NAME

INSTALL – Installation procedure for NetBSD/mvme68k.

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DESCRIPTION

About this Document

This document describes the installation procedure for NetBSD 1.6 on the *mvme68k* 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.

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 1.6 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 1.6 release. Some highlights include:

Kernel

- Ports to new platforms including: algor, dreamcast, evbarm, hpcarm, hpcsh, newsmips, sandpoint, sgimips, sun2, and walnut.
- 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 1.6 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.

mvme68k specific

This is the sixth major release of NetBSD for the mvme68k series of boards.

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 1.6 Release Contents

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

`.../NetBSD-1.6/`

`CHANGES`	Changes since earlier NetBSD releases.
`LAST_MINUTE`	Last minute changes.
`MIRRORS`	A list of sites that mirror the NetBSD 1.6 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 1.6 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 1.6 sources which are not in **gnusrc**, **sharesrc**, or **syssrc**.
27 MB gzipped, 136 MB uncompressed

syssrc This set contains the sources to the NetBSD 1.6 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/mvme68k subdirectory structure

The mvme68k-specific portion of the NetBSD 1.6 release is found in the `mvme68k` subdirectory of the distribution: `.../NetBSD-1.6/mvme68k/`

`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.

```
                    netbsd.VME147.gz
                            A kernel for MVME147 boards.
                    netbsd.VME162.gz
                            A kernel for MVME162 boards.
                    netbsd.VME167.gz
                            A kernel for MVME167 boards.
                    netbsd.VME172.gz
                            A kernel for MVME172 boards.
                    netbsd.VME177.gz
                            A kernel for MVME177 boards.
            sets/   mvme68k binary distribution sets; see below.
installation/
            miniroot/
                    mvme68k miniroot file system image; see below.
            netboot/
                    Two programs needed to boot mvme68k kernels over the network; see below.
            tapeimage/
                    Tape boot programs, and a RAMDISK kernel; see below.
```

Binary distribution sets

The NetBSD mvme68k binary distribution sets contain the binaries which comprise the NetBSD 1.6 release for the mvme68k. There are eight binary distribution sets. The binary distribution sets can be found in the `mvme68k/binary/sets` subdirectory of the NetBSD 1.6 distribution tree, and are as follows:

base The NetBSD 1.6 mvme68k **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.
17 MB gzipped, 41 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.
14 MB gzipped, 52 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/mvme68k 1.6 `GENERIC` kernel, named `/netbsd`. You *must* install this distribution set.
1 MB gzipped, 2 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, 7 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

The mvme68k 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.

The following are included in the `mvme68k/installation` directory:

`miniroot/`

Note: The **`sysinst`** method of installation is the preferred method for installing NetBSD/mvme68k. *The Traditional method of installation is deprecated and will be removed in a future release.* Some other important differences between the two installation methods are:

- The Installer and Mkfs utilities are not used if the installation is done using the **`sysinst`** method via booting an Installation Kernel.
- Mkfs creates a 4.3BSD "old" format file system. This is the only file system format understood by the Installer. The **`sysinst`** process creates "new" file systems which can't be processed by Mkfs or the Installer.
- The Installer (and probably Mkfs) is known to have problems with BSD file systems that are larger than 1 GB or extend beyond the 1 GB physical limit. Keep this in mind if doing a Traditional method installation with these utilities.

- The Booter is known to have problems booting from a NetBSD file system if the inode of the kernel file is to large. For large disks it is advisable to have a small root partition and one or more usr-type partitions for other files. This ensures the inode of the kernel in the root file system will be small.
- The Booter is designed to work with 4.3BSD "old" file systems, but there are enough similarities between the "old" and "new" file system formats in the first few hundred blocks that the Booter can usually boot a Kernel from a 4.3BSD new file system. If you choose to use "new" file system formats, it is advisable to use a small root partition and one or more usr-type partitions for other files. This is the default layout used by **sysinst**.

`miniroot.gz` A copy of the miniroot file system. This file system image is copied into the swap partition of the disk which you intend to boot NetBSD from. Normally, this step will be performed manually from the ramdisk boot environment.

