Errata for SunOS Release 4.0/4.0.1
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Introduction

This document supports software for the SunOS™ Release 4.0 installed on Sun-2™, Sun-3™, and Sun-4™ systems. Workstations may be configured as standalone systems, diskless or dataless clients, or homogeneous or heterogeneous servers. Workstations may be installed from 1/2-inch or 1/4-inch tape and must have a minimum of 4 megabytes of memory. For ERRATA specific to releases that update documentation after 4.0.1, see the Release/Upgrade Box shipped with a specific release.

Co-packaged with the 4.0 distribution tapes you will find SunOS release 4.0.1. SunOS 4.0.1 is a collection of fixes for bugs discovered in SunOS 4.0. Please complete the installation of SunOS 4.0 and boot and check the operation of your workstation(s) before proceeding with the upgrade to SunOS 4.0.1. Information on SunOS 4.0.1 is provided in the SunOS 4.0.1 ERRATA, attached at the end of this document as Appendix G.

This document is divided into various sections to help you obtain the information you need to install and use this release. Under the heading Installation Issues, you will find general installation information that is important to all users.

The section Known Problems in the Software is divided into a series of headings to help identify the areas that are appropriate to your installation and usage needs.

Documentation Errata and Addenda contains changes to Release 4.0 documentation.

Finally, there are appendices at the end of this RTF that contain the following:

- Boot PROM Issues
- Sizing Your Disk Partitions
- Remote Installation Notes
- Kernel Configuration Procedures
- Performance Tips
- Sun-2, Sun-3, and Sun-4 Distribution Tape Layouts
- SunOS 4.0.1 Bugfix ERRATA

Getting Help

If you have any problems installing or using Release 4.0, call Sun Microsystems at: 1-800-USA-4SUN (1-800-872-4786).
Sun Customers throughout the world have service hotlines available for both software and hardware support questions. Outside the USA, call your local support office or the number provided with your software support contract. Have your system model number and the SunOS release number (for software) ready to give to the dispatcher.

You can also send questions by electronic mail to sun!hotline. Be sure to include your name, company, phone number, and SunOS release number in your mail message.

If you have questions about Sun's support services or your shipment, call your sales representative.

To see the SunOS release number, type: `cat /etc/motd`

### Installation Issues

Installation is separated into three parts: pre-installation issues that should be considered before actual procedures begin; issues with *Installing the SunOS 4.0*; and post-installation considerations.

#### Pre-Installation Issues

1. SunOS 4.0 is a major new release that includes significant changes to the filesystem layout. As a result, upgrading from releases prior to SunOS 4.0 is not possible. You must do a complete new installation. Back up your customized and user files, do a complete installation of SunOS 4.0, and then restore the saved files. (As always, full dumps should be done prior to re-installing your system.)

2. Refer to Appendix A of this document, *PROM Issues*, to find out if you need an updated boot PROM.

3. As in previous releases, it is recommended that networks be configured with servers more powerful than their clients (especially for diskless operation). SunOS 4.0 has improved heterogeneity, file caching and buffer management features that make the benefits of this arrangement more apparent.

4. For Sun-3 and Sun-4 machines with 1/4-inch tape drives, choose the `st8` option for 1/4-inch tape type.

5. If you have a Sun 100U with an Archive 1/4-inch tape controller, you cannot boot MUNIX and use `format` to format and label your disks. Instead, use the `diag` program from Release 3.5 to format and label your disks.

6. Disk labeling: the importance of partition 'c':

   By Sun convention, every disk drive must have a 'c' partition which starts at sector zero (0) and is the full size of the disk. All `format` default labels follow this convention. Please note that if the 'c' partition is not correctly designated on a drive, `suninstall` will not 'see' it; that is, it will not show up in the Disk Form.

7. If you have a Fujitsu-M2284/M2322 disk and are using `format` to relabel your disk, the standard label is incorrect because the starting cylinder for the swap partition is wrong. If you want to use the standard label, edit `/etc/format.dat`. Go to the section for this particular disk and change `b=105` to `b=50`.

#### Issues on Installing the SunOS

1. When installing a system which uses a serial terminal as console and setting the terminal type to *other*, certain other non-Sun terminal types may cause `suninstall` to dump core later on during the installation. This problem stems from an inadequate buffer for parsing the `termcap` file. Work around this as follows:
Before entering suninstall, set the TERMCP environment variable to the termcap entry with these keyins:

```
# setnoglob
# eval 'tset -s terminal_type'
# unset noglob
```

2. Setting the correct time zone in suninstall:

When suninstall is invoked, it will request information on your local time zone. There is no default for this information and it must be filled in when asked for. See Appendix B of Installing the SunOS 4.0 for a complete listing of world time zones.

3. If you are installing a server, installing a system which may become a server at a later date, using a system as a remote installation server, or planning on adding Sun software after installing the SunOS, answer y to Install files category on the Software Form:

```
Install files: y
```

This will load setup_exec(8) and other system administration utilities.

4. If the "Security" software is selected, then the "System_V" software must also be selected. If it is not, the C2conv script used to configure C2 security will fail attempting to execute /bin/id.

5. The suninstall.log file:

After completing an installation and before booting the newly installed system, review the file /usr/etc/install/files/suninstall.log. Errors from utilities such as tar will appear here even if they were scrolled off the screen during the installation.

6. Installing from mixed types of distribution tapes:

suninstall does not currently support installation of the different architectures on a heterogeneous server from different tape drives. For example, you cannot install a Sun-3 heterogeneous server by loading the Sun-3 software from a local 1/2-inch tape drive and the Sun-2 software from a remote 1/4-inch tape drive. If such an installation is necessary, install the machine as a homogeneous server (be sure to select Install optional software), bring up the SunOS and then use setup_exec and setup_client to add the heterogeneous software and clients.

Post-Installation Issues

1. Booting Ethernet interface ec0 from fast servers:

Diskless Sun-2s (or Sun 100Us) with 3Com Ethernet interface (ec0) will have trouble booting from fast servers such as Sun-3s or Sun-4s. To correct this, apply the following patch.

On the machine named SERVER, do the following for the client named CLIENT:
Also, be sure that the client's /etc/fstab entries have the rsize and wsize options set to 2K for any fast servers. For example, the entry for /usr on the CLIENT should look similar to the following:

```
SERVER:/export/exec/sun2     /usr  nfs  ro,rsize=2048,wsize=2048 0 0
```

Alternatively, the ec board should be upgraded to a Sun multibus Ethernet board (ieo); see your sales representative for details.

2. The symbol LOGHOST is not correctly defined by syslogd on loghost machines. This results in 100% CPU usage and syslogd accumulating large amounts of CPU time.

