% lint -n -lposix posix_src.c
```

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