NAME

INSTALL – Installation procedure for NetBSD/sparc.

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DESCRIPTION

About this Document

This document describes the installation procedure for NetBSD 1.6L on the *sparc* platform. It is available in four different formats titled `INSTALL.`*`ext`*, where *`.ext`* is one of `.ps`, `.html`, `.more`, or `.txt`:

`.ps` PostScript.

`.html` Standard Internet HTML.

`.more` The enhanced text format used on UNIX-like systems by the `more`(1) and `less`(1) pager utility programs. This is the format in which the on-line *man* pages are generally presented.

`.txt` Plain old ASCII.

You are reading the *PostScript* version.

Quick install notes for the impatient

This section contains some brief notes describing what you need to install NetBSD 1.6L on a machine of the sparc architecture.

- Fetch the CD image, `sparccd.iso` or the floppy disk images, `install/floppy/disk1.gz` and `install/floppy/disk2`. You need either the pair of floppies or the CD to boot your system. Alternatively, you may netboot the installation kernel, which requires several local netboot services. The details are not covered here, as setting up a netboot server is hardly ''quick''.
- The actual binary distribution is in the `binary/sets/` directory. When you boot the install floppies or CD-ROM, the installation program can fetch these files for you (using e.g. ftp), if you have a network connection. There are several other methods to get the binary sets onto your machine.

  You will at a minimum need the following sets: `kern-GENERIC.tgz`, `base.tgz` and `etc.tgz`. In a typical workstation installation you will probably want all the installation sets.

- Make sure your sparc's CD-ROM drive is bootable. Burn the CD. Otherwise, write the floppy images directly to a pair of floppies (after uncompressing disk1.gz).

  The disk(s) you just prepared will be used to boot the installation kernel, which contains all the tools required to install NetBSD.

- You will need to get to the OpenBoot PROM ''**`ok`**'' prompt. After your system first powers on, and displays some initial information, press the `STOP-A` keys. At the ''**`ok`**'' prompt, type the command to boot your system into NetBSD. The command to boot from CD is one of the following commands (depending on your model): ''**`b sd(,30,)`**'', ''**`boot sd(,30,)`**'', or ''**`boot cdrom`**''.

  The command to boot from floppy is either ''**`boot fd(,,1)`**'' or ''**`boot floppy`**''. The installer will prompt you to insert the second floppy when it is ready for it.

- For third-party programs which are not part of the base NetBSD distribution, you will want to explore the **`pkgsrc`** system with its more than 3000 program packages.

What is NetBSD?

The NetBSD Operating System is a fully functional Open Source UNIX-like operating system derived from the University of California, Berkeley Networking Release 2 (Net/2), 4.4BSD-Lite, and 4.4BSD-Lite2 sources. NetBSD runs on fifty three different system architectures (ports), featuring seventeen machine architectures across eleven distinct CPU families, and is being ported to more. The NetBSD 1.6L release contains complete binary releases for thirty eight different system architectures. (The fifteen remaining are not fully supported at this time and are thus not part of the binary distribution. For information on them, please see the NetBSD web site at **http://www.netbsd.org/**.)

NetBSD is a completely integrated system. In addition to its highly portable, high performance kernel, NetBSD features a complete set of user utilities, compilers for several languages, the X Window System, firewall software and numerous other tools, all accompanied by full source code.

NetBSD is a creation of the members of the Internet community. Without the unique cooperation and coordination the net makes possible, it's likely that NetBSD wouldn't exist.

Upgrade path to NetBSD 1.6

If you are not installing your system ''from scratch'' but instead are going to upgrade an existing system already running NetBSD you need to know which versions you can upgrade with NetBSD 1.6.

NetBSD 1.6 is an upgrade of NetBSD 1.5.3 and earlier major and patch releases of NetBSD.

The intermediate development versions of code available on the main trunk in our CVS repository (also known as ''NetBSD-current'') from *after* the point where the release cycle for 1.6 was started are designated by version identifiers such as 1.6A, 1.6B, etc. These identifiers do not designate releases, but indicate major changes in internal kernel APIs. Note that the kernel from NetBSD 1.6 can *not* be used to upgrade a system running one of those intermediate development versions. Trying to use the NetBSD 1.6 kernel on such a system *will* probably result in problems.

Please also note that it is not possible to do a direct ''version'' comparison between any of the intermediate development versions mentioned above and 1.6 to determine if a given feature is present or absent in 1.6. The development of 1.6 and the subsequent ''point'' releases is done on a separate branch in the CVS repository. The branch was created when the release cycle for 1.6 was started, and during the release cycle of 1.6 and its patch releases selected fixes and enhancements have been imported from the main development trunk.

Changes Between The NetBSD 1.5 and 1.6 Releases

The NetBSD 1.6 release provides numerous significant functional enhancements, including support for many new devices, integration of hundreds of bug fixes, new and updated kernel subsystems, and many user-land enhancements. The result of these improvements is a stable operating system fit for production use that rivals most commercially available systems.

It is impossible to completely summarize over eighteen months of development that went into the NetBSD 1.6L release. Some highlights include:

Kernel

- Ports to new platforms including: algor, dreamcast, evbarm, evbppc, hpcarm, hpcsh, newsmips, sandpoint, sgimips, and sun2.
- Unified Buffer Cache (UBC) removes size restriction of the file system's buffer cache to use all available RAM (if not otherwise used!) and improves overall system performance.
- Round-robin page colouring implemented for various ports for better cache utilisation, more deterministic run-time behaviour, and faster program execution.

- A rewritten SCSI middle layer to provide a cleaner interface between the different kernel layers, including a kernel thread to handle error recovery outside of the interrupt context. See scsipi(9).
- A new pipe implementation with significantly higher performance due to lower overheads, which uses the UVM Page Loan facility.
- New boot loader flags **-v** (*bootverbose*) and **-q** (*bootquiet*), to be used by kernel code to optionally print information during boot.
- An in-kernel boot time device configuration manager userconf(4), activated with the **-c** boot loader flag.
- A work-in-progress snapshot of ACPI support, based on the 20010831 snapshot of the Intel ACPICA reference implementation.
- USB 2.0 support, in the form of a preliminary driver for the ehci(4) host controller.
- Basic kernel support for IrDA in the form of the irframe(4) IrDA frame level driver. Serial dongles and the oboe(4) driver are currently supported.
- Kernel configuration files can be embedded into the kernel for later retrieval. Refer to INCLUDE_CONFIG_FILE in options(4) for more information.
- Many more kernel tunable variables added to sysctl(8).
- Linux binary emulation has been greatly improved, and now supports Linux kernel version 2.4.18.

Networking

- Hardware assisted IPv4 TCP and UDP checksumming and caching of the IPv6 TCP pseudo header. Support for checksum offloading on the DP83820 Gigabit Ethernet, 3Com 3c90xB, 3Com 3c90xC, and Alteon Tigon/Tigon2 Gigabit Ethernet cards.
- Zero-Copy for TCP and UDP transmit path achieved through page loaning code for **sosend**().
- In-kernel ISDN support, from the ISDN4BSD project.
- 802.1Q VLAN (virtual LAN) support. See vlan(4).
- IPFilter now supports IPv6 filtering.
- ndbootd(8) added; used to netboot NetBSD/sun2 machines.
- racoon(8) added; IKE key management daemon for IPsec key negotiation, from the KAME project.
- WEP encryption supported in ifconfig(8) and awi(4) driver.
- wi(4) and wiconfig(8) now support scanning for access points, and defaults to BSS instead of ad-hoc mode.
- Bridging support; currently only for ethernet. See bridge(4).
- In-kernel PPP over Ethernet (PPPoE) - RFC 2516, with much lower overhead than user-land PPPoE clients. See pppoe(4).
- ifwatchd(8) added; invokes up-script and down-script when a network interface goes up and down. Used by pppoe(4).

File system

- Enhanced stability of LFS version 2, the BSD log-structured file system.
- dump(8), dumpfs(8), fsck_ffs(8), fsirand(8), newfs(8), and tunefs(8) support a **-F** option to manipulate file system images in regular files.
- makefs(8) added; creates file system images from a directory tree. (Currently ffs only.)
- Enhanced **ffs_dirpref**( ) by Grigoriy Orlov, which noticeably improves performance on FFS file systems when creating directories, and subsequently manipulating them.
- Fixes for free block tracking and directory block allocation in FFS softdeps.
- Correctly support FFS file systems with a large number of cylinder groups.
- Fix the endian independant FFS (FFS_EI) support.
- newfs(8) calculates default block size from the file system size, and uses the largest possible cylinders/group (cpg) value if **-c** isn't given.
- dpti(4) driver added; an implementation of the DPT/Adaptec SCSI/I2O RAID management interface. Allows the use of the Linux versions of **dptmgr**, **raidutil**, **dptelog**, (etc).
- Support for Windows 2000 'NTFS' (NTFS5).
- Tagged queueing support for SCSI drivers based on the ncr53c9x controller.

Security

- Addition of a chroot(8) hierarchy for services including named(8), ntpd(8), and sshd(8).
- Additional passwd(5) ciphers: MD5, and DES with more encryption rounds. See passwd.conf(5).
- Several more code audits were performed.
- /etc/security performs many more checks and is far more flexible in how it monitors changes. See security.conf(5).

System administration and user tools

- sushi(8) added; a menu based system administration tool.
- pgrep(1) and pkill(1) added; find or signal processes by name or other attributes.
- System upgrades are made easier through the etcupdate(8) script which helps updating the /etc config files interactively, and the /etc/postinstall script which is provided to check for or fix configuration changes that have occurred in NetBSD.
- stat(1) added; a user interface to the information returned by the stat(2) system call.
- BSD sort(1) replaces GNU sort(1).
- The "stop" operation for rc.d(8) scripts waits until the service terminates before returning. This improves the reliability of "restart" operations as well.
- Swap devices can be removed at system shutdown by enabling swapoff in rc.conf(5).
- An optional watchdog timer which will terminate rc.shutdown(8) after the number of seconds provided in rcshutdown_timeout from rc.conf(5).