`netboot/`

`sboot` An MVME147 bootstrap program in Motorola S-Record format. This is required when you wish to boot an MVME147 over the network since the ROM has no built-in network support. Instructions for getting this program into memory are discussed later.

`netboot` A standalone 2nd stage bootstrap program loaded over the network via TFTP. This is responsible for fetching and starting the NetBSD mvme68k kernel from an NFS server.

`tapeimage/`

`stboot` This file contains a boot sector for Motorola MVME boards. It must be the first file written to a tape in order to make the tape bootable.

`bootst` This file contains a bootstrap program which knows how to load the NetBSD mvme68k ramdisk image from tape. This must be the second file written to the tape.

`netbsd.RAMDISK.gz` This is the NetBSD mvme68k ramdisk image. It contains a `GENERIC` kernel and a built in RAMDISK with just enough tools to partition a disk, dump the miniroot kernel to it and make the disk bootable. This must be the third file written to the tape.

Note: Each directory in the mvme68k binary distribution also has its own checksum files, just as the source distribution does.

NetBSD/mvme68k System Requirements and Supported Devices

NetBSD/mvme68k 1.6 runs on Motorola MVME147 , MVME162 , MVME167 , MVME172 , and MVME177 Single Board Computers.

The minimal configuration requires 8 MB of RAM and ~200 MB of disk space. To install the entire system requires much more disk space (approx. 600 MB additional space is necessary for full sources. Double that if you want to recompile it all!). To run X (clients only) or compile the system, more RAM is recommended. Good performance requires 16 MB of RAM, or 32 MB when running the X Window System.

Note that you can install NetBSD 1.6 on a system with only 4 MB of onboard RAM, but you will need to use a VMEbus RAM card with at least another 4 MB to augment the onboard memory in order to actually install the system.

Here is a table of recommended HD partition sizes for a full install:

Partition	Suggested	Needed
/ (root)	32 MB	26 MB
/usr	200 MB	150 MB
/var	32 MB	6 MB
swap	*2-3 ∗RAM*	16 MB

Anything else is up to you!

Note that the NetBSD/mvme68k installation procedure uses a *miniroot* image which is placed into the swap area of the disk. The swap partition must be large enough to hold this miniroot image (> 7.5 MB).

Supported VME147 hardware

- Serial ports (RS232)
  - built-in console
  - ttyZ1
  - ttyZ2
  - ttyZ3
- Parallel port
  - On-board centronics style printer port
- Network interfaces:
  - On-board Lance Ethernet (le)
- SCSI
  - Most SCSI disks, tapes, CD-ROMs, etc
  - On-board wd33c93 SCSI bus interface chip (async only)
- Miscellaneous:
  - Battery-backed real-time clock
  - VMEbus RAM cards
  - Any VMEbus interface cards with Machine Independent drivers

Supported VME162/VME172 hardware

- Serial ports (RS232)
  - built-in console
  - ttyC1
  - ttyC2
  - ttyC3
- Network interfaces:
  - On-board Intel Ethernet (ie)
- SCSI
  - Most SCSI disks, tapes, CD-ROMs, etc
  - On-board ncr53c710 SCSI I/O processor chip
- Miscellaneous:
  - Battery-backed real-time clock
  - VMEbus RAM cards
  - Any VMEbus interface cards with Machine Independent drivers

Supported VME167/VME177 hardware

- Serial ports (RS232)
  - built-in console
  - ttyZ1
  - ttyZ2
  - ttyZ3
- Parallel port
  - On-board centronics style printer port
- Network interfaces:
  - On-board Intel Ethernet (ie)
- SCSI
  - Most SCSI disks, tapes, CD-ROMs, etc
  - On-board ncr53c710 SCSI I/O Processor chip
- Miscellaneous:
  - Battery-backed real-time clock
  - VMEbus RAM cards
  - Any VMEbus interface cards with Machine Independent drivers

If it's not on the above lists, there is no support for it in this release.