To prevent this problem, insert the following line at the beginning of /etc/syslog.conf on loghost machines:

```
define(LOGHOST, 1)
```

3. Even if a machine is chosen as a yp server during suninstall, it is still necessary to run /usr/etc/ypinit on the server before booting clients. After doing this, edit /etc/rc.local and remove the comment symbols from the lines of code referring to ypbind. If you do not do this the yellow pages will not work on the server.

4. The directory /mann is missing under /usr/man; this results in catman failure. To prevent this problem, create the directory mann under /usr/man:

```
# mkdir /usr/man/mann
```

Known Problems with the Software

System Administration Issues

1. File system blocksize must be >= system page size.

The system will not support the use of file systems with a block size that is smaller than the page size of the system. An example would be a file system with a blocksize of 4K bytes used on a Sun-3 (8K page size). Such file systems should be recreated with an appropriate block size. This problem does not affect file systems with a block size larger than page size. For example, a block size of 8K on a Sun-2 (2K page size) works properly. System page sizes are: Sun-2 - 2K; Sun-3 - 8K; Sun-4 - 8K.
2. *core* files appear to be very large:

A *core* file of a dynamically linked program produced by 4.0 appears to be very large, having a *length* over 2Mbytes in many cases (as shown by an `ls -l` command). However, their actual size on disk (as shown by an `ls -s`) is often much less, usually less than it would be with previous versions of the system. Such files contain one or more "holes" of unused space that are optimized out of the disk space allocation.

If such files (or for that matter, any file containing a hole) are copied using a command such as `cp` or `tar`, the "holes" will be filled in and as a consequence the file will actually occupy the amount of disk space indicated by its length. This is not a problem if the files are renamed (via `mv`) or dumped with `dump`.

Graphics Issues

1. In *SunCGI*, one can specify that the view surface be retained. When this view surface is redisplayed (when the window is overlapped or `Redisplay` is selected from the menu), the image shifts to the right. This effectively negates the utility of having a retained view surface. Use canvases if retained data is a must. Otherwise, avoid using the retained flag to open_vws.

2. In *GPSI*, lines drawn using the `XF_LINE_INT_2D` and `INT_3D` commands seem to be shifted off of the left side of the screen where they are clipped (one pixel usually remains on the screen). This happens regardless of the viewport and transformation matrix used. Use `XF_LINE_FLT_2D` or `FLT_3D` commands instead. There is no workaround for users of the INT package.

SCSI/SMD Issues

1. Sun 3/2xx and Sun 4/2xx workstations configured with an SMD disk plus two or more SCSI devices may hang under heavy load. Prevent this problem by upgrading to SunOS 4.0.1, specifically the "SCSI" and "mb" fixes.

2. On workstations using SMD disks supported by the Xylogics 450/451 disk controller messages may appear in the following form:

```
xy<disk partition>: read/write retry (message) - blx #xxxxx, abs blk #xxxxx
```

The message may be one of:

- disk sequencer error
- cylinder & head header error
- memory addr error
- header not found
- lost interrupt

Occasional retry or restore messages are normal and are not cause for concern, and indicate that the I/O operation ultimately succeeded. If the message states that the operation 'failed', you should be more concerned. In particular, read operations that fail with the message 'hard ecc error' may indicate worn cabling, poor drive grounding, or possible drive problems.
Sun FORTRAN and Sun PASCAL Issues

Sun FORTRAN 1.1 and Sun Pascal 1.1 are separate, value-added products that will be shipped subsequently to SunOS 4.0. f77 and pc, the UNIX FORTRAN and Pascal compilers have been removed from SunOS 4.0 tapes. Customers with support contracts are eligible to receive a one time upgrade to SunOS 4.0 versions of Sun FORTRAN and Sun Pascal free of charge. Other customers may purchase these as separate products.

Sun FORTRAN has many new features including performance enhancements and VMS extensions. Sun Pascal is ISO Pascal with separate compilation, variable-length strings, a variety of extensions, and global optimization.

For additional information, please call your sales representative.

Unbundled Product issues

Some Sunlink products cause diskless nodes to hang during boot:

In order to install Sunlink products that contain kernel drivers on diskless nodes running 4.0, the configuration file line for the system’s Ethernet device MUST be placed BEFORE the config file lines that define the zs ports.

Old:

device zs0 at obio ? csr 0x20000 flags 3 priority 3
device zs1 at obio ? csr 0x00000 flags 0x103 priority 3
device ie0 at obio ? csr 0xc0000 priority 3

New:

device ie0 at obio ? csr 0xc0000 priority 3
device zs0 at obio ? csr 0x20000 flags 3 priority 3
device zs1 at obio ? csr 0x00000 flags 0x103 priority 3

Documentation Errata and Addenda

There are several miniboxxes shipped with this release. In each box, you will find a READ THIS FIRST that pertains to the information exclusive to the manuals contained in the specific box. Be sure and read these RTFs as well as this errata for complete information about the release.

SunOS Reference Manual

1. In the printed versions of the Reference Manual pages listed below, the indicated files are incorrectly shown as residing in /etc. The on-line versions correctly show these files as residing in /usr/etc:

    audit_warn(8)  /usr/etc/security/audit/audit_warn
    auditd(8)      /usr/etc/auditd
    config(8)      /usr/etc/config
    devnm(8)       /usr/etc/devnm
    lockd(8C)      /usr/etc/rpc.lockd
routed(8C) /usr/etc/in.routed
sendmail(8) /usr/etc/sendmail
statd(8C) /usr/etc/rpc.statd

2. The printed version of the init(8) Reference Manual page incorrectly states that for a secure system, when the console is marked secure in /etc/ttytab, a root password is required before the system comes up in single-user mode. The on-line page correctly states that when the console is not marked secure, the root password is required.

System and Network Administration

1. Changes and additions to System and Network Administration, Section 9.5, Changing Swap Space:

There are two ways to expand the local swap space of a standalone (or server) system.

I. Re-run suninstall. It is permissible to EXPAND the size of the 'b' (swap) partition while in the Disk form. If you need to REDUCE the size of the 'b' partition you must use MUNIX and format.

II. Add swap space in a regular file; these keyins create a swap file using mkfile(8):

```
# mkfile -v 84m /export/swap/localswap
/export/swap/localswap 88080384 bytes
```

Add a swap entry to /etc/fstab:

```
# /export/swap/localswap swap swap rw 0 0
```

Execute swapon(8):

```
# swapon -a
```

On subsequent boots, swapon(8) will be automatically executed by /etc/rc.

2. When using mkfile(8) to create client swap files for normal use DO NOT use the -n option to mkfile(8). This option creates an empty file with no disk blocks allocated. This will result in a discontiguous (and therefore less efficient) swap file for the client. It also risks client failure if it attempts to allocate blocks to the swap file and none are available.