Miscellaneous

- Support for multibyte LC_CTYPE locales has been integrated from the Citrus project. Many Chinese, Japanese, Korean, and other encodings are now available.
- Full support for cross-compilation of the base system, even as a non-root user! `src/build.sh` is available for doing arbitrary cross-builds; see `src/BUILDING` for more information. At least 38 ports for the NetBSD 1.6L release were cross-built on a NetBSD/i386 system using this mechanism.
- Migrated the following CPU platforms to ELF: arm, and m68k (including amiga, hp300, mac68k, mvme68k, sun2, and x68k).
- Updates of most third party packages that are shipped in the base system to the following latest stable releases:
  - amd 6.0.6
  - BIND 8.3.3
  - binutils 2.11.2
  - bzip2 1.0.2
  - cvs 1.11
  - dhcp 3.0.1rc9
  - file 3.38
  - gcc 2.95.3
  - groff 1.16.1
  - Heimdal 0.4e
  - IPfilter 3.4.27
  - kerberos4 1.1
  - ksh from pdksh 5.2.14p2
  - less 374
  - nvi 1.79
  - OpenSSH 3.4
  - OpenSSL 0.9.6g
  - Postfix 1.1.11
  - ppp 2.4.0
  - routed 2.24
  - sendmail 8.11.6
  - tcpdump 3.7.1
- Many new packages in the *pkgsrc* system, including the latest open source desktop KDE3, OpenOffice, perl, Apache and many more. At the time of writing, there are over 3000 third party packages available in pkgsrc.
- Added AGP GART driver `agp`(4) for faster access to graphics boards.
- `init`(8) will create an mfs (memory based file system) `/dev` if `/dev/console` is missing.
- `vmstat`(8) displays kernel hash statistics with **`-H`** and **`-h`** *`hash`*.
- `wscons`(4) supports blanking of VGA consoles.

Kernel interfaces have continued to be refined, and more subsystems and device drivers are shared among the different ports. You can look for this trend to continue.

sparc specific

NetBSD 1.6L is the seventh major release for the sparc.

Some (but not all!) notable sparc-specific improvements include:

- Enable support for DHCP net booting in the standard kernels, and try bootp/DHCP before bootparams during net booting.
- Support for Sun 4/400 machines.
- Provide 32-bit sun4u (UltraSPARC) kernels.
- Support inter-processor interrupts and DDB on SMP systems.

NetBSD 1.6L on sparc is, as usual, also fully backward compatible with old NetBSD/sparc binaries, so you don't need to recompile all your local programs provided you set the appropriate binary compatibility options in your kernel configuration.

The Future of NetBSD

The NetBSD Foundation has been incorporated as a non-profit organization. Its purpose is to encourage, foster and promote the free exchange of computer software, namely the NetBSD Operating System. The foundation will allow for many things to be handled more smoothly than could be done with our previous informal organization. In particular, it provides the framework to deal with other parties that wish to become involved in the NetBSD Project.

The NetBSD Foundation will help improve the quality of NetBSD by:

- providing better organization to keep track of development efforts, including co-ordination with groups working in related fields.
- providing a framework to receive donations of goods and services and to own the resources necessary to run the NetBSD Project.
- providing a better position from which to undertake promotional activities.
- periodically organizing workshops for developers and other interested people to discuss ongoing work.

We intend to begin narrowing the time delay between releases. Our ambition is to provide a full release every six to eight months.

We hope to support even *more* hardware in the future, and we have a rather large number of other ideas about what can be done to improve NetBSD.

We intend to continue our current practice of making the NetBSD-current development source available on a daily basis.

We intend to integrate free, positive changes from whatever sources submit them, providing that they are well thought-out and increase the usability of the system.

Above all, we hope to create a stable and accessible system, and to be responsive to the needs and desires of NetBSD users, because it is for and because of them that NetBSD exists.

Sources of NetBSD

Refer to **http://www.netbsd.org/Sites/net.html**.

NetBSD 1.6L Release Contents

The root directory of the NetBSD 1.6L release is organized as follows:

`.../NetBSD-1.6L/`

`CHANGES`	Changes since earlier NetBSD releases.
`LAST_MINUTE`	Last minute changes.
`MIRRORS`	A list of sites that mirror the NetBSD 1.6L distribution.
`README.files`	README describing the distribution's contents.
`TODO`	NetBSD 's todo list (also somewhat incomplete and out of date).
`patches/`	Post-release source code patches.
`source/`	Source distribution sets; see below.

In addition to the files and directories listed above, there is one directory per architecture, for each of the architectures for which NetBSD 1.6L has a binary distribution. There are also `README.export-control` files sprinkled liberally throughout the distribution tree, which point out that there are some portions of the distribution that may be subject to export regulations of the United States, e.g. code under `src/crypto` and `src/sys/crypto`. It is your responsibility to determine whether or not it is legal for you to export these portions and to act accordingly.

The source distribution sets can be found in subdirectories of the `source` subdirectory of the distribution tree. They contain the complete sources to the system. The source distribution sets are as follows:

gnusrc This set contains the ''gnu'' sources, including the source for the compiler, assembler, groff, and the other GNU utilities in the binary distribution sets.
55 MB gzipped, 247 MB uncompressed

pkgsrc This set contains the ''pkgsrc'' sources, which contain the infrastructure to build third-party packages.
12 MB gzipped, 94 MB uncompressed

sharesrc This set contains the ''share'' sources, which include the sources for the man pages not associated with any particular program; the sources for the typesettable document set; the dictionaries; and more.
4 MB gzipped, 16 MB uncompressed

src This set contains all of the base NetBSD 1.6L sources which are not in **gnusrc**, **sharesrc**, or **syssrc**.
27 MB gzipped, 136 MB uncompressed

syssrc This set contains the sources to the NetBSD 1.6L kernel for all architectures; `config`(8); and `dbsym`(8).
22 MB gzipped, 114 MB uncompressed

xsrc This set contains the sources to the X Window System.
78 MB gzipped, 394 MB uncompressed

All the above source sets are located in the `source/sets` subdirectory of the distribution tree.

The source sets are distributed as compressed tar files. Except for the **pkgsrc** set, which is traditionally unpacked into `/usr/pkgsrc`, all sets may be unpacked into `/usr/src` with the command:

```
# ( cd / ; tar -zxpf - ) < set_name.tgz
```

The `sets/Split/` subdirectory contains split versions of the source sets for those users who need to load the source sets from floppy or otherwise need a split distribution. The split sets are named `set_name.`*xx* where `set_name` is the distribution set name, and *xx* is the sequence number of the file, starting with "aa" for the first file in the distribution set, then "ab" for the next, and so on. All of these files except the last one of each set should be exactly 240,640 bytes long. (The last file is just long enough to contain the remainder of the data for that distribution set.)

The split distributions may be reassembled and extracted with **cat** as follows:

```
# cat set_name.?? | ( cd / ; tar -zxpf - )
```

In each of the source distribution set directories, there are files which contain the checksums of the files in the directory:

`BSDSUM` Historic BSD checksums for the various files in that directory, in the format produced by the command:
cksum -o 1 *file*.

`CKSUM` POSIX checksums for the various files in that directory, in the format produced by the command:
cksum *file*.

`MD5` MD5 digests for the various files in that directory, in the format produced by the command:
cksum -m *file*.

`SYSVSUM` Historic AT&T System V UNIX checksums for the various files in that directory, in the format produced by the command:
cksum -o 2 *file*.

The MD5 digest is the safest checksum, followed by the POSIX checksum. The other two checksums are provided only to ensure that the widest possible range of system can check the integrity of the release files.

NetBSD/sparc subdirectory structure

The sparc-specific portion of the NetBSD 1.6L release is found in the `sparc` subdirectory of the distribution:

`.../NetBSD-1.6L/sparc/`

`INSTALL.html`
`INSTALL.ps`
`INSTALL.txt`
`INSTALL.more` Installation notes in various file formats, including this file. The `.more` file contains underlined text using the `more`(1) conventions for indicating italic and bold display.

`binary/`
`kernel/`
`netbsd-GENERIC.gz`
A gzipped NetBSD kernel containing code for everything supported in this release.
`sets/` sparc binary distribution sets; see below.

`installation/`
`miniroot/`
sparc miniroot file system image; see below.

`misc/` Statically-linked versions of **`gzip`** (GNU gzip) and **`gtar`** (GNU tar).

`netboot/`
Server boot-file image for diskless machines.

Binary distribution sets

The NetBSD sparc binary distribution sets contain the binaries which comprise the NetBSD 1.6L release for the sparc. There are eight binary distribution sets. The binary distribution sets can be found in the `sparc/binary/sets` subdirectory of the NetBSD 1.6L distribution tree, and are as follows:

base The NetBSD 1.6L sparc **base** binary distribution. You *must* install this distribution set. It contains the base NetBSD utilities that are necessary for the system to run and be minimally functional. It includes shared library support, and excludes everything described below.
20 MB gzipped, 50 MB uncompressed

comp Things needed for compiling programs. This set includes the system include files (`/usr/include`) and the various system libraries (except the shared libraries, which are included as part of the **base** set). This set also includes the manual pages for all of the utilities it contains, as well as the system call and library manual pages.
16 MB gzipped, 60 MB uncompressed

etc This distribution set contains the system configuration files that reside in `/etc` and in several other places. This set *must* be installed if you are installing the system from scratch, but should *not* be used if you are upgrading.
1 MB gzipped, 1 MB uncompressed

games This set includes the games and their manual pages.
3 MB gzipped, 7 MB uncompressed

kern-GENERIC
This set contains a NetBSD/sparc 1.6L `GENERIC` kernel, named `/netbsd`. You *must* install this distribution set.
2 MB gzipped, 4 MB uncompressed

man This set includes all of the manual pages for the binaries and other software contained in the **base** set. Note that it does not include any of the manual pages that are included in the other sets.
7 MB gzipped, 27 MB uncompressed

misc This set includes the (rather large) system dictionaries, the typesettable document set, and other files from `/usr/share`.
3 MB gzipped, 8 MB uncompressed

text This set includes NetBSD's text processing tools, including `groff`(1), all related programs, and their manual pages.
2 MB gzipped, 6 MB uncompressed

NetBSD maintains its own set of sources for the X Window System in order to assure tight integration and compatibility. These sources are based on XFree86, and tightly track XFree86 releases. They are currently equivalent to XFree86 3.3.6. Binary sets for the X Window System are distributed with NetBSD. The sets are:

xbase The basic files needed for a complete X client environment. This does not include the X servers.
3 MB gzipped, 8 MB uncompressed

xcomp The extra libraries and include files needed to compile X source code.
2 MB gzipped, 8 MB uncompressed

xcontrib Programs that were contributed to X.
1 MB gzipped, 1 MB uncompressed

xfont Fonts needed by X.
6 MB gzipped, 7 MB uncompressed

xmisc Miscellaneous X programs.
1 MB gzipped, 1 MB uncompressed

xserver The Xsun, Xsun24, XsunMono and Xprt servers with man pages.
4 MB gzipped, 9 MB uncompressed

The sparc binary distribution sets are distributed as gzipped tar files named with the extension **.tgz**, e.g. `base.tgz`.