Getting the NetBSD System on to Useful Media

Installation is supported from several media types, including:

- Tape
- NFS
- CD-ROM
- FTP

Note that installing on a 'bare' machine requires either a bootable tape drive or an ethernet to a compatible NFS server. MVME147 may also need to be booted over an RS232 connection.

The procedure for transferring the distribution sets onto installation media depends on the type of media. Instructions for each type of media are given below.

In order to create installation media, you will need all the files and subdirectories in these two directories:

```
.../NetBSD-1.6/mvme68k/installation
```

```
.../NetBSD-1.6/mvme68k/binary
```

Creating boot/install tapes

Installing from tape is the simplest method of all. This method uses two tapes, one containing a bootable ramdisk and miniroot, the other containing the installation sets.

The boot tape is created as follows:

```
# cd .../NetBSD-1.6/mvme68k/installation
# set T = /dev/nrst0
# mt -f $T rewind
# dd if=tapeimage/stboot of=$T
# dd if=tapeimage/bootst of=$T obs=8k conv=osync
```

```
# gzip -dc tapeimage/netbsd.RAMDISK.gz | dd of=$T obs=8k conv=osync
# gzip -dc miniroot/miniroot.fs.gz  | dd of=$T obs=8k conv=osync
# mt -f $T rewind
```

The installation set tape is created as follows:

```
# cd .../NetBSD-1.6/mvme68k/binary/sets
# set T = /dev/nrst0
# mt -f $T rewind
# for f in base etc comp games man misc text; do
    gzip -d < $f.tgz | dd of=$T bs=8k
# done
# mt -f $T rewind
```

If the tape does not work as expected, you may need to explicitly set the EOF mark at the end of each tape segment. Consult the tape-related manual pages on the system where the tapes are created for more details.

Boot/Install from NFS server

If your machine has a disk and network connection, but no tape drive, it may be convenient for you to install NetBSD over the network. This involves temporarily booting your machine over NFS, just long enough so you can initialize its disk. This method requires that you have access to an NFS server on your network so you can configure it to support diskless boot for your machine. Configuring the NFS server is normally a task for a system administrator, and is not trivial.

If you are using a NetBSD system as the boot-server, have a look at the `diskless`(8) manual page for guidelines on how to proceed with this. If the server runs another operating system, consult the documentation that came with it (i.e. `add_client`(8) on SunOS).

Booting an MVME147 from ethernet is not possible without first downloading a small bootstrap program (sboot) via RS232. See the section entitled **Installing from NFS** for details on how to accomplish this.

sboot expects to be able to download a second stage bootstrap program via TFTP after having acquired its IP address through RARP It will look for a filename derived from the machine's IP address expressed in hexadecimal, with an extension of '`.147`'. For example, an MVME147 with IP address 130.115.144.11 will make an TFTP request for `8273900B.147`. Normally, this file is just a symbolic link to the NetBSD/mvme68k `netboot` program, which should be located in a place where the TFTP daemon can find it (remember, many TFTP daemons run in a chroot'ed environment). The netboot program may be found in the install directory of this distribution.

The MVME162 , MVME167 , MVME172 , and MVME177 boot ROMs have code builtin to boot over ethernet from a TFTP server. You should configure it to download the same `netboot` program as is used for MVME147.

The netboot program will query a bootparamd server to find the NFS server address and path name for its root, and then load a kernel from that location. The server should have a copy of the netbsd.RAMDISK kernel in the root area for your client (no other files are needed in the client root, although it might be a convenient place to put the uncompressed miniroot image) and `/etc/bootparams` on the server should have an entry for your client and its root directory. Note that you should rename the `netbsd.RAMDISK` kernel to just `netbsd` in the client's root directory before trying to netboot the client.

The client will need access to the miniroot image, which can be provided using NFS or remote shell. If using NFS, miniroot.fs.gz should be expanded on the server, because doing so from the RAMDISK shell is not so easy. The unzipped miniroot takes about 7.5 MB of space.

If you will be installing NetBSD on several clients, it may be useful to know that you can use a single NFS root for all the clients as long as they only use the netbsd.RAMDISK kernel. There will be no conflict between clients because the RAM-disk kernel will not use the NFS root. No swap file is needed; the RAM-

disk kernel does not use that either.