This feature of mkfile(8) and NFS can be used on an experimental basis to determine efficient swap file sizes for clients. Note that while ls -l will show the maximum size for a file made using mkfile -n, ls -lS will also show the actual number of disk blocks allocated to the file:

```
# mkfile -n 16m mt
# mkfile 16m full
# ls -lS
16392 -rw------t 1 root 16777216 full
16 -rw------t 1 root 16777216 mt
```

After making a swap file with mkfile -n, boot up the client and use it for awhile. Then check how many
blocks have actually been required for normal operation of the client. Add some more room to avoid overrunning your swap space later and create the production swap file for the client:

```
# mkfile [blocks]k /export/swap/clientname
```

Release 4.0 Change Notes

*Chapter 2, Section 2.3: Shared Libraries*
By default, programs are built to access shared libraries. This is the standard behavior and can only be changed through the use of the `-bstatic` flag. See the `ld(1)` man page for more information.

*Chapter 2, Section 2.3: Kernel Boot Sequence*
The kernel boots with the root filesystem initially mounted read-only. This allows `fsck` to repair any damaged filesystems reliably. The root filesystem can be initially mounted read/write by using the new `-w` option when booting.

*Chapter 2, Section 2.7: Utilities*
`fsck(8)`:
`fsck(8)` now checks the raw device by default. `fsck(8)` is unreliable in checking filesystems currently mounted read-write since the filesystem activity can interfere with `fsck` operation.

`mount(8)`:
A new remount option for the `mount(8)` command allows converting 4.2 filesystems mounted as read-only to read-write. This facility is used in the `rc` scripts to remount 4.2 filesystems as read-write after the filesystems have passed `fsck`.

*Chapter 2, Section 2.9: System V Enhancements*
The definition for the largest shared memory segment has been changed from `SHMPOOL` in Release 3.x to `SHMSIZE` in Release 4.0.

*Sun-4 Assembly Language Reference Manual*
Correction to Sun-4 Assembly Language Reference Manual, pages 17 and 18 of Table 2-3:
The following SPARC floating-point instructions are not supported in the SunOS 4.0 release version of the Sun-4 SPARC assembler: `FINTRZ`, `FCLASS`, `FEXPO`, `FScale`, `FREM`, and `FQUOT`. 
APPENDICES to the SunOS 4.0 ERRATA

- A. Boot PROM Issues
- B. Sizing Your Disk Partitions
- C. Remote Tape Installation
- D. Kernel Configuration Procedures
- E. Performance Tips
- F. Sun-2, Sun-3, and Sun-4 Distribution Tape Layouts
- G. SunOS 4.0.1 ERRATA
A: PROM Issues

- Minimum boot PROM revision levels:

  If you have a Sun-3 system and try to load SunOS Version 4.0 from a 1/4-inch tape drive, the boot may fail and an error code may appear on the screen. If this happens, you should check your boot PROM revision level. The table below lists the minimum PROM revision level required with the various Sun architectures.

<table>
<thead>
<tr>
<th>Architecture</th>
<th>Minimum PROM Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun-3/50</td>
<td>1.8</td>
</tr>
<tr>
<td>Sun-3/75</td>
<td>1.8</td>
</tr>
<tr>
<td>Sun-3/110</td>
<td>1.8</td>
</tr>
<tr>
<td>Sun-3/140</td>
<td>1.8</td>
</tr>
<tr>
<td>Sun-3/150</td>
<td>1.8</td>
</tr>
<tr>
<td>Sun-3/160</td>
<td>1.8</td>
</tr>
<tr>
<td>Sun-3/180</td>
<td>1.8</td>
</tr>
<tr>
<td>Sun-3/260</td>
<td>1.8</td>
</tr>
<tr>
<td>Sun-3/280</td>
<td>1.8</td>
</tr>
<tr>
<td>Sun-3/60</td>
<td>1.6</td>
</tr>
</tbody>
</table>

- How to determine your current PROM revision:

  Have your system administrator bring your system down safely:

  `su
  enter password
  ##/etc/halt`

  After the > prompt, type `kb`:

  `>kb Return`

  The system will respond with something like this:

  `Self Test completed successfully.
  Sun Workstation, Model some number
  ROM Rev 1.8, 8MB memory installed
  and so on...`

  Look at the ROM Rev number and compare it with the revision given for your architecture in the table above. If the number is less than the minimum level shown in the table, you need an upgrade kit.

- How to obtain an upgrade PROM kit:

  If you found that you need a new PROM and you have an On-site Hardware or Comprehensive Support contract, Sun will install the new PROM for you. On-site Hardware Support customers should phone the Sun Response
Center at 800-USA-4SUN, request Field Service, and schedule PROM installation.

If you want to install the PROM yourself, ask for a Sun-3 PROM Upgrade Kit to be mailed to you.

If you do not have an On-Site or Comprehensive support contract, Sun will mail you this kit at no charge. The kit contains instructions for replacing the Boot PROM on your CPU board, a process that takes about 10-15 minutes. You should call Sun’s 800 USA-4-SUN phone number, request Field Service, and ask for a Sun-3 PROM Upgrade Kit. If you want Sun to install the PROM, Sun will bill you on a time (but not materials) basis.

- **PROM bugs:**

  1. The Sun-3/60 Ethernet chip does not reset properly on power-up. This can be worked around by typing (X2) in the PROM monitor mode. See the *PROM User’s Manual* for help in accessing the monitor.

  2. If you find that your PROM Revision is greater than 1.8 but lower than 2.6, and you still receive an error code when you try to boot from 1/4-inch tape, the problem could be caused by one of the anomalies described below:

     - If your system contains a Sysgen Controller board and a Wangtec tape drive, and if the tape you are trying to load is write protected, you will receive an error message when you try to boot.

       Remove the tape and make sure it is NOT write-protected. If the boot still fails contact hardware support at 1-800-USA-4SUN. Outside the USA call your local support office. Please mention FA #136.

     - If you have a Sysgen Controller and an Archive tape drive and your PROM revision level is greater than 1.8, but lower than 2.6, call Sun as described above and request that you receive the latest PROM revision. Please mention FA #135.

     - If you have a Sun-2 shoebox connected to a Sun-3 workstation and get a tape error message, call Sun as described above. Please mention FA #137 and FA #138.
B: Sizing Your Disk Partitions

- / (root)
  The default root filesystem size is about 8 megabytes. This size should be correct for most applications.

- swap
  The default swap partition size is about 16 megabytes. This should be ample for general applications. Certain applications will require more swap space. You can expand the size of the swap partition using the Disk Form of `suninstall` during your installation. Once the system has been installed you can add swap space using the procedures in this RTF. *(Documentation Errata and Addenda, System and Network Administration.)*

- /usr
  The /usr partition is expanded by `suninstall` to accommodate the optional software selected in the Disk Form of `suninstall`. The space needed is ‘stolen’ from the partition designated as the ‘Free Hog’, typically the /home partition.