The instructions given for extracting the source sets work equally well for the binary sets, but it is worth noting that if you use that method, the filenames stored in the sets are relative and therefore the files are extracted *below the current directory*. Therefore, if you want to extract the binaries into your system, i.e. replace the system binaries with them, you have to run the **`tar -xpf`** command from the root directory (`/`) of your system. This utility is used only in a Traditional method installation.

Note: The distribution cannot be extracted using the SunOS **`tar`** program so statically-linked SunOS versions of **`gzip`** (GNU gzip) and **`gtar`** (GNU tar) are provided in `sparc/installation/misc`.

Note: Each directory in the sparc binary distribution also has its own checksum files, just as the source distribution does.

NetBSD/sparc System Requirements and Supported Devices

Supported machines

- sun4
  - 4/100
  - 4/200
  - 4/300
  - 4/400
- sun4c
  - SPARCstation/server 1
  - SPARCstation/server 1+
  - SPARCstation/server 2
  - IPC
  - ELC
  - IPX
  - SLC
- sun4c clones
  - Aries Parrot II
  - Opus/5000
  - Opus/5250
  - FORCE Sparc CPU1e/4
  - FORCE Sparc CPU2e/4

  (and possibly more)

Note: NetBSD doesn't support the VME interface on the FORCE models

- sun4m
  - 4/600
  - SPARC Classic
  - SPARC LX
  - SPARCstation 4
  - SPARCstation/server 5
  - SPARCstation/server 10
  - SPARCstation/server 20
  - SPARCstation Voyager

  Note: All known SuperSPARC, HyperSPARC, microSPARC, and TurboSPARC CPUs are supported

- sun4m clones
  - Axil 245
  - Axil 311
  - Axil 320
  - Cycle C C Cycle 5-IP
  - DTKstation/Classic+
  - RDI PowerLite-85
  - RDI PowerLite-110
  - RDI BriteLite
  - Ross sparc 20
  - Transtec SS5/170
  - Tatung microCOMPstation 5
  - Twinhead TWINstation 5G
  - TWS SuperCOMPstation-20S
  - Tadpole SPARCbook 3 series

  (and possibly more)

Machines not supported by NetBSD/sparc

- sun4d
  - SPARCcenter 1000
  - SPARCcenter 2000
- sun4u and other UltraSPARC based machines in 64-bit mode. They are supported in 32-bit mode with the NetBSD/sparc `GENERIC_SUN4U` kernel.

  UltraSPARC based machines in 32-bit or 64-bit mode are supported by the NetBSD/sparc64 port. Refer to
  http://www.netbsd.org/Ports/sparc64/index.html
- JavaStation models. Refer to the NetBSD/sparc JavaStation Support page
  http://www.netbsd.org/Ports/sparc/javastation.html
- Solbourne machines

The minimal configuration requires 4 MB of RAM and ˜60 MB of disk space. To install the entire system requires much more disk space, and to run X or compile the system, more RAM is recommended, as NetBSD with 4 MB of RAM feels like Solaris with 4 MB of RAM - slow. Note that until you have around 16 MB of RAM, getting more RAM is more important than getting a faster CPU.

Supported devices

- sun4c and sun4m video; Sbus card, on-board, or optional
  - *bwtwo*; 1 bpp framebuffer. On-board and Sbus card (MG1 and MG2)
  - *cgthree*; 8 bpp framebuffer. On-board and Sbus card
  - *cgsix*; 8 bpp accelerated framebuffer. On-board and Sbus card (GX, GX+, TGX, and TGX+)
  - *cgfourteen*; SX 24 bpp accelerated framebuffer. On-board SPARCstation 10SX and SPARCstation 20, requires optional 4 or 8 MB VSIMM, limited to *cgthree* emulation
  - *tcx*; S24 accelerated color framebuffer. On-board SPARCstation 4 (8 bpp), JavaStation-1 (24 bpp), and optional on SPARCstation 5 (24 bpp), limited to *cgthree* emulation
  - *pnozz*; Weitek p9100 24 bpp accelerated framebuffer. On-board Tadpole SPARCbook 3GS and 3GX, limited to *cgthree* emulation
- sun4 video; VME card, on-board, or P4 (supported only on 4/100 and 4/300 series machines)
  - *bwtwo*; 1 bpp framebuffer. On-board and P4
  - *cgtwo*; 8 bpp framebuffer. VME card
  - *cgfour*; 8 bpp framebuffer with overlay. P4
  - *cgsix*; LEGO 8 bpp accelerated framebuffer. P4
  - *cgeight*; 24 bpp framebuffer with overlay. P4 (not well tested)
- Network interfaces
  - *be*; 100 Mbps half-duplex ''Big Mac'' ethernet. Sbus card
  - *en*; Efficient Networks, Inc. ATM interface. Sbus card
  - *hme*; 100 Mbps full-duplex ''Happy Meal'' ethernet. Sbus card
  - *ie*; 10 Mbps Intel 82586 ethernet. On-board (4/100 and 4/200, may not be working properly on 4/400) and VME card
  - *le*; 10 Mbps AMD 9790 Lance ethernet. On-board (4/300, sun4c, and sun4m) and Sbus card
  - *qec*; One 100 Mbps be interface and four 10 Mbps Mace ethernet interfaces. Sbus card
  - *qfe*; quad 100 Mbps full-duplex ''Happy Meal'' ethernet (four ethernet interfaces). Sbus card (not well tested)
  - misc: various ethernet interfaces are found on multi-function Sbus cards (e.g. along with SCSI), the ethernet interfaces work even if the other functions do not
- SCSI interfaces
  - *esp*; 5 MB/s and 10 MB/s (Fast) NCR 53C9x SCSI controller, and 20 MB/s (Fast+Wide) FAS336 controller (known as 'fas' on Solaris). On-board (sun4c, sun4m, 4/300, Ultra 1e, and Ultra 2) and Sbus cards
  - *isp*; 10 MB/s (Fast) and 20 MB/s (Fast+Wide) Qlogic ISP 10x0 family. Sbus card
  - *si*; 5 MB/s NCR 5380 SCSI controller. VME card (Interrupt driven and polled DMA)
  - *sw*; 5 MB/s NCR 5380 ''SCSI Weird'' controller. Onboard 4/110 (polled DMA only)
  - misc: SCSI functionality is sometimes found on multi-function Sbus cards (e.g. along with ethernet), the SCSI *esp* and *isp* portions of those cards should work, even if the other functions do not.

    Note: Non-Sun SCSI CD-ROMs may have trouble booting any OS, NetBSD or otherwise. Your CD-ROM must support 512 byte blocks for the OpenBoot PROM to load a file. Most newer CD-ROM drives support this automatically, and many older drives allow you to set it using a jumper. See
    http://www.ebsinc.com/solaris/suncdrom.html
    for information on bootable CD-ROMs
- VME disk interfaces

- *xd*; Xylogics 7053 VME/SMD disk controller
- *xy*; Xylogics 450/451 VME disk controller

Note: VME/IPI disks are not supported

- Floppy drives
  - *fd*; floppy disk drive. On-board sun4c and sun4m
  - *sd*; SCSI floppy drive, acts as a SCSI drive to kernel. found with some SPARCBook 3 machines
- *nell*; PCMCIA/Cardbus devices using the sbus-to-PCMCIA bridge. On-board (SPARCstation Voyager) and Sbus card.
  - All 8 bit devices listed in the Machine-independent PCMCIA drivers page should work. Very few have been tested with NetBSD/sparc. There is a byte endian issue which currently prevents 16 bit devices from working.
    http://www.netbsd.org/Hardware/pcmcia.html

    Note: Note: there is a conflict between the *audioamd* device in sun4c and some sun4m models and the *nell* device. See the FAQ for more information.
    http://www.netbsd.org/Ports/sparc/faq.html#nell
- Serial interfaces
  - On-board serial ports based on Zilog 8530 and Zilog 85C30 (can be used as console if needed)
- Input devices
  - Sun keyboard and mouse
  - SPARCBook 3 keyboard and joystick
  - Third-party keyboards, mice, and trackballs
- Audio
  - *audioamd*; AMD 7930-based 8000 Hz, 8 bit, mono, mu-law. On-board sun4c and SPARC Classic
  - *audiocs*; CS4231-based 44 KHz, 16 bit, stereo, PCM. On-board SPARCStation 5, JavaStation-1, JavaStation-10, and optional on SPARCStation 4.
- Misc cards
  - *mtty / mbpp*; Magma Serial/Parallel ports. Sbus card
  - *xbox*; Sun Sbus expander device
- *bpp*; Bi-directional parallel port. On-board and Sbus card

Unsupported devices

- Use of more than one processor in sun4m machines (it boots, but only uses one processor). There is currently a work in progress to resolve this
- DBRIe-based audio and ISDN. On-board some sun4m machines (such as SS10, SS20, SPARC LX, and Tadpole SPARCbook)
- *sc*; Sun SCSI. VME card
- *cgtwelve*; I.e. GS, 24 bpp framebuffer. Sbus card
- *leo*; I.e. ZX and TZX, 24 bpp accelerated framebuffer. Sbus card

Getting the NetBSD System on to Useful Media

Installation is supported from several media types, including:

- CD-ROM
- MS-DOS floppy
- FTP
- Remote NFS partition
- Tape
- Existing NetBSD partitions, if performing an upgrade

The steps necessary to prepare the distribution sets for installation depend upon which installation medium you choose. The steps for the various media are outlined below.