Install/Upgrade from CD-ROM

This method requires that you boot from another device (i.e. tape or network, as described above). You may need to make a boot tape on another machine using the files provided on the CD-ROM. Once you have booted netbsd.RAMDISK (the RAMDISK kernel) and loaded the miniroot, you can load any of the distribution sets directly from the CD-ROM. The **install** program in the miniroot automates the work required to mount the CD-ROM and extract the files.

Install/Upgrade via FTP

This method requires that you boot from another device (i.e. tape or network, as described above). You may need to make a boot tape on another machine using the files in .../install (which you get via FTP). Once you have booted netbsd.RAMDISK (the RAM-disk kernel) and loaded the miniroot, you can load any of the distribution sets over the net using FTP. The **install** program in the miniroot automates the work required to configure the network interface and transfer the files.

This method, of course, requires network access to an FTP server. This might be a local system, or it might even be ftp.netbsd.org itself. If you wish to use ftp.netbsd.org as your FTP file server, you may want to keep the following information handy:

```
No IP Address: ftp.netbsd.org
Login: anonymous
Password: <your e-mail address>
Server path: /pub/NetBSD/NetBSD-1.6/mvme68k/binary
```

Note: If you're not using a nameserver during installation, you might find 204.152.184.75 handy; it's the IP address of ftp.netbsd.org as of October, 2000.

Preparing your System for NetBSD installation

mvme68k machines usually need little or no preparation before installing NetBSD, other than the usual, well advised precaution of *backing up all data* on any attached storage devices.

The exception to the above is that MVME162 , MVME167 , MVME172 and MVME177 boards require a jumper to be removed or DIP switch changed before NetBSD can be installed. On MVME162-LX and MVME172-LX pins 1-2 of jumper J11 *must* be removed. On MVME162-P2/P4 and MVME172-P2/P4 switch S4, position 8 *must* be set to OFF. On MVME167 and MVME177 pins 1-2 of jumper J1 *must* be removed.

Once you've made any necessary jumper changes, the following instructions should make your machine "NetBSD Ready".

Power-up your MVME147 board. You should have the *bug* prompt:

```
COLD Start

Onboard  RAM start = $00000000,  stop = $007FFFFF

147-Bug>
```

Or, if you have an MVME162/172 or MVME167/177 board (the following boot message is from MVME167; the others are similar):

```
MVME167 Debugger/Diagnostics Release Version 2.3 - 02/25/94
COLD Start
```

```
Local Memory Found =02000000 (&33554432)

MPU Clock Speed =33Mhz

167-Bug>
```

Make sure the RAM size looks ok (if you've got an 8 MB MVME147 or a 32 MB MVME167 you should have the same value as we do). Also make sure the clock is ticking:

```
1xx-Bug>time
Sunday 12/21/31 16:25:14
1xx-Bug>time
Sunday 12/21/31 16:25:15
1xx-Bug>
```

Note that NetBSD bases its year at 1968, and adds the year offset in the system's real-time clock to get the current year. So the 31 here equates to 1999. You may have to adjust your clock using the **set** command to comply with NetBSD 's requirements. Don't worry if the 'Day of the week' is not correct, as NetBSD doesn't use it. Motorola has acknowledged a year 2000 bug in some versions of the MVME147 whereby the day of the week doesn't get set correctly by the 147Bug PROM. *It does not affect* NetBSD !

Also make sure that your board's ethernet address is initialised to the correct value. You'll find the address on a label on the inside of the MVME147's front panel, and on the VMEbus P2 connector of the other board types. On the MVME147, enter the last five digits of the address using the **lsad** command. On the MVME162/172 and MVME167/177, you should use the **cnfg** command.

The NetBSD kernel reads the first two long words of the onboard NVRAM to determine the starting and ending address of any VMEbus RAM that should be used by the system. You should verify that this area is set properly for your configuration.

If you have no VMEbus RAM boards, the values should be set to zero (0).