  Allowing `suninstall` to automatically size the /usr partition by stealing from the Free Hog partition will result in a very full /usr partition. It is prudent to allow `suninstall` to size the partition and then to return to the Disk Form to expand the partition a bit further. Add about 8 megabytes or 10%, whichever is greater. This will allow room for building a custom kernel, etc. Also add space for any custom or unbundled software which you intend to add to the /usr filesystem.

- /var
  The /var directory tree is intended as a repository for files which vary in size. In 4.0 all of the following are links into /var: /usr/adm, /usr/tmp, /usr/spool. Additionally, database files on Yellow Pages servers are kept in /var/yp. As installed by default, /var is a plain directory in the root (/) filesystem. This risks the possibility of rapidly filling the root filesystem during normal system operation.

  It is suggested that you allocate a separate disk partition for /var. Size it based on your experience with /usr/adm, /usr/tmp, and /usr/spool requirements in previous releases.

- /export
  /export is the default name on a server for the partition used to support diskless clients. It includes three primary subdirectories. You may, if you wish, make each of these a separate disk partition.

  /export/exec
  This directory’s partition is grown by `suninstall` as optional software is selected for client systems of architectures different from the server’s, much like /usr. As in the case of /usr you will want to add more space to accommodate kernel configuration and additional software. (Note that every standalone and server system has a symbolic link /export/exec/arch to its own /usr partition.)

  /export/root
  This is the default name on a server for the directory used to hold diskless clients’ root partitions. Allow a minimum of 2 megabytes for each diskless client.

  /export/swap
  This is the default name on a server for the directory used to hold diskless clients’ swap partitions. The suggested size for a client’s swap area is 16 Megabytes. (Note that this is only a suggestion, requirements are system and application dependent.) To size this partition add up the swap sizes for the diskless clients to be supported and then add about 6% more room for file system overhead.
C: Remote Tape Installation

1. Before beginning a remote tape installation, insert the hostname of the target system into the "/rhosts" file of the tapehost system, creating the file if it does not exist.

2. For remote 1/2-inch tape installation, the user should always pick remote mt 0 regardless of the actual half-inch tape controller type on the tapehost.

3. For remote installations, on page 105 and 106 in Chapter 5 of "Installing the SunOS", the user must specify bs (block size) in order for dd to copy the miniroot correctly. On page 105, the line

   \texttt{dd if=/dev/nr\langle\text{tape device}\rangle of=/export/exec/ARCH/local/miniroot}

   should be changed to

   \texttt{dd if=/dev/nr\langle\text{tape device}\rangle bs=\langle\text{block size}\rangle of=/export/exec/ARCH/local/miniroot}

   On page 106, the line

   \texttt{dd if=/usr/local/miniroot of=/dev/r\langle\text{disk device}\rangle b}

   should be changed to

   \texttt{dd if=/usr/local/miniroot bs=\langle\text{block size}\rangle of=/dev/r\langle\text{disk device}\rangle b}

Block size is determined by the following:

For st0, bs is 126.
For st8, bs is 200.
For mt0, bs is 20.

If the user does not specify the correct block size, the miniroot will not boot.
D: Kernel Configuration Procedures

If you have never configured a kernel, read *Installing the SunOS*, Appendix A. Specific procedures for building a kernel are provided below.

Two methods for making a customized kernel are presented on the next two pages. The first, Procedure I, builds a kernel on a workstation with local disk. The second, Procedure II, builds a kernel on a diskless or dataless client.

The kernel used by a diskless client can be built on its server only if the diskless client is of the same architecture as the server. If a diskless client is of a different architecture from its server (heterogeneous), its kernel must be made on the client.

Procedure I is simpler to perform. It requires write privileges on the workstation `/usr` filesystem. Use it to build a kernel for:

- A standalone workstation
- A server
- A diskless client workstation of an architecture the same as its server
- A dataless client workstation of an architecture the same as its server

Procedure II requires a little more work, but allows building a kernel without having write privileges on the `/usr` filesystem. Procedure II requires only root privileges on the client workstation; no special privileges are needed on the server. Use the second procedure to build a kernel for:

- A diskless client workstation of an architecture different from its server
- A dataless client workstation of an architecture different from its server
- A diskless or dataless client workstation when you do not have root privileges on the server

All procedures are performed when logged in as root (or `su`'d to superuser if root logins are not allowed).

SYS_NAME, shown on the example screens following, is the name given to the custom kernel configuration file. It is typically chosen to match the hostname of the workstation that will run the kernel. This name is automatically compiled into the kernel and is announced when the kernel is booted. For example, a kernel made from a configuration file named `ASLAN` announces itself when booted as:

```plaintext
SunOS Release 4.0 (ASLAN) #1: Wed Sep 14 15:33:16 PDT 1988
```

A kernel that will be used by several client workstations of a server might be called `ASLAN_CLIENT`.

`sun#` on the example screens requires you to fill in `sun2`, `sun3` or `sun4`, whichever is appropriate to the workstation on which you are building the kernel.
Procedure I:

Log in as root and execute the following:

```
# cd /usr/sys/sun#/conf
# cp GENERIC SYS_NAME
# chmod +w SYS_NAME
# vi SYS_NAME
   (Edit out unneeded kernel modules.)
# config SYS_NAME
# cd ..SYS_NAME
# make
```

When the make completes successfully, install the kernel.

To install the kernel on the standalone or server workstation it was built on:

```
# mv /vmunix /vmunix.SV
# cp /vmunix /vmunix
```

To install the kernel on a diskless client workstation of the same architecture:

```
# mv /export/root/SYS_NAME/vmunix /export/root/SYS_NAME/vmunix.SV
# cp /vmunix /export/root/SYS_NAME/vmunix
```

To install the kernel on a dataless workstation of the same architecture, log onto the dataless workstation as root and:

```
# mv /vmunix /vmunix.SV
# cp /usr/sys/sun#/SYS_NAME/vmunix /vmunix
```

Now halt and reboot the workstation whose kernel you have just installed.
Procedure II:
The example for Procedure II makes the kernel in /sys on the client. The client's /sys will be located in the server's /export/root filesystem and there must be about two megabytes of disk space available in order to make a kernel. If space is not available in that filesystem, the procedure may be done in any filesystem which is writable by the client that has sufficient free space.

Log in as root and execute the following:

```
# mkdir /sys
# cd /sys
# ln -s /usr/sys/* .
# rm sun#
# mkdir sun#
# cd sun#
# ln -s /usr/sys/sun#/* .
# rm conf
# mkdir conf
# cd conf
# ln -s /usr/sys/sun#/conf/* .
```

Now configure and make a kernel:

```
# cp GENERIC SYS_NAME
# chmod +w SYS_NAME
# vi SYS_NAME
   (Edit out unneeded kernel modules.)
# config SYS_NAME
# cd ../SYS_NAME
# make
```

When the `make` completes successfully, install the kernel:

```
# mv /vmunix /vmunix.SV
# cp vmunix /vmunix
```

Halt and reboot the workstation.