CD-ROM Find out where the distribution set files are on the CD-ROM.

Proceed to the instruction on installation.

MS-DOS floppy Count the number of `set_name.`*xx* files that make up the distribution sets you want to install or upgrade. You will need one sixth that number of 1.44 MB floppies.

Format all of the floppies with MS-DOS. Do *not* make any of them bootable MS-DOS floppies, i.e. don't use `format /s` to format them. (If the floppies are bootable, then the MS-DOS system files that make them bootable will take up some space, and you won't be able to fit the distribution set parts on the disks.) If you're using floppies that are formatted for MS-DOS by their manufacturers, they probably aren't bootable, and you can use them out of the box.

Place all of the `set_name.`*xx* files on the MS-DOS disks.

Once you have the files on MS-DOS disks, you can proceed to the next step in the installation or upgrade process. If you're installing NetBSD from scratch, go to the section on preparing your hard disk, below. If you're upgrading an existing installation, go directly to the section on upgrading.

FTP The preparations for this installation/upgrade method are easy; all you need to do is make sure that there's an FTP site from which you can retrieve the NetBSD distribution when you're about to install or upgrade. You need to know the numeric IP address of that site, and, if it's not on a network directly connected to the machine on which you're installing or upgrading NetBSD, you need to know the numeric IP address of the router closest to the NetBSD machine. Finally, you need to know the numeric IP address of the NetBSD machine itself. If you don't have access to a functioning nameserver during installation, the IP address of **ftp.netbsd.org** is `204.152.184.75` (as of June, 2002).

Once you have this information, you can proceed to the next step in the installation or upgrade process. If you're installing NetBSD from scratch, go to the section on preparing your hard disk, below. If you're upgrading an existing installation, go directly to the section on upgrading.

Note: This method of installation is recommended only for those already familiar with using BSD network configuration and management commands. If you aren't, this documentation should help, but is not intended to be all-encompassing.

NFS Place the NetBSD distribution sets you wish to install into a directory on an NFS server, and make that directory mountable by the machine on which you are installing or upgrading NetBSD. This will probably require modifying the `/etc/exports` file on of

the NFS server and resetting its mount daemon (mountd). (Both of these actions will probably require superuser privileges on the server.)

You need to know the numeric IP address of the NFS server, and, if the server is not on a network directly connected to the machine on which you're installing or upgrading NetBSD, you need to know the numeric IP address of the router closest to the NetBSD machine. Finally, you need to know the numeric IP address of the NetBSD machine itself.

Once the NFS server is set up properly and you have the information mentioned above, you can proceed to the next step in the installation or upgrade process. If you're installing NetBSD from scratch, go to the section on preparing your hard disk, below. If you're upgrading an existing installation, go directly to the section on upgrading.

Note: This method of installation is recommended only for those already familiar with using BSD network configuration and management commands. If you aren't, this documentation should help, but is not intended to be all-encompassing.

Tape

To install NetBSD from a tape, you need to make a tape that contains the distribution set files, in 'tar' format.

If you're making the tape on a UNIX-like system, the easiest way to do so is probably something like:

```
# tar -cf tape_device dist_directories
```

where *tape_device* is the name of the tape device that describes the tape drive you're using; possibly `/dev/rst0`, or something similar, but it will vary from system to system. (If you can't figure it out, ask your system administrator.) In the above example, *dist_directories* are the distribution sets' directories, for the distribution sets you wish to place on the tape. For instance, to put the **misc, base,** and **etc** distributions on tape (in order to do the absolute minimum installation to a new disk), you would do the following:

```
# cd .../NetBSD-1.6L
# cd sparc/binary
# tar -cf tape_device misc etc kern
```

Note: You still need to fill in *tape_device* in the example.

Once you have the files on the tape, you can proceed to the next step in the installation or upgrade process. If you're installing NetBSD from scratch, go to the section on preparing your hard disk, below. If you're upgrading an existing installation, go directly to the section on upgrading.

Upgrade

If you are upgrading NetBSD, you also have the option of installing NetBSD by putting the new distribution sets somewhere in your existing file system, and using them from there. To do that, you must do the following:

Place the distribution sets you wish to upgrade somewhere in your current file system tree.

At a bare minimum, you must upgrade the **base** and **kern** binary distributions, and so must put the **base** and **kern** sets somewhere in your file system. If you wish, you can do the other sets, as well, but you should *not* upgrade the **etc** distribution; it contains contains system configuration files that you should review and update by hand.

Once you have done this, you can proceed to the next step in the upgrade process, actually upgrading your system.

Preparing your System for NetBSD installation

Configuring your PROM

Before you start, you should configure your PROM. There are three categories of PROM: "sunmon" (sometimes called Restricted Prompt, sun monitor, or old command mode), OpenBoot PROM 1, and OpenBoot PROM 2. The sun4 machines only have sunmon. Some of the early sun4c models default to sunmon but have OpenBoot PROM 1. The later sun4c models and all sun4m models have OpenBoot PROM 2.

First, you need to stop your system from automatically booting when powered on. Pressing the `STOP` key (sometimes called the `L1` key, found on the left side of your keyboard) and the `a` key will halt your system and give you a PROM prompt. If you are using a Tadpole SPARCbook, you press the `Pause` and `a` keys. If you are using a serial console, send a "BREAK" signal from your terminal (the method of sending "BREAK" varies from terminal to terminal).

If the ethernet address of your sparc system is `ff:ff:ff:ff:ff:ff`, then your NVRAM battery is dead and you will have trouble using ethernet (among other problems). Read the Sun NVRAM/Hostid FAQ.

http://www.squirrel.com/squirrel/sun-nvram-hostid.faq.html

If you have a valid ethernet address and you plan to netboot, write down your system's ethernet address.

Next, you should set your system to always use the OpenBoot PROM (sometimes called "new command mode") if it defaults to sunmon. The NetBSD kernel relies on some of the functionality provided by the OpenBoot PROM. If your machine gives you a '>' prompt instead of an 'ok' prompt, type:

```
> n
ok setenv sunmon-compat? false
ok
```

Next, if you are using any security features of OpenBoot PROM, you should turn them off — NetBSD can't deal well with this.

```
ok setenv security-mode none
```

The OpenBoot PROM 1 machines (SPARCstation/server 1, SPARCstation/server 1+, IPC, and SLC) have an odd SCSI quirk you should be aware of. There are three SCSI addressing schemes used by your system: SCSI target ID (set by physical jumpers on the device), PROM 'unit' number (set by OpenBoot PROM 1, based on its SCSI target ID), and the name you reference within an operating system (set by the kernel, based on the PROM 'unit' number).

Sun shipped these systems with the internal drives set to SCSI target IDs 3 and 1. The default value of the OpenBoot PROM variable 'sd-targets' is '31204567.' This variable maps how the OpenBoot PROM 1 assigns 'unit' numbers based on the SCSI target ID. Thus the device at SCSI target ID 3 is considered 'unit' 0, and the SCSI device at target ID 0 is 'unit' 3. When you type **``boot scsi(0,0,0)''**, the OpenBoot PROM will boot from 'unit' 0 (which is SCSI target ID 3, the internal hard drive). The SunOS kernel is hard-wired to map sd0 to SCSI target 3, and sd3 to SCSI target 0.

PROM Unit#	*SCSI Target*	*SunOS name*
0	3	sd0
1	1	sd1
2	2	sd2
3	0	sd3
4	4	st0
5	5	st1
6	6	cdrom

The NetBSD/sparc GENERIC kernel does not wire things down as does SunOS. It names the disks in the order that the SCSI targets are probed (01234567). If you only have one disk, it is always sd0 regardless of its SCSI target ID or its PROM 'unit' number, and there are no problems. If you have two disks, one at SCSI ID 2 ('unit' 2) and SCSI ID 3 ('unit' 0), then they are recognized as sd0 and sd1 respectively. This can be a problem if you are not aware of it, particularly when creating an fstab.

There are two approaches to fixing this problem: changing the mapping that OpenBoot PROM 1 does, and changing the NetBSD kernel configuration. To get OpenBoot PROM 1 to number the SCSI 'unit' numbers the same as the SCSI target IDs, you need to run this command:

ok **setenv sd-targets 01234567**

This may, however, cause problems if you were to later attempt to use SunOS on this machine or if you reset the OpenBoot PROM variables.

The other approach is to use a NetBSD kernel that matches the PROM's odd target mapping by treating 'unit' 0 (i.e. SCSI target ID 3) as sd0 and 'unit' 3 (i.e. SCSI target ID 0) as sd3. The GENERIC_SCSI3 kernel performs this target mapping, but the GENERIC and INSTALL kernels do not.

Note: This is also a concern when you start building your own customised kernels.

The machines with OpenBoot PROM 2 (SPARCstation/server 2, ELC, IPX, and all sun4m models) have a similar SCSI target mapping in the form of a **devalias** entry. That is, the device alias **disk** is shorthand for the disk at SCSI ID 3 on the internal SCSI controller. Normally, the **disk** device alias is what the PROM uses as the default boot device, i.e. in the absence of a *device* argument to the **boot** command. Note that there are also pre-configured device alias entries for **disk0**, **disk1**, **disk2** and **disk3**, which are in fact a one-to-one mapping to the SCSI targets **0** to **3** (all on the internal SCSI controller).

Again, it may be advantageous to use a fixed ''SCSI target'' to ''NetBSD disk unit'' mapping in your kernel configuration file (such as is done in the GENERIC_SCSI3 kernel) to ensure that your disks remain showing up at the same NetBSD device unit numbers even if you add disks to your system at a later time.