For an MVME162, MVME167, MVME172 or MVME177 board, at the 1xx-Bug> prompt:

```
1xx-Bug>mm fffc0000 ;1
fffc0000: xxxxxxxx?0
fffc0004: xxxxxxxx?0
fffc0008: xxxxxxxx?.
1xx-Bug>
```

For an MVME147 board, at the 147Bug prompt:

```
147Bug>mm fffe0764 ;1
fffe0764: xxxxxxxx?0
fffe0768: xxxxxxxx?0
fffe076c: xxxxxxxx?.
```

If you do have VMEbus RAM available and want NetBSD to use it, the first long word should be set to the starting address of this RAM and the second long word should be set to the ending address.

If you have more than one VMEbus RAM board installed, the starting and ending addresses must be contiguous from one board to the next. Also note that, for various reasons beyond the scope of this document, VMEbus RAM should be configured in A32 address space.

To install successfully to a local SCSI disk, you need to ensure that the system is aware of what targets are connected to the SCSI bus. This can be done by issuing the following command:

```
1xx-Bug> iot;t
```

At this point, Bug will scan for any attached SCSI devices. After a short delay, a list of SCSI devices will be displayed. 147Bug will ask if LUNs should be assigned from SCSI ids, to which you should answer Y. You should also answer Y when asked if the information is to be saved to NVRAM. 16xBug does not prompt for this information.

The following installation instructions will assume that your target SCSI disk drive appears at SCSI-ID 0. If you have a tape drive, the instructions assume is is configured for SCSI-ID 5. When the RAMDISK root boots, NetBSD will refer to these devices as `sd0` and `rst0` respectively. You may wish to note these down; you'll be using them a lot. :-)

Installing the NetBSD System

Installing NetBSD is a relatively complex process, but if you have this document in hand it should not be too difficult.

There are several ways to install NetBSD onto your disk. If your MVME147 machine has a tape drive the easiest way is **Installing from tape** (details below). All other machines can be installed easily over the network from a suitable NFS server. See **Installing from NFS** for details. Otherwise, if you have another mvme68k machine running NetBSD you can initialize the disk on that machine and then move the disk.

Installing from tape

Create the NetBSD/mvme68k 1.6 boot tape as described in the section entitled **Preparing a boot tape**. Then, with the tape in the drive, type the following at the Bug prompt:

```
147-Bug> bo 5
```

```
16x-Bug> bo 0,50
```

As mentioned earlier, this assumes your tape is jumpered for SCSI-ID 5.

As the tape loads (which may take 20 to 30 seconds), you will see a series of status messages. It may be useful if you can capture these messages to a file, or a scrollable xterm window. In particular, you should make a note of the lines which describe the geometry of the SCSI disks detected by NetBSD. They are of the form:

```
sd0 at scsibus0 targ 0 lun 0: <Maker, Disk, Foo> SCSI1 0/direct fixed
sd0: 800 MB, 800 cyl, 16 head, 128 sec, 512 bytes/sect x 1638400 sectors
```

The information of most interest is the number of sectors; for the fictitious disk above, it's 1638400. You will need this number when you come to create a disklabel for that drive.

Here is an example of an MVME147 system booting from tape:

```
RAM address from VMEbus = $00000000

Booting from: VME147, Controller 5, Device 0
Loading: Operating System

Volume: NBSD

IPL loaded at:  $003F0000
>> BSD MVME147 tapeboot [$Revision: 1.16.2.1 $]
578616+422344+55540+[46032+51284]=0x11a6e4
Start @ 0x8000 ...
Copyright (c) 1996, 1997, 1998, 1999, 2000
    The NetBSD Foundation, Inc.  All rights reserved.
```

```
Copyright (c) 1982, 1986, 1989, 1991, 1993
    The Regents of the University of California.  All rights reserved.

NetBSD 1.5 (RAMDISK) #1: Sun Oct 29 16:19:04 GMT 2000
    steve@fatbob:/usr/src/sys/arch/mvme68k/compile/RAMDISK
Motorola MVME-147S: 25MHz MC68030 CPU+MMU, MC68882 FPU
real mem  = 7237632
avail mem = 6381568
using 88 buffers containing 360448 bytes of memory
mainbus0 (root)
pcc0 at mainbus0: Peripheral Channel Controller, rev 0, vecbase 0x40
clock0 at pcc0 offset 0x0 ipl 5: Mostek MK48T02, 2048 bytes of NVRAM
  .
  .
```

Note: The exact text of the messages will vary depending on which mvme68k variant you're using.