After the client has booted successfully, clean up /sys. (You may wish to save a copy of your customized configuration file first):

```
# rm -xf /sys
```
E: Performance Tips

The following recommendations are intended to improve performance on 4MB workstations running SunOS 4.0. They will not solve every performance problem, but many problems can be eliminated by implementing the following suggestions. The goal of these recommendations is to maximize the number of memory pages available to user processes (including SunView).

Routing

Workstations with only one ethernet interface do not need to do dynamic routing with `in.routed`; instead, they can route statically by commenting out (with the pound sign "#" in column 1) these lines in `/etc/rc.local`:

```bash
#if [-f /usr/etc/in.routed ]; then
 # in.routed; (echo -n ' routed') >/dev/console
#if
```

(Routing table entries can still be added or modified by the kernel as a result of ICMP redirect messages.) Diskless clients have a default route provided automatically by the server; on other machines, a command of the form

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

can be added to `rc.local`, where `router` is the hostname of an IP router ("gateway") on your local network. This action frees up both the pages used by `in.routed` and most of the memory allocated for routing table entries. Here at Sun in Mountain View, static routing typically reduces the size of the routing table from over 150 entries to 3.

Sendmail

Receiving mail on a diskless workstation typically causes a significant amount of paging, not only due to the creation of `sendmail` and `/bin/mail` processes, but also due to alias resolution and access over the network to the mailbox on the server. Recommendation: have each client mount its spool directory via secure NFS, change the YP alias map to direct users' mail to their servers, and don't run `sendmail` on the clients. For example, add a line like the following to each client's `/etc/fstab`:

```
server:/var/spool/mail /var/spool/mail nfs rw,bg,hard,intr,secure 0 0
```

Export `/var/spool/mail` on the server using the "secure" option. (Don't forget to run `exportfs`.) Change or create aliases in `/etc/aliases` on the YP master to provide aliases of the form

```
user: user@server
```

for all users who would otherwise receive mail on the clients, and re-make the YP alias map (cd `/var/yp`; make aliases). Comment out these lines in each client's `/etc/rc.local` and reboot the clients:
An interesting side effect of this change is that a user can receive mail even if the client workstation is down. This change is also useful in environments where users wish to be able to log in to any machine of a cluster and read their mail.

- **Accounting**
  Don't 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 /etc/rc).

- **Other changes in /etc/rc.local**
  Don’t start unnecessary server processes. Typically only portmap, ypbind, biod (4 of them), syslogd, update, inetd, and lpd are required on client workstations. Add keyserv if you use secure NFS, and sendmail if you don't implement the sendmail strategy above.

- **Miscellaneous**
  Make sure that you have defined LOGHOST if required as specified on page 4 of this document.
  Don’t enable file system quotas. (By default, quotas are not enabled.) Replacing /usr/ucb/quotas 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 filesystem mounted.

  Use the default SunView background, and don’t use retained windows.

  Don’t enable in.rwhod.

- **Minimizing kernel size**

  Don’t run the GENERIC kernel except to configure a smaller one!

  **Kernel configuration file:**

  Remove all unnecessary entries from the kernel configuration file. For example, the following lines can be removed from DL50 in /usr/sys/sun3/conf:

<table>
<thead>
<tr>
<th>options</th>
<th>CRYPT</th>
<th>(unless you use secure NFS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>pseudo-device</td>
<td>clone</td>
<td></td>
</tr>
<tr>
<td>pseudo-device</td>
<td>snit</td>
<td></td>
</tr>
<tr>
<td>pseudo-device</td>
<td>pf</td>
<td></td>
</tr>
<tr>
<td>pseudo-device</td>
<td>nbuf</td>
<td></td>
</tr>
<tr>
<td>device</td>
<td>des0 at obio ? csr 0x1c0000</td>
<td></td>
</tr>
</tbody>
</table>
Streams NIT is used by `etherfind`; to run `etherfind`, boot another kernel or run it on the server.

In many cases "maxusers" can be reduced to 3:

```
maxusers 3
```

Also, these lines can be changed as follows:

```
pseudo-device dtopl
pseudo-device msl
pseudo-device kbl
```

Streams buffers:

The default allocation of streams buffers is overly generous. Use the following procedure to make a kernel with smaller allocations.

1. Run `config` using your modified configuration file.
2. In `/usr/share/sys/sun3/KERNELNAME/param.c`, modify these lines as follows:

```
#define NBLK2048 4
#define NBLK1024 4
#define NBLK512 4
#define NBLK256 16
#define NBLK128 64
#define NBLK64 64
#define NBLK16 64
#define NBLK4 64

#define NSTREAM 20
#define NMUXLINK 37
#define NSTREVENT 64
```

Larger allocations may be required in some environments; in some circumstances, running out can deadlock the system. Check your usage with `netstat -m`.

3. Run `make`.

Ethernet buffers:

If you have an 1e. Ethernet interface (Sun-3/50 or 3/60), reduce the number of Ethernet buffers:

```
hostname# adb -w vmunix 
_1e_nrdmxp2?W 3
_1e_nrbufs?W A
$q
hostname#
```
If you have an ie Ethernet interface:

```
hostname# adb -w vmunix
  _ie_tbufs?W 1
  _ie_rhds?W 6
  _ie_rfds?W 5
  _ie_rbufs?W 9
$q
hostname#
```

UFS (Unix File System) buffers:

If you have a disk, you can reduce the number of buffers allocated to the UFS buffer cache:

```
hostname# adb -w vmunix
  _nbuf?W 6
$q
hostname#
```
F: Distribution Tape Layout

The following tables describe the contents of the SunOS 4.0 distribution tapes. The list is in the order in which the tape files appear.