Determining how to access your SCSI disk from the PROM

sunmon and OpenBoot PROM 1 use an archaic sd(*c*,*u*,*p*) syntax to address SCSI devices. OpenBoot PROM 2 uses a more intuitive syntax using device aliases.

To calculate the parameters for sunmon and OpenBoot PROM 1:

- *c* specifies the SCSI controller number (first is 0, second is 1, ...)
- *u* the hexadecimal number obtained from evaluating the expression *(8 * TARGET) + LUN*
- *p* the partition number from which to boot ('0' = 'a', '1' = 'b', etc.)

Therefore, to boot from the swap partition on the internal hard drive (first SCSI bus, target 0, lun 0, partition 1), one would use:

ok **boot sd(0,0,1)**

To boot from a CD-ROM (first SCSI bus, target 6, lun 0, partition dynamically determined), one would use:

ok **boot sd(0,30,)**

And, to boot from a kernel named netbsd-GENERIC on the fourth partition ('d', often the /usr partition) on an external hard drive (first SCSI bus, target 2, lun 0, partition 3), one would use:

ok **boot sd(0,10,3)netbsd-GENERIC**

Now, for OpenBoot PROM 2, SCSI devices are specified by an OpenBOOT **devalias** which provides simple mnemonics for the full path to the device. Type **devalias** in OpenBoot PROM 2 to get a list of all of the available aliases. Just the alias and partition are necessary when booting.

Therefore, to boot from the swap partition on the internal hard drive (OpenBoot PROM 2 assumes the internal hard drive is at target 3), one would use:

ok **boot disk:b**

To boot from a CD-ROM (OpenBoot PROM 2 assumes the CD-ROM is at target 6), one would use:

ok **boot cdrom**

And, to boot from a kernel named netbsd-GENERIC on the fourth partition ('d', often the /usr partition) on an external hard drive (target 2, partition 3), one would use:

ok **boot disk2:d netbsd-GENERIC**

The full device path specifier for OpenBoot PROM 2 depends on how OpenBoot PROM 2 recognizes your SCSI controller. Typically, one would use something like: /sbus/esp/sd@*t*,*p* where t is the SCSI target and p is the partition number.

Determining how to boot from an SBUS card

Some SBUS cards have firmware that lets you use them as a boot device. These cards do not automatically create a **devalias** entry, so you must traverse the device tree to figure out what the OpenBoot PROM calls your card. You will be using OpenBoot PROM commands at the 'ok' prompt. First 'cd' to the top of the device tree and list the nodes there. The following is the procedure to boot from an HME card in a SPARC Classic.

```
ok cd /
ok ls
ffd3b790 TI,TMS390S10@0,f8fffffc
ffd2d254 virtual-memory@0,0
ffd2d198 memory@0,0
ffd2b65c obio
ffd2b310 iommu@0,10000000
ffd2b2a0 openprom
ffd24af0 aliases
ffd24abc options
ffd24a88 packages
```

Usually, you can simply type in the name before the at (@) sign and the OpenBoot PROM will fill in the rest.

```
ok cd iommu
ok ls
ffd2b454 sbus@0,10001000
ok cd sbus
ok ls
ffd467e8 cgthree@3,0
ffd42a1c SUNW,hme@1,8c00000
ffd4297c le@0,c00000
ffd40d28 ledma@4,8400010
ffd40c9c SUNW,bpp@4,c800000
ffd40c00 audio@4,1300000
ffd3dc68 espdma@4,8400000
ok cd SUNW,hme
ok ls
ok pwd
/iommu@0,10000000/sbus@0,10001000/SUNW,hme@1,8c00000
```

OK, now we know the path to the HME device in this example. Now, we need to determine if it's capable of booting. If it is, it will have the **word** 'open'.

```
ok words
reset          seek           load           open           close
watch-net      selftest       obp-selftest   write          read
```

```
preamble-32   enable-link-pulse          disable-link-pulse
force-speeds  reset-transceiver          use-bit-bang-mode
use-frame-mode              dump-phys    transfer-speed=10
transfer-speed=100          mii-write    mii-read
create-rev-id
```

Great! Also, in case you're interested in further details about your hardware, you can use the '.attributes' command.

```
ok .attributes
hm-rev                  00000022
version                 1.18
model                   SUNW,501-2919
device_type             network
intr                    00000037  00000000
interrupts              00000004
address-bits            00000030
max-frame-size          00004000
reg                     00000001  08c00000  00000108
                        00000001  08c02000  00002000
                        00000001  08c04000  00002000
                        00000001  08c06000  00002000
                        00000001  08c07000  00000020
name                    SUNW,hme
ok
```

So, when it's time to type in a boot command, use the shortened version of the **pwd** command. In this example, you'd type:

```
ok boot /iommu/sbus/SUNW,hme
```

And when the kernel is done booting, it may not automatically use your card as the root device -- you may need to type in the NetBSD/sparc name for that device:

```
root on sd0a dumps on sd0b
no file system for sd0 (dev 0x700)
cannot mount root, error = 79
root device (default sd0a): ?
use one of: fd0[a-h] le0 le1 hme0 sd0[a-h] halt
root device (default sd0a): hme0
dump device: hme0
file system (default generic): nfs
root on hme0
```

Deciding on partition sizes

If you're installing NetBSD/sparc for the first time it's a good idea to look at the partition sizes of disk you intend installing NetBSD/sparc on.

Assuming a classic partition scheme with / (root) and /usr file systems, a comfortable size for the NetBSD root file system partition is about 20 MB; a good initial size for the swap partition is twice the amount of physical memory in your machine (though, unlike SunOS 4.x, there are no restrictions on the size of the swap partition that would render part of your memory unusable). A full binary installation takes about 60 MB in /usr.

Most sparc systems have trouble booting if the root partition extends beyond the first 2 GB of your disk.

Configuration of network interfaces

Some network devices (i.e. the built-in *le* interface on sun4m machines) allow a choice between operating on a UTP or a AUI port once the NetBSD kernel is running. The *le* driver supports automatic detection of the port which is actually connected to the wire. Additionally, some of the Fast ethernet devices (such as *be*, *hme*, *qec*, and *qfe*) support selection of various speeds and options. The default is to attempt to automatically detect the speed.

If automatic detection is not available or not working properly in your environment, you may have to specify the type connection using the **media** parameter of ifconfig(8). During installation, you'll get the opportunity to specify the appropriate medium. Use 10base5 or AUI to select the AUI connector, or 10baseT or UTP to select the UTP connector. Fast ethernet interfaces default to auto, which usually does not detect properly and runs at '10BaseT' speed. The options are 10baseT, 10baseTX, and auto. The *hme* and *qfe* interfaces also allow 10baseT-FDX and 100baseT-FDX.

Installing the NetBSD System

Installing NetBSD is a relatively complex process, but if you have this document in hand it shouldn't be too much trouble.

There are several ways to install NetBSD onto your system. The easiest way is to use the miniroot.fs image copied to your local disk's swap partition or a scratch drive. If your Sparc is hooked up in a network, you may configure another UNIX-like machine as a netboot server for your Sparc. Alternatively, there is a pair of floppy images that will boot your system and run the installer.

For more information on the commands and variables available in the Open-Boot PROM (present in all sun4c and sun4m machines), go to **http://docs.sun.com** and search for ''openboot reference'' (without quotes).

Installing NetBSD by placing a bootable file system on a partitioned hard drive

installation/miniroot/miniroot.fs.gz is a compressed, self-contained NetBSD file system holding all utilities necessary to install NetBSD onto a disk attached to your system. It is distributed as a compressed plain file you will transfer to a raw disk partition. You will then boot this installer using the appropriate PROM command. The simplest case is where you place the miniroot.fs file system on the swap partition of your disk. Alternatively, you can place it on any other unused partition on any disk (such as a Zip disk). Be forewarned that you will not be able to install NetBSD onto the partition that contains the miniroot.fs as this partition is needed during the install process.

Loading the file system onto a raw partition is straightforward. First, download miniroot.fs to your system. Next, reboot in single-user mode (i.e. **boot -s**) to ensure that your system will not be swapping. Finally, place the miniroot.fs on your partition of choice. On NetBSD or SunOS the commands are:

```
# gunzip miniroot.fs.gz
# dd if=miniroot.fs of=/dev/rsd0b bs=4k conv=sync
```

Here, /dev/rsd0b is assumed to be your swap partition. If you decide to place miniroot.fs on a non-swap partition, it will overwrite all of the contents of that partition, but you will not need to reboot into single-user mode to write it.

After transferring the file system to disk, bring the system down by:

```
# halt
```

Then boot the installer by typing the appropriate command at the PROM prompt (this example is for the swap partition):

sunmon

```
> b sd(,,1)netbsd -s
```

OpenBoot PROM 1

```
ok boot sd(,,1)netbsd -s
```

OpenBoot PROM 2

```
ok boot disk:b netbsd -s
```

The monitor boot command will load the NetBSD kernel contained in the file system image. After the initial probe messages you'll be asked to start the install or upgrade procedure. Proceed to the section **Running the installation scripts.** below.

Installing NetBSD by using a bootable CD-ROM

If you wish to burn a CD-R containing a bootable NetBSD installation, then you can either burn the prepared disk image in installation/cdrom/netbsd-sparc.iso or create your own. If you wish to create your own, you should follow the directions on the NetBSD Bootable CD-ROM HOW-TO at:

http://www.netbsd.org/Documentation/bootcd.html#sparcimage

Once you have downloaded netbsd-sparc.iso or created your own disk image, then you need to burn it to a CD-R.

The CD-ROM attached to your Sparc must support 512 byte sectors to be bootable. All Sun brand CD-ROMs will work, as well as many other manufacturers. See the Sun CD-ROM FAQ: **http://saturn.tlug.org/suncdfaq/**

Sun sets their CD-ROM drives to SCSI ID 6. We recommend you do the same.