Finally, you will see the following "welcome" message:

```
        Welcome to the NetBSD/mvme68k RAMDISK root!

This environment is designed to do only four things:
  1:  Partition your disk (use the command:  edlabel /dev/rsd0c)
  2:  Copy a miniroot image into the swap partition  (/dev/rsd0b)
  3:  Make that partition bootable (using 'installboot')
  4:  Reboot (using the swap partition, i.e. /dev/sd0b).

Copying the miniroot can be done several ways, allowing the source
of the miniroot image to be on any of these:
    boot tape,  NFS server, TFTP server, rsh server

The easiest is loading from tape, which is done as follows:
        mt -f /dev/nrst0 rewind
        mt -f /dev/nrst0 fsf 3
        dd bs=8k if=/dev/nrst0 of=/dev/rsd0b
(For help with other methods, please see the install notes.)

To reboot using the swap partition after running installboot, first
use
halt,
then at the Bug monitor prompt use a command like:
              1x7Bug> bo 0,,b:

To view this message again, type:  cat /.welcome
#
```

You must now create a disklabel on the disk you wish to use for the root file system (/). This will usually be sd0. The disklabel is used by NetBSD to identify the starting block and size of each partition on the disk.

Partitions are named sd0a, sd0b, sd0c, etc, up to sd0h. The mvme68k port of NetBSD makes some assumptions about the first three partitions on a

boot disk:

sd0a The root file system (/).
sd0b The swap partition.
sd0c The whole disk. Also known as the *raw partition*.

The *raw partition* is special; NetBSD is able to use it even if the disk has no label. You should never create a file system on the Raw Partition, even on a non-boot disk.

It is good practice to put /usr on a different partition than / (root, AKA sd0a). So, the first available partition for /usr is sd0d. Refer to the section entitled **NetBSD System Requirements and Supported Devices** for information on the recommended sizes of the / (root), /usr and swap partitions.

You are not required to define any partitions beyond sd0d, but if you have a large disk drive, you might want to create several other partitions for file systems such as /home or /usr/src. Note that at this time you are only required to partition the root/boot disk; you will get the opportunity to partition any other disks in your system from the main **miniroot** installation program.

To create the disklabel and partitions, use the edlabel program, passing it the name of the Raw Partition of your root/boot disk.

```
# edlabel /dev/rsd0c
edlabel menu:
print - display the current disk label
modify - prompt for changes to the label
write - write the new label to disk
quit - terminate program
edlabel>
```

The program shows what commands it recognizes; **print**, **modify**, **write**, and **quit**. It will accept the first letter of a command if you don't feel like typing each one in full.

To start creating the basic partitions, you should enter **m** (modify) at the edlabel prompt, then enter the letter corresponding to the first partition, **a**.

```
edlabel> m

modify subcommands:
@: modify disk parameters
a-h: modify partition
s: standardize geometry
q: quit this subcommand
edlabel/modify> a
a (root) 0 (0/00/00) 0 (0/00/00) unused
start as <blkno> or <cyls/trks/sects>: 0
length as <nblks> or <cyls/trks/sects>: 65536
type: 4.2BSD
edlabel/modify>
```

When you enter the start and length of a partition, you can use either blocks or cylinder/track/sector notation. If this is the first time

you've partitioned a disk for NetBSD, it's probably easiest to use block notation. The above example creates partition 'a', starting at block zero and with a size of 65536 blocks. Note that the usual size of a block is 512 bytes, so this creates a 32 MB partition.

The type of the partition should be 4.2BSD, otherwise you won't be able to create a file system on it.