### SunOS 4.0 Sun-2 Release - 1/2" Media

<table>
<thead>
<tr>
<th>Tape/ File</th>
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<th>Description</th>
<th>Size</th>
<th>Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/0</td>
<td>boot</td>
<td>A general purpose bootstrap program. Boot it from the PROM monitor.</td>
<td>26624</td>
<td>image</td>
</tr>
<tr>
<td>1/1</td>
<td>XDRTOC</td>
<td>Table of Contents in xdr(3N) format.</td>
<td>4096</td>
<td>toc</td>
</tr>
<tr>
<td>1/2</td>
<td>copy</td>
<td>Standalone copy.</td>
<td>33280</td>
<td>image</td>
</tr>
<tr>
<td>1/3</td>
<td>mini-root</td>
<td>An image of a mini version of SunOS sufficient to run suninstall.</td>
<td>6154240</td>
<td>image</td>
</tr>
<tr>
<td>1/4</td>
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<td>Memory UNIX.</td>
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<td>image</td>
</tr>
<tr>
<td>1/5</td>
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<tr>
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<td>Required /usr files.</td>
<td>18872320</td>
<td>tar</td>
</tr>
<tr>
<td>1/8</td>
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<td>2682880</td>
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</tr>
<tr>
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<td>Networking tools and programs.</td>
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<tr>
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<td>Debugging tools.</td>
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<tr>
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<td>SunWindows for users.</td>
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<td>tar</td>
</tr>
<tr>
<td>1/12</td>
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<td>The copyright file.</td>
<td>512</td>
<td>tar</td>
</tr>
<tr>
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<td>boot</td>
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<td>26624</td>
<td>image</td>
</tr>
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<td>toc</td>
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<tr>
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<td>SunWindows files for programmers.</td>
<td>2048000</td>
<td>tar</td>
</tr>
<tr>
<td>2/3</td>
<td>SunView_Demo</td>
<td>SunWindows demo programs source.</td>
<td>573440</td>
<td>tar</td>
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<td>Text</td>
<td>Text processing tools and files.</td>
<td>696320</td>
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<td>Install</td>
<td>Installation and system administration tools.</td>
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<td>C2 security support.</td>
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<td>SunWindows files for programmers.</td>
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<td>Security</td>
<td>C2 security support.</td>
<td>153600</td>
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## SunOS 4.0 Sun-3 Release - 1/4" Media

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<td>munixfs</td>
<td>The MUNIX initialization file.</td>
<td>1638400</td>
<td>image</td>
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<td>1/6</td>
<td>root</td>
<td>The complete root file system for SunOS.</td>
<td>204800</td>
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<td>Sys</td>
<td>/usr/share/sys files for making custom kernels.</td>
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<td>User_Diag</td>
<td>Sysdiag.</td>
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<td>1/17</td>
<td>SunCore</td>
<td>SunCore programmer's files.</td>
<td>2969600</td>
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<td>uucp files.</td>
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<td>General purpose boot.</td>
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<td>System V compatibility files.</td>
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<td>2/3</td>
<td>Manual</td>
<td>On-line man pages.</td>
<td>6246400</td>
<td>tar</td>
</tr>
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<td>Demo</td>
<td>Assorted graphics demonstrations including Graphics Processor source.</td>
<td>2764800</td>
<td>tar</td>
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<tr>
<td>2/5</td>
<td>Games</td>
<td>Game programs.</td>
<td>2457600</td>
<td>tar</td>
</tr>
<tr>
<td>2/6</td>
<td>Versatec</td>
<td>Versatec raster printer/plotter support.</td>
<td>6144000</td>
<td>tar</td>
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<tr>
<td>2/7</td>
<td>Security</td>
<td>C2 security support.</td>
<td>204800</td>
<td>tar</td>
</tr>
<tr>
<td>2/8</td>
<td>Copyright</td>
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<td>512</td>
<td>image</td>
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</table>
## SunOS 4.0 Sun-4 Release - 1/2" Media

<table>
<thead>
<tr>
<th>Tape/ File</th>
<th>Name</th>
<th>Description</th>
<th>Size</th>
<th>Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/0</td>
<td>boot</td>
<td>A general purpose bootstrap program. Boot it from the PROM monitor.</td>
<td>40960</td>
<td>image</td>
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<tr>
<td>1/1</td>
<td>XDRTOC</td>
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<td>toc</td>
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<td>Standalone copy.</td>
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<tr>
<td>1/3</td>
<td>mini-root</td>
<td>An image of a mini version of SunOS sufficient to run suninstall.</td>
<td>6154240</td>
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<td>1/4</td>
<td>munix</td>
<td>Memory UNIX.</td>
<td>942592</td>
<td>image</td>
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<tr>
<td>1/5</td>
<td>munixfs</td>
<td>The MUNIX initialization file.</td>
<td>1581056</td>
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<td>root</td>
<td>The complete root file system for SunOS.</td>
<td>16384</td>
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<td>Required /usr files.</td>
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<td>/usr/share/sys files for making custom kernels.</td>
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<td>System V compatibility files.</td>
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<td>On-line man pages.</td>
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## SunOS 4.0 Sun-4 Release - 1/4" Media

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<th>Description</th>
<th>Size</th>
<th>Format</th>
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<td>1/0</td>
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<td>A general purpose bootstrap program. Boot it from the PROM monitor.</td>
<td>40960</td>
<td>image</td>
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<tr>
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<td>toc</td>
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<tr>
<td>1/2</td>
<td>copy</td>
<td>Standalone copy.</td>
<td>49664</td>
<td>image</td>
</tr>
<tr>
<td>1/3</td>
<td>mini-root</td>
<td>An image of a mini version of SunOS sufficient to run suninstall.</td>
<td>6246400</td>
<td>image</td>
</tr>
<tr>
<td>1/4</td>
<td>munix</td>
<td>Memory UNIX.</td>
<td>942592</td>
<td>image</td>
</tr>
<tr>
<td>1/5</td>
<td>munixfs</td>
<td>The MUNIX initialization file.</td>
<td>1638400</td>
<td>image</td>
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<td>root</td>
<td>The complete root file system for SunOS.</td>
<td>204800</td>
<td>tar</td>
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<td>usr</td>
<td>Required /usr files.</td>
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<td>1/8</td>
<td>Sys</td>
<td>/usr/share/sys files for making custom kernels.</td>
<td>3276800</td>
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<td>Debugging tools.</td>
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<td>Security</td>
<td>C2 security support.</td>
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<tr>
<td>2/12</td>
<td>Copyright</td>
<td>The copyright file.</td>
<td>512</td>
<td>image</td>
</tr>
</tbody>
</table>
G: SunOS 4.0.1 Bugfix ERRATA

The text of the ERRATA for SunOS Release 4.0.1 follows.
Introduction

SunOS™ Release 4.0.1 contains fixes for bugs reported against SunOS 4.0. It applies to Sun-2™, Sun-3™, and Sun-4™ workstations.

This document includes important information on installing the fixes, post-installation procedures, dependencies, and kernel rebuilding. Read it carefully before you begin your upgrade.

Getting Help

If you have any problems installing or using this release, call Sun Microsystems at 1-800-USA-4SUN (1-800-872-4786). Have your system’s model number, release number for software, and Sun operating system—SunOS—release number ready to give to the dispatcher.

You can also send questions by electronic mail to sun!hotline. Be sure to include your name, company, phone number, release number, and SunOS release number in your mail message.

If you have questions about Sun’s support services or your shipment, call your sales representative.

To see the SunOS release number, key in `cat /etc/motd`.