Boot the installer by typing the appropriate command at the PROM prompt:

sunmon

```
> b sd(,30,)
```

OpenBoot PROM 1

```
ok boot sd(,30,)
```

OpenBoot PROM 2

ok **boot cdrom**

After the initial probe messages you'll be asked to start the install or upgrade procedure. Proceed to the section **Running the installation scripts.** below.

Installing NetBSD by using the bootable floppies

The NetBSD install floppies only work on the sun4c and sun4m machines. Making the install floppies is fairly straightforward.

NetBSD and SunOS use the same commands. First, get two 1.44 MB floppy disks and format them either using the fdformat(8) command or a PC.

```
# fdformat
```

Be sure that the 'fdformat' command completes successfully before proceeding; on NetBSD success is a string of all 'V 's', and on SunOS success is a string of '. 's'.

Next, transfer the two floppy images (installation/floppy/disk1.gz and installation/floppy/disk2) to the disks you just formatted. You can do this step from NetBSD, SunOS, or a Windows machine using **rawrite.exe** (available in the NetBSD/i386 distribution). Insert the first floppy and run the following commands:

```
# gunzip disk1.gz
# dd if=disk1 of=/dev/rfd0a bs=36k
# eject floppy
```

Insert the second floppy and run the following commands:

```
# dd if=disk2 of=/dev/rfd0a bs=36k conv=sync
# eject floppy
```

Note that disk2 may be a symlink to .tgz file; do not uncompress it, just follow the instructions above, verbatim. After writing the two floppies, be sure to label them so you can later identify them.

Insert the floppy made from disk1 into your Sparc. From the OpenBoot prompt, boot the floppy with the following command:

OpenBoot PROM 1

ok **boot fd(,,1)**

OpenBoot PROM 1 (alternate)

ok **boot /fd**

OpenBoot PROM 2

ok **boot floppy**

After the initial probe messages you'll be asked to insert the floppy labeled ''NetBSD disk2''. If the floppy is not automatically ejected, you

can either use a straightened paperclip to eject the disk or do the following:

Press the STOP key (sometimes called the L1 key, found on the left side of your keyboard) and the a key, which will halt your system and give you a PROM prompt.

ok **eject**
ok **go**

Now, insert the floppy labeled disk2. After the installation tools have been loaded, you'll be asked to start the install or upgrade procedure. Proceed to the section **Running the installation scripts.** below.

Installing NetBSD by using a netboot setup

1. Introduction

To netboot a sparc, you must configure one or more servers to provide information and files to your sparc (the 'client).' If you are using NetBSD (any architecture) on your netboot server(s), the information provided here should be sufficient to configure everything. Additionally, you may wish to look at the diskless(8) manual page and the manual pages for each daemon you'll be configuring. If the server(s) are another operating system, you should consult the NetBSD Diskless HOW-TO, which will walk you through the steps necessary to configure the netboot services on a variety of platforms.

http://www.netbsd.org/Documentation/network/netboot/

You may either netboot the installer so you can install onto a locally attached disk, or you may run your system entirely over the network.

Briefly, the netboot process involves discovery, bootstrap, kernel and file system stages. In the first stage, the client discovers information about where to find the bootstrap program. Next, it downloads and executes the bootstrap program. The bootstrap program goes through another discovery phase to determine where the kernel is located. The bootstrap program tries to mount the NFS share containing the kernel. Once the kernel is loaded, it starts executing. For RAM disk kernels, it mounts the RAM disk file system and begins executing the installer from the RAM disk. For normal (non-RAM disk) kernels, the kernel tries to mount the NFS share that had the kernel and starts executing the installation tools or init(8). All sparc systems use a combination of RARP and BOOTP for the discovery stage. In the past, these systems used RARP and BOOTPARAMS. TFTP is used in the bootstrap phase to download the bootstrap program, boot.net, which has been linked to a file name appropriate to the client's architecture and IP address as described in the TFTP section below. NFS is used in both the kernel and file system stages to download the kernel, and to access files on the file server.

We will use 'CC:CC:CC:CC:CC:CC' as the MAC address (ethernet hardware address) of your netboot client machine. You should have determined this address in an earlier stage. In this example, we will use '192.168.1.10' as the IP address of your client and 'client.test.net'

as its name. We will assume you're providing all of your netboot services on one machine called 'server.test.net' with the client's files exported from the directory /export/client/root. You should, of course, replace all of these with the names, addresses, and paths appropriate to your environment.

You should set up each netboot stage in order (i.e. discovery, bootstrap, kernel, and then file system) so that you can test them as you proceed.

2. dhcpd(8) in bootpd(8) compatible mode

Put the following lines in your /etc/dhcpd.conf (see dhcpd.conf(5) and dhcp-options(5) for more information):

```
ddns-update-style none;
                # Do not use any dynamic DNS features
                #
allow bootp;    # Allow bootp requests, thus the dhcp server
                # will act as a bootp server.
                #
authoritative;  # This is the authoritative DHCP server for this subnet
                #
subnet 192.168.1.0 netmask 255.255.255.0 {
                # Which network interface the server will listen on.
               # The zeros indicate which range of addresses are
               # allowed to connect.
}
group {
                # Set of parameters common to all clients
                # in this "group".
                #
        option broadcast-address        192.168.1.255;
        option domain-name              "test.net";
        option domain-name-servers      dns.test.net;
        option routers                  router.test.net;
        option subnet-mask              255.255.255.0;
                #
                # An individual client.
                #
        host client.test.net {
                hardware ethernet       CC:CC:CC:CC:CC:CC;
                fixed-address           192.168.1.10;
                #
                # Name of the host (if the fixed address
                # doesn't resolve to a simple name).
                #
                option host-name        "client";
                #
                # The path on the NFS server.
                #
                option root-path        "/export/client/root";
        }
 #you may paste another "host" entry here for additional clients on this netw
```

```
}
```

You will need to make sure that the dhcpd.leases file exists.

```
# touch /var/db/dhcpd.leases
```

You will need to start the **dhcpd**. If it's already running, you will need to restart it to force it to re-read its configuration file. If the server is running NetBSD 1.5 or later, you can achieve this with:

```
# /etc/rc.d/dhcpd restart
```

3. rarpd(8)

   Create an /etc/ethers file with the following line:

   ```
   CC:CC:CC:CC:CC:CC     client
   ```

   Add your client to the server's /etc/hosts file:

   ```
   192.168.1.10 client
   ```

   You will need to start the **rarpd**. If it's already running, you will need to restart it to force it to re-read its configuration file. If the server is running NetBSD 1.5 or later, you can achieve this with:

   ```
   # /etc/rc.d/rarpd restart
   ```

4. tftpd(8)

   The default configuration of the TFTP server is to run in a chroot(8) environment in the /tftpboot directory. Thus, the first order of business is to create this directory:

   ```
   # mkdir -p /tftpboot
   ```

   Next, edit /etc/inetd.conf and uncomment the line with the TFTP daemon:

   ```
   tftp            dgram   udp     wait    root    /usr/libexec/tftpd tftpd -l
   ```

   Now, restart inetd(8). If the server is running NetBSD 1.5 or later, you can achieve this with:

   ```
   # /etc/rc.d/inetd restart
   ```

   Now, you need to copy the bootloader for your sparc machine to /tftpboot. Get boot.net from the installation/netboot directory of the distribution.

   ```
   # cp boot.net /tftpboot
   ```

Now, you need to link boot.net to the filename that your sparc will look for. It will look for a filename composed of the machine's IP address (in hexadecimal) followed by the machine's architecture, separated by a period. For example, a sun4c machine which has been assigned IP address 192.168.1.10, will make a TFTP request for C0A8010A.SUN4C.

You can use bc(1) to help calculate the filename:

```
# bc
obase=16
192
C0
168
A8
1
1
10
A
quit
# cd /tftpboot
# ln -s boot.net C0A8010A.SUN4C
```

Just to be sure, let's make everything readable.

```
# chmod -R a+rX /tftpboot
```

Sometimes, the arp(8) table gets messed up, and the TFTP server can't communicate with the client. In this case, it will write a log message (via syslogd(8)) to /var/log/messages saying: 'tftpd: write: Host is down'. If this is the case, you may need to force the server to map your client's ethernet address to its IP address:

```
# arp -s client CC:CC:CC:CC:CC:CC
```

5. nfsd(8), mountd(8), and rpcbind(8)

   Now your system should be able to load the bootstrap program and start looking for the kernel. Let's set up the NFS server. Create the directory you are exporting for the netboot client:

   ```
   # mkdir -p /export/client/root
   ```

   Put the following line in /etc/exports to enable NFS sharing:

   ```
   /export/client/root -maproot=root client.test.net
   ```

   If your server is currently running an NFS server, you only need to restart mountd(8). Otherwise, you need to start rpcbind(8) and nfsd(8). If the server is running NetBSD 1.5 or later, you can achieve this with:

```
# /etc/rc.d/rpcbind start
# /etc/rc.d/nfsd start
# /etc/rc.d/mountd restart
```

6. NetBSD kernel and installation tools

   Now, if you place a kernel named netbsd in /export/client/root your client should boot the kernel. Use binary/kernel/netbsd-GENERIC.gz).

```
# gunzip netbsd-GENERIC.gz
# mv netbsd-GENERIC /export/client/root/netbsd
```

   If you are netbooting the installer, copy the distribution files to the client's root directory and extract the tools from installation/netboot/rootfs.tgz.

```
# cp *tgz /export/client/root
# cd /export/client/root
# tar -xpzf rootfs.tgz
```

7. Client file system

   You can skip this step if you do not plan to run your client diskless after installation. Otherwise, you need to extract and set up the client's installation of NetBSD. The Diskless HOW-TO describes how to provide better security and save space on the NFS server over the procedure listed here.

   http://www.netbsd.org/Documentation/network/netboot/nfs.html

   - Extracting distribution sets

```
# cd /export/client/root
# tar -xpzf /path/to/files/base.tgz
# tar -xpzf /path/to/files/etc.tgz
```

     Continue with the other non-essential distribution sets if desired.