Next, create a swap partition (b). Note that the minimum size of this swap partition should be 8 MB, otherwise you won't be able to use a miniroot to complete the NetBSD installation!

```
edlabel/modify> b
b (swap) 0 (0/00/00) 0 (0/00/00) unused
start as <blkno> or <cyls/trks/sects>: 65536
length as <nblks> or <cyls/trks/sects>: 32768
type: swap
edlabel/modify>
```

Here, we specify a value for start such that the swap partition follows immediately after partition 'a', i.e. 65536. The length of the swap partition should be a multiple of the amount of RAM you have in your system. Here, we've chosen 32768, or 16 MB. The next available block on the drive is thus 65536 + 32768. We will use this to create partition 'd' for our /usr file system. (Note that for a busy system, or a system with more than 8 MB of RAM, you'll be better off with a 32 or 64 MB swap partition.)

```
edlabel/modify> d
d (user) 0 (0/00/00) 0 (0/00/00) unused
start as <blkno> or <cyls/trks/sects>: 98304
length as <nblks> or <cyls/trks/sects>: 1540096
type: 4.2BSD
edlabel/modify> q
edlabel>
```

As you can see, we've chosen to assign the remainder of the disk to /usr. Since there are 1638400 sectors on the example disk (did you remember to note down the number of sectors on your disk during boot?), and partition **d** starts at sector 98304, a simple bit of arithmetic (1638400 - 98304) gives **d** a size of 1540096.

Note that the above partition sizes are just guidelines. If your disk is large enough, you should resize the partitions appropriately and perhaps also create a /var partition as well.

You now need to write this new disklabel, together with the partition details you've just entered, to disk. You might also try the **'p'** command to view the partitions. Once written, you can quit back to the shell using **'q'**.

```
edlabel> p

        type_num: 4
        sub_type: 0
       type_name: SCSI disk
```

```
        pack_name: fictitious
     bytes/sector: 512
    sectors/track: 128
  tracks/cylinder: 16
        cylinders: 800
sectors/cylinder: 2048
partition      start         (c/t/s)      nblks         (c/t/s)  type

 a (root)          0       (0/00/00)      65536      (32/00/00)  4.2BSD
 b (swap)      65536      (32/00/00)      32768      (48/00/00)  swap
 c (disk)          0       (0/00/00)    1638400     (800/00/00)  unused
 d (user)      98304      (48/00/00)    1540096     (752/00/00)  4.2BSD

edlabel> w
edlabel> q
#
```

Now that your disk's partitioned, you need to get the proper installation miniroot image onto it. The miniroot image is designed to be copied into the swap partition of your disk. This is a safe place which won't be overwritten by the installation procedure. From the shell prompt, use the following commands to copy the miniroot image from tape to swap (b).

```
# mt -f /dev/nrst0 rewind
# mt -f /dev/nrst0 fsf 3
# dd bs=8k if=/dev/nrst0 of=/dev/rsd0b
```

The disk and the miniroot must now be made bootable using the installboot(8) command. To do this, issue the following commands:

```
# mount /dev/sd0b /mnt
# installboot /mnt/usr/mdec/bootsd /bootxx /dev/rsd0b
# umount /dev/sd0b
```

You can now shutdown the system.

```
# halt
signal 15
syncing disks... done
unmounting / (root_device)...
halted

147-Bug> reset
Reset Local SCSI Bus [Y,N] N? y
Automatic reset of known SCSI Buses on RESET [Y,N] Automatic0
Cold/Warm Reset flag [C,W] = C?
Execute Soft Reset [Y,N] N? y
```

Resetting the other types of MVME boards are very similar. You should now reboot from that just installed miniroot. See the section entitled **Booting the miniroot** for details.

Installing from NFS

Before you can install from NFS, you must have already configured your NFS server to support your machine as a bootable client. Instructions for configuring the server are found in the section entitled **Getting the NetBSD System onto Useful Media** above.

To get started on the MVME147, you need to download sboot into RAM (you will find **sboot** in the install directory of the mvme68k distribution). You can either do that through the console line or through a 2nd serial connection. For example, an MVME147 connected to a sun4/110 and accessed via tip(1) can be loaded as follows:

```
lo 0
~Ccat sboot
go 4000
```

Which will look like this:

```
147-Bug> lo 0
~CLocal command? cat