Installing the 4.0.1 Fixes

SunOS Release 4.0.1 is a collection of individual patches rather than a monolithic release or upgrade. Related fixes are identified by a keyword and are individually installable using the program `install_fix` supplied on the 4.0.1 tape. The keywords, the files which are affected when a keyword is selected for installation, and a list of the bugs addressed by each keyword are all documented in the README file. Extract and study the README to decide which of the patches you’ll want to install on your system.

If you elect to install all of the patches you may do so by executing `install_fix` without arguments and responding ‘y’ to each fix in turn.

Read and understand the Post-Installation Procedures section of the document before installing the 4.0.1 fixes. In particular, on Sun-3 systems be sure to run `installboot` before rebooting the system.

Extracting the README Document

The release tape contains a README file with descriptions and installation instructions for each fix; it is important that you read this file before updating your system with the 4.0.1 fixes.
Mount the release tape in your tape drive and `tar (1)` off the README file for printing or viewing with this command sequence:

```
% cd /tmp
% mt -f /dev/nxdevice rew
% mt -f /dev/nxdevice 2f
% tar xvpf /dev/nxdevice README
```

device is one of the types given in Table 1 below.

<table>
<thead>
<tr>
<th>Architecture</th>
<th>Tape</th>
<th>Device</th>
<th>Blocksize</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun-4</td>
<td>1/2&quot;</td>
<td>mt8</td>
<td>20</td>
</tr>
<tr>
<td>Sun-4</td>
<td>1/4&quot;</td>
<td>st8</td>
<td>200</td>
</tr>
<tr>
<td>Sun-3</td>
<td>1/2&quot;</td>
<td>mt0</td>
<td>20</td>
</tr>
<tr>
<td>Sun-3</td>
<td>1/4&quot;</td>
<td>st8</td>
<td>200</td>
</tr>
<tr>
<td>Sun-2</td>
<td>1/2&quot;</td>
<td>mt0</td>
<td>20</td>
</tr>
<tr>
<td>Sun-2</td>
<td>1/4&quot; (Archive)</td>
<td>ar0</td>
<td>126</td>
</tr>
<tr>
<td>Sun-2</td>
<td>1/4&quot; (others)</td>
<td>st0</td>
<td>126</td>
</tr>
</tbody>
</table>

Remove the tape from the drive and print out the README file.

**Saving Current Files**

As always, you should have a current backup of your system on hand prior to performing the upgrade.

**Extracting the Installation Scripts**

Follow the procedures given in the next sections to extract the 4.0.1 installation scripts.

**Local Tape Installation**

1. Become superuser and halt the system.
   If the system is a server, halt all client workstations before halting the system.

```
# /etc/halt
```

2. Reboot and bring the system up in single-user mode; `disk` is selected from the devices in Table 2 below:

```
> b disk(0,0,0) vmunix -s
```
Table 2  **Disk Devices**

<table>
<thead>
<tr>
<th>Devices</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>xy</td>
<td>Xylogics 450/451 SMD disk controller</td>
</tr>
<tr>
<td>xd</td>
<td>Xylogics 7053 VME/SMD disk controller</td>
</tr>
<tr>
<td>sd</td>
<td>SCSI disk controller</td>
</tr>
</tbody>
</table>

The boot completes in single-user mode.

3. Mount the tape appropriate to your workstation’s architecture in the drive and type the following:

```
# cd /etc
# mt -f /dev/nxdevice rew
# mt -f /dev/nxdevice fsf 2
# tar xvpfb /dev/nxdevice blocksize
```

*device* is one of the types given in Table 1.

*blocksize* is as specified in Table 1.

This tars the following four files into /etc:

- **install_fix**, the file which installs the fixes contained in the release.
- **remove_fix**, the file which allows you to back out the fixes you have installed and replaces the 4.0 binaries for these modules.
- **read_info**, the file which parses information from the README file for the scripts. You do not have to be concerned with this file.
- **README**, the file describing all the fixes available in 4.0.1, as well as special installation instructions for many of them. You must read this file before installing the release.

4. Now execute **install_fix**:

```
# install_fix
```

**Remote Tape Installation**

For a remote installation, use this procedure:

1. Remote installation in single-user mode requires that these network files be properly set up:
   - On the machine you are updating, /etc/hosts must include the internet number and hostname of the machine with the tape drive.
   - On the machine whose tape drive you are using, .rhosts must include the hostname of the system you are updating.
2. Become superuser and halt the system. If the system is a server, make sure to halt all clients before halting the system.

```bash
# /etc/halt
```

3. Reboot to bring the system up in single user mode; `disk` is selected from Table 2:

```bash
>b disk(0,0,0)vmunix -s
```

The boot completes in single-user mode.

4. Now configure the network interface:

```bash
#/etc/ifconfig interface hostname up -trailers
```

`interface` is `ie0`, `lea`, or `ec0`, depending on your Ethernet interface type.
`hostname` is the name of the system you are updating.

More information on `ifconfig` is in Section 8 of the `SunOS Reference Manual`.

5. Mount the filesystems, and then tar the script files into `/etc`:

```bash
# mount -a
# cd /etc
# rsh tapehost mt -f /dev/nxdevice rew
# rsh tapehost mt -f /dev/nxdevice fsf 2
# rsh tapehost -n dd if=/dev/nxdevice bs=blocksizeb | tar zvpFb -
```

`tapehost` above is the name of the system with the tape drive.
`device` is selected from Table 1.
`blocksize` as found in Table 1.

6. Now execute `install_fix`:

```bash
# install_fix
```
Post-Installation Procedures

The following condenses the individual Special Installation Instructions listed in the README document. Once the install_fix script has completed, perform the following procedures.

- Before rebooting your system:

  On Sun-3 workstations only:

  If you have installed the lgkernel fix, you must install the new boot block. To do this, key in the commands on the display below.

  ```
  # cd /usr/mdec
  # installboot -v /boot bootdd /dev/xxd0a
  ```

  `dd` on the screen above is `sd`, `xy`, or `xd`, as shown in Table 2.

  If your Sun-3 is equipped with a Floating Point Accelerator (FPA) board and you have installed the fpaload fix, you will need to merge changes into your `/etc/rc.local`. The new rc.local was left in `/usr/share/tmp/sun3` by install_fix. Compare the two. The only change from the standard version of rc.local as shipped with SunOS 4.0 is the addition of this line:

  ```
  (echo 'initializing fpa board ...') >/dev/console
  ```

  The line is added immediately following line 91 of rc.local which reads:

  ```
  if [ -f /dev/fpa ]; then
  ```

  On all workstations:

  Rebuild your kernel. Be sure to keep a copy of your current, working kernel in the root directory (as `/vmunix.SV`, for example) to boot in case of problems with the new kernel. Refer to the Kernel Rebuild Procedures section of this document.