   - Set up swap

```
# mkdir /export/client/root/swap
# dd if=/dev/zero of=/export/client/swap bs=4k count=4k
# echo '/export/client/swap -maproot=root:wheel client.test.net'  cat >>
# /etc/rc.d/mountd restart
```

     This creates a 16 MB swap file and exports it to the client.

   - Create device nodes

```
# cd /export/client/root/dev
# ./MAKEDEV all
```

     This procedure only works on NetBSD hosts.

- Set up the client's fstab(5)

  Create a file in /export/client/root/etc/fstab with the following lines:

```
server:/export/client/swap   none  swap  sw,nfsmntpt=/swap
server:/export/client/root   /     nfs   rw 0 0
```

- Set up the client's rc.conf(5)

  Edit /export/client/root/etc/rc.conf

```
rc_configured=YES
hostname="client"
defaultroute="192.168.1.1"
nfs_client=YES
auto_ifconfig=NO
net_interfaces=""
```

  Make sure rc does not reconfigure the network device since it will lose its connection to the NFS server with your root file system.

- Set up the client's hosts(5) file.

  Edit /export/client/root/etc/hosts

```
::1                     localhost
127.0.0.1               localhost
192.168.1.10 client.test.net client
192.168.1.5  server.test.net server
```

8. Setting up the server daemons

   If you want these services to start up every time you boot your server, make sure the following lines are present in your /etc/rc.conf:

```
dhcpd=YES               dhcpd_flags="-q"
rarpd=YES               rarpd_flags="-a"
nfs_server=YES                                  # enable server daemons
mountd=YES
rpcbind=YES             rpcbind_flags="-l"      # -l logs libwrap
```

   Also, you'll need to make sure the tftpd line in /etc/inetd.conf remains uncommented.

Now, netboot your Sparc from the server by entering the appropriate **boot** command at the monitor prompt. Depending on the PROM version in your machine, this command takes one of the following forms:

sunmon

> **b le()netbsd**

OpenBoot PROM 1

ok **b le()netbsd**

OpenBoot PROM 2

ok **boot net netbsd**

After the initial probe messages you'll be asked to start the install or upgrade procedure. Proceed to the section **Running the installation scripts.** below.

Installing NetBSD by using a bootable tape

Sun sets their tape drives to SCSI ID 4. We recommend you do the same.

Get the tape images (installation/tape/tapefile1.gz and installation/tape/tapefile2) and transfer them to a tape. Make sure you use the 'no rewind scsi tape' device. Run the following commands:

```
# gunzip tapefile1.gz
# mt -f /dev/nrst0 rew
# dd if=tapefile1 of=/dev/nrst0 bs=4k
# dd if=tapefile2 of=/dev/nrst0 bs=4k
```

Now you can transfer the NetBSD 1.6L. distribution sets from (binary/sets) to the tape by using a series of additional

```
# dd if=<aset>.tgz of=/dev/nrst0 bs=4k
```

commands. See also the section **Getting the NetBSD System on to Useful Media.** Be sure to mark the location of these files on the tape; you'll need them during the installation procedure.

Insert the tape into your Sparc's tapestation. Boot the installer by typing the appropriate command at the PROM prompt:

sunmon

> **b st()**

OpenBoot PROM 1

ok **boot st()**

OpenBoot PROM 2

ok **boot tape**

After the initial probe messages you'll be asked to confirm the tape device and tape file number containing the installation tools. Then, proceed to the section **Running the installation scripts.** below.

Running the installation scripts

The first thing that the installation scripts will inquire about is the type of console you're using on your machine. If you're using a Sun frame buffer display, choose the terminal type **sun** (this is presented as the default).

Note: if your frame buffer device is a cgsix Sbus board, you should change the terminal type to **sun-cgsix** to avoid triggering a bug in the board's firmware code that can garble your screen.

If you're using a terminal device connected to a serial port, choose a terminal type appropriate for that device, e.g. **vt100** or **vt200.**

Next, you will be presented with a choice of two installation methods: a new full-screen **sysinst** program, or the traditional script-based **miniroot** program. The **sysinst** program is easier to use, but the **miniroot** program is more flexible. Both of these installation methods will follow the same set of procedures and will fully install NetBSD on your Sparc.

You will frequently be asked for confirmation before the system proceeds with each phase of the installation process.

Occasionally, you will have to provide a piece of information such as the name of the disk you want to install on, partitioning information, or IP addresses and domain names you want to assign. If your system has more than one disk, you may want to look at the output of the dmesg(8) command to see how your disks have been identified by the kernel.

Note: If you repartition a hard drive, be certain that every partition starts on a cylinder boundary for compatibility with the Sparc ROM.

The installation script goes through the following phases:
- determination of the disk on which to install NetBSD
- checking/creation of the partition information on the disk
- creating and mounting the NetBSD file systems
- setup of network configuration
- extraction of the distribution tar files
- installation of bootstrap programs

Now try a reboot. Initially we'd suggest you **boot sd()netbsd -bs**, then try multiuser after that. If you boot single-user the NetBSD incantation to make the root file system writable is

```
# mount -u /dev/sd0a /
```

Your PROM might have been setup to instruct the boot program to load a file called vmunix. On OpenBoot PROM systems you can change it to load netbsd instead using the following commands:

OpenBoot PROM 1

```
ok setenv boot-from sd(0,0,0)netbsd
```

OpenBoot PROM 2

```
ok setenv boot-file netbsd
ok setenv boot-device disk:a
```

Congratulations, you have successfully installed NetBSD 1.6L.

Post installation steps

Once you've got the operating system running, there are a few things you need to do in order to bring the system into a properly configured state, with the most important ones described below.

1. Configuring /etc/rc.conf

   If you or the installation software haven't done any configuration of /etc/rc.conf (**sysinst** usually will), the system will drop you into single user mode on first reboot with the message

```
/etc/rc.conf is not configured. Multiuser boot aborted.
```

and with the root file system (/) mounted read-only. When the system asks you to choose a shell, simply press RETURN to get to a /bin/sh prompt. If you are asked for a terminal type, respond with **sun** for a local console, or whatever is appropriate for your serial console (some systems display garbage with a **sun** terminal type, you may need to use **sun-ss5**) and press RETURN. You may need to type one of the following commands to get your delete key to work properly, depending on your keyboard:

```
# stty erase '^h'
# stty erase '^?'
```

At this point, you need to configure at least one file in the /etc directory. You will need to mount your root file system read/write with:

```
# /sbin/mount -u -w /
```

Change to the /etc directory and take a look at the /etc/rc.conf file. Modify it to your tastes, making sure that you set rc_configured=YES so that your changes will be enabled and a multi-user boot can proceed. Default values for the various programs can be found in /etc/defaults/rc.conf, where some in-line documentation may be found. More complete documentation can be found in rc.conf(5).

If your /usr directory is on a separate partition and you do not know how to use **ed**, you will have to mount your /usr partition to gain access to **ex** or **vi**. Do the following:

```
# mount /usr
# export TERM=sun
```

If you have /var on a separate partition, you need to repeat that step for it. After that, you can edit /etc/rc.conf with vi(1). When you have finished, type **exit** at the prompt to leave the single-user shell and continue with the multi-user boot.

Other values that need to be set in /etc/rc.conf for a networked environment are *hostname* and possibly *defaultroute*, furthermore add an *ifconfig_int* for your <int> network interface, along the lines of

```
ifconfig_le0="inet 123.45.67.89 netmask 255.255.255.0"
```

or, if you have *myname.my.dom* in /etc/hosts:

```
ifconfig_le0="inet myname.my.dom netmask 255.255.255.0"
```

To enable proper hostname resolution, you will also want to add an /etc/resolv.conf file or (if you are feeling a little more adventurous) run named(8). See resolv.conf(5) or named(8) for more information.

Other files in /etc that may require modification or setting up include /etc/mailer.conf, /etc/nsswitch.conf, and /etc/wscons.conf.

2. Logging in

After reboot, you can log in as root at the login prompt. Unless you've set a password in **sysinst**, there is no initial password. If you're using the machine in a networked environment, you should create an account for yourself (see below) and protect it and the

''root'' account with good passwords. By default, root login from the network is disabled (even via ssh(1)). One way to become root over the network is to log in as a different user that belongs to group ''wheel'' (see group(5)) and use su(1) to become root.

Unless you have connected an unusual terminal device as the console you can just press RETURN when it prompts for Terminal type? [...].

3. Adding accounts

   Use the useradd(8) command to add accounts to your system; *do not* edit /etc/passwd directly. See useradd(8) for more information on how to add a new user to the system.

4. The X Window System

   If you have installed the X Window System, look at the files in /usr/X11R6/lib/X11/doc for information.

   Don't forget to add /usr/X11R6/bin to your path in your shell's dot file so that you have access to the X binaries.

5. Installing third party packages

   If you wish to install any of the software freely available for UNIX-like systems you are strongly advised to first check the NetBSD package system. This automatically handles any changes necessary to make the software run on NetBSD, retrieval and installation of any other packages on which the software may depend, and simplifies installation (and deinstallation), both from source and precompiled binaries.

   - More information on the package system is at
     http://www.netbsd.org/Documentation/software/packages.html
   - A list of available packages suitable for browsing is at
     ftp://ftp.netbsd.org/pub/NetBSD/packages/pkgsrc/README.html
   - Precompiled binaries can be found at
     ftp://ftp.netbsd.org/pub/NetBSD/packages,
     usually in the 1.6L/sparc/All subdir. You can install them with the following commands:

     ```
     # PKG_PATH=ftp://ftp.netbsd.org/pub/NetBSD/packages/1.6L/sparc/All
     # export PKG_PATH
     # pkg_add -v tcsh
     # pkg_add -v apache
     # pkg_add -v perl
     ...
     ```

     The above commands will install the tcsh shell, the Apache web server and the perl programming language as well as all the packages they depend on.