- After rebooting your system:

  Relink any statically linked programs in which you wish to incorporate library fixes. Dynamically linked programs will pick up the fixes automatically.

  Make sure that the yellow pages maps which will support the nameserver are built with the `-b` flag to `makeldbm`. Refer to manual page `named(8)`.

- Each time you use the `format(8S)` program:

  The new `format` program must be reinstalled each time it is run while booted from MUNIX or from the miniroot. The quickest way to do this is to tar a copy of the 4.0.1 `format` program to a scratch tape. Then, once MUNIX or the miniroot is up and running, tar back the new `format` program over the old one in `/usr/etc/format`. 
Bugs Fixed in SunOS Release 4.0.1

A list of the bugs fixed by this release appears in the README file. The bug descriptions are arranged in alphabetical order by keyword. They are further listed in ascending bug reference numerical order within each keyword heading.

Each bug is described by the five kinds of information shown below. Note that when 'Special Installation Instructions' are given for the bug, these MUST be completed correctly to install the fix.

Reference Number: nnnnnnn
Synopsis:
Description:
Files Changed:
Special Installation Instructions:
Instructions, or 'None required.'

Fix Dependencies and 'Be-Awaress'

- Page 4 of the SunOS Release 4.0 READ THIS FIRST (800-1737-15 or 800-1737-16) mentions a modification needed if your workstation is a Sun-3/2xx or a Sun-4/2xx configured with an SMD disk plus two or more SCSI devices. The 'scsi' fix in SunOS 4.0.1 supersedes this modification (the SCSI/ALM-2 Patch Tape part #700-1873-10). Additionally, the 'serial' fix in SunOS 4.0.1 supersedes the ALM-2 fix on the SCSI/ALM-2 Patch Tape. If you do not have this Patch Tape you do not need it. If you have previously installed this Patch Tape, simply install the 4.0.1 'scsi' and 'serial' fixes over it to get the preferred 4.0.1 fixes.

- If you install the 'sysdiag' fix, you must also install the 'serial' patch.

- If you install the 'dbx' fix without installing the 'winlibs' fix, when dbxtool(1) executes you will receive the warning message:

  ld.so: warning: /usr/lib/libsuntool.so.0.28 has older revision than expected 30

  This message is expected in this case and not a cause for concern. Installing the 'winlibs' fix will prevent the error message from occurring.

- When compiling programs which use the suntools libraries, you may receive this warning message:

  ld: /lib/libsuntool.sa.0.30: warning: table of contents for archive is out of date; rerun ranlib(1)

  To prevent the warning from being displayed, become superuser and execute the following:

  # ranlib -t /lib/libsuntool.sa.0.30
Kernel Rebuild Procedures

The 'Special Installation Instructions' given for many of the bug fixes require rebuilding the kernel. If you have never configured a kernel, read Installing the SunOS, Appendix A. Specific procedures for rebuilding a kernel are provided below.

Making Custom Kernels

Two methods for making a customized kernel are shown on the next two pages. The first, Procedure I, builds a kernel on a workstation with local disk. The second, Procedure II, builds a kernel on a diskless or dataless client.

The kernel used by a diskless client can be built on its server only if the diskless client is of the same architecture as the server. If a diskless client is of a different architecture from its server (heterogeneous), its kernel must be made on the client.

Procedure I is simpler to perform. It requires write privileges on the workstation /usr filesystem. Use it to build a kernel for:

- A standalone workstation
- A server
- A diskless client workstation of an architecture the same as its server
- A dataless client workstation of an architecture the same as its server

Procedure II requires a little more work, but allows building a kernel without having write privileges on the /usr filesystem. Procedure II requires only root privileges on the client workstation; no special privileges are needed on the server. Use the second procedure to build a kernel for:

- A diskless client workstation of an architecture different from its server
- A dataless client workstation of an architecture different from its server
- A diskless or dataless client workstation when you do not have root privileges on the server

All procedures are performed when logged in as root (or su'd to superuser if root logins are not allowed).

SYS_NAME, shown on the example screens following, is the name given to the custom kernel configuration file. It is typically chosen to match the hostname of the workstation that will run the kernel. This name is automatically compiled into the kernel and is announced when the kernel is booted. For example, a kernel made from a configuration file named ASLAN announces itself when booted as:

```
SunOS Release 4.0 (ASLAN) #1: Wed Sep 14 15:33:16 PDT 1988
```

A kernel that will be used by several client workstations of a server might be called ASLAN_CLIENT.

sun# on the example screens requires you to fill in sun2, sun3 or sun4, whichever is appropriate to the workstation on which you are building the kernel.
- **Procedure I:**

Log in as *root* and execute the following:

```
# cd /usr/sys/sun#/conf
# cp GENERIC SYS_NAME
# chmod +w SYS_NAME
# vi SYS_NAME
   (Edit out unneeded kernel modules.)
# config SYS_NAME
# cd ./SYS_NAME
# make
```

When the make completes successfully, install the kernel.

To install the kernel on the standalone or server workstation it was built on:

```
# mv /vmunix /vmunix.SV
# cp vmunix /vmunix
```

To install the kernel on a diskless client workstation of the same architecture:

```
# mv /export/root/SYS_NAME/vmunix /export/root/SYS_NAME/vmunix.SV
# cp vmunix /export/root/SYS_NAME/vmunix
```

To install the kernel on a dataless workstation of the same architecture, log onto the dataless workstation as *root* and:

```
# mv /vmunix /vmunix.SV
# cp /usr/sys/sun#/SYS_NAME/vmunix /vmunix
```

Now halt and reboot the workstation whose kernel you have just installed.
Procedure II:

The example for Procedure II makes the kernel in /sys on the client. The client's /sys will be located in the server's /export/root filesystem and there must be about two megabytes of disk space available in order to make a kernel. If space is not available in that filesystem, the procedure may be done in any filesystem which is writable by the client that has sufficient free space.

Log in as root and execute the following:

```
# mkdir /sys
# cd /sys
# ln -s /usr/sys/* ..
# rm sun#
# mkdir sun#
# cd sun#
# ln -s /usr/sys/sun#/* ..
# rm conf
# mkdir conf
# cd conf
# ln -s /usr/sys/sun#/conf/* ..
```

Now configure and make a kernel:

```
# cp GENERIC SYS_NAME
# chmod +w SYS_NAME
# vi SYS_NAME
  (Edit out unneeded kernel modules.)
# config SYS_NAME
# cd ..(SYS_NAME)
# make
```

When the make completes successfully, install the kernel:

```
# mv /vmunix /vmunix.SV
# cp vmunix /vmunix
```

Halt and reboot the workstation.

After the client has booted successfully, clean up /sys. (You may wish to save a copy of your customized configuration file first):

```
# rm -rf /sys
```