   - Package sources for compiling packages on your own can be obtained by retrieving the file
     ftp://ftp.netbsd.org/pub/NetBSD/NetBSD-current/tar_files/pkgsrc.tar.gz
     They are typically extracted into /usr/pkgsrc (though other locations work fine), with the commands:

```
# mkdir /usr/pkgsrc
# ( cd /usr/pkgsrc ; tar -zxpf - ) < pkgsrc.tar.gz
```

After extracting, then see the README file in the extraction directory (e.g. /usr/pkgsrc/README) for more information.

6. Misc

- Edit /etc/mail/aliases to forward root mail to the right place. Don't forget to run newaliases(1) afterwards.
- The /etc/mail/sendmail.cf file will almost definitely need to be adjusted; files aiding in this can be found in /usr/share/sendmail. See the README file there for more information.
- Edit /etc/rc.local to run any local daemons you use.
- Many of the /etc files are documented in section 5 of the manual; so just invoking

  ```
  # man 5 filename
  ```

  is likely to give you more information on these files.

Upgrading a previously-installed NetBSD System

The upgrade to NetBSD 1.6L is a binary upgrade; it can be quite difficult to update the system from an earlier version by recompiling from source, primarily due to interdependencies in the various components.

To do the upgrade, you must boot from the installer kernel using one of the methods described above. You must also have at least the **base** and **kern** binary distribution sets available, so that you can upgrade with them, using one of the upgrade methods described above. Finally, you must have sufficient disk space available to install the new binaries. Since files already installed on the system are overwritten in place, you only need additional free space for files which weren't previously installed or to account for growth of the sets between releases. If you have a few megabytes free on each of your root (/) and /usr partitions, you should have enough space.

Since upgrading involves replacing the boot blocks on your NetBSD partition, the kernel, and most of the system binaries, it has the potential to cause data loss. You are strongly advised to *back up* any important data on your disk, whether on the NetBSD partition or on another operating system's partition, before beginning the upgrade process.

The upgrade procedure using the **sysinst** tool is similar to an installation, but without the hard disk partitioning. The original /etc directory is renamed to /etc.old, and no attempt is made to merge any of the previous configuration into the new system except that the previous /etc/fstab file is copied into the new configuration. Getting the binary sets is done in the same manner as the installation procedure; refer to the installation part of the document for how to do this. Also, some sanity checks are done, i.e. file systems are checked before unpacking the sets.

After a new kernel has been copied to your hard disk, your machine is a complete NetBSD 1.6L system. However, that doesn't mean that you're finished with the upgrade process. You will probably want to update the set of device nodes you have in /dev. If you've changed the contents of /dev by hand, you will need to be careful about this, but if not, you can just cd into /dev, and run the command:

```
# sh MAKEDEV all
```

Finally, you will want to delete old binaries that were part of the version of NetBSD that you upgraded from and have since been removed from the NetBSD distribution.

NetBSD/sparc has switched its executable format from the old a.out format to ELF, the now more commonly used and supported format. Your old binaries will continue to work just fine. The installation procedure will try to take the necessary steps to accomplish this. The most important step is to move the old a.out shared libraries in /usr/lib and /usr/X11R6/lib (if X was installed) to /emul/aout, where they will be automatically found if an older a.out binary is executed. **sysinst** will use an existing /emul and / or /emul/aout directory if available, and will create it (as a symbolic link to /usr/aout) if necessary.

If you already had a /emul directory, or a symbolic link by that name, **sysinst** should rename it and tell you about it.

The network bootstrap /usr/mdec/boot.net and GENERIC and INSTALL kernels now try DHCP/BOOTP before falling back to bootparams.

Compatibility Issues With Previous NetBSD Releases

Users upgrading from previous versions of NetBSD may wish to bear the following problems and compatibility issues in mind when upgrading to NetBSD 1.6L.

Issues affecting an upgrade from NetBSD 1.5

The following issues can generally be resolved by extracting the **etc** set into a temporary directory and running *postinstall*:

```
mkdir /tmp/upgrade
cd /tmp/upgrade
pax -zrpe -f /path/to/etc.tgz
./etc/postinstall -s `pwd` check
./etc/postinstall -s `pwd` fix
```

Issues fixed by *postinstall*:

- Various files in /etc need upgrading. These include:
  - /etc/defaults/*
  - /etc/mtree/*
  - /etc/daily
  - /etc/weekly
  - /etc/monthly
  - /etc/security

- /etc/rc.subr
- /etc/rc
- /etc/rc.shutdown
- /etc/rc.d/*

- The following files are now obsolete: /etc/rc.d/NETWORK and /etc/rc.d/gated.
- The following rc.conf(5) entries are now obsolete: amd_master, ip6forwarding, defcorename, and nfsiod_flags. critical_filesystems_beforenet has been replaced by critical_filesystems_local. critical_filesystems has been replaced by critical_filesystems_remote.
- The users and groups 'named', 'ntpd', and 'sshd' need to be created.
- The configuration files for ssh(1) and sshd(8) were moved from /etc to /etc/ssh, including ssh_known_hosts* files and the host key files ssh_host*_key*. /etc/ssh.conf was renamed to /etc/ssh/ssh_config, and /etc/sshd.conf was renamed to /etc/ssh/sshd_config.
- The **mux** entries in wscons.conf(5) are now obsolete.

The following issues need to be resolved manually:

- postfix(8) configuration files require upgrading.

```
cd /usr/share/examples/postfix
cp post-install postfix-files postfix-script /etc/postfix
postfix check
```

- The *de* ethernet driver was replaced with the *tlp* driver. This may require the renaming of the files /etc/ifconfig.de* to /etc/ifconfig.tlp*, renaming of rc.conf(5) entries ifconfig_de* to ifconfig_tlp*, and the reconfiguration of files such as /etc/dhclient.conf and /etc/ipf.conf.

Issues affecting an upgrade from NetBSD 1.4 or prior

- /etc/rc modified to use /etc/rc.d/*

  Prior to NetBSD 1.5, /etc/rc was a traditional BSD style monolithic file; each discrete program or substem from /etc/rc and /etc/netstart has been moved into separate scripts in /etc/rc.d/.

  At system startup, /etc/rc uses rcorder(8) to build a dependency list of the files in /etc/rc.d and then executes each script in turn with an argument of 'start'. Many rc.d scripts won't start unless the appropriate rc.conf(5) entry in /etc/rc.conf is set to 'YES.'

  At system shutdown, /etc/rc.shutdown uses rcorder(8) to build a dependency list of the files in /etc/rc.d that have a ''KEYWORD: shutdown'' line, reverses the resulting list, and then executes each script in turn with an argument of 'stop'. The following scripts support a specific shutdown method: cron, inetd, local, and xdm.

  Local and third-party scripts may be installed into /etc/rc.d as necessary. Refer to the other scripts in that directory and rc(8) for

more information on implementing rc.d scripts.

- named(8) leaks version information.

  Previous releases of NetBSD disabled a feature of named(8) where the version number of the server could be determined by remote clients. This feature has not been disabled in NetBSD 1.5, because there is a named.conf(5) option to change the version string:

```
option {
        version "newstring";
};
```

- sysctl(8) was moved from /usr/sbin/sysctl to /sbin/sysctl. If you have hardcoded references to the full pathname (in shell scripts, for example) please be sure to update those.

- sendmail(8) configuration file pathname changed.

  Due to sendmail(8) upgrade from 8.9.x to 8.10.x, /etc/sendmail.cf is moved to /etc/mail/sendmail.cf. Also, the default sendmail.cf(5) refers different pathnames than before. For example, /etc/aliases is now located at /etc/mail/aliases, /etc/sendmail.cw is now called /etc/mail/local-host-names, and so forth. If you have customized sendmail.cf(5) and friends, you will need to move the files to the new locations. See /usr/share/sendmail/README for more information.

Using online NetBSD documentation

Documentation is available if you first install the manual distribution set. Traditionally, the ``man pages'' (documentation) are denoted by 'name(section)'. Some examples of this are

- intro(1),
- man(1),
- apropos(1),
- passwd(1), and
- passwd(5).

The section numbers group the topics into several categories, but three are of primary interest: user commands are in section 1, file formats are in section 5, and administrative information is in section 8.

The *man* command is used to view the documentation on a topic, and is started by entering **man** [*section*] *topic*. The brackets [] around the section should not be entered, but rather indicate that the section is optional. If you don't ask for a particular section, the topic with the lowest numbered section name will be displayed. For instance, after logging in, enter

```
# man passwd
```

to read the documentation for passwd(1). To view the documentation for passwd(5), enter

```
# man 5 passwd
```

instead.

If you are unsure of what man page you are looking for, enter **apropos** *subject-word*

where *subject-word* is your topic of interest; a list of possibly related man pages will be displayed.

Administrivia

If you've got something to say, do so! We'd like your input. There are various mailing lists available via the mailing list server at majordomo@netbsd.org. To get help on using the mailing list server, send mail to that address with an empty body, and it will reply with instructions.

There are various mailing lists set up to deal with comments and questions about this release. Please send comments to: netbsd-comments@netbsd.org.

To report bugs, use the send-pr(1) command shipped with NetBSD, and fill in as much information about the problem as you can. Good bug reports include lots of details. Additionally, bug reports can be sent by mail to: netbsd-bugs@netbsd.org.

Use of send-pr(1) is encouraged, however, because bugs reported with it are entered into the NetBSD bugs database, and thus can't slip through the cracks.

There are also port-specific mailing lists, to discuss aspects of each port of NetBSD. Use majordomo to find their addresses, or visit **http://www.netbsd.org/MailingLists/**. If you're interested in doing a serious amount of work on a specific port, you probably should contact the 'owner' of that port (listed below).

If you'd like to help with this effort, and have an idea as to how you could be useful, send us mail or subscribe to: netbsd-help@netbsd.org.

As a favor, please avoid mailing huge documents or files to these mailing lists. Instead, put the material you would have sent up for FTP or WWW somewhere, then mail the appropriate list about it, or, if you'd rather not do that, mail the list saying you'll send the data to those who want it.

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(If you're not on that list and should be, tell us! We probably were not able to get in touch with you, to verify that you wanted to be listed.)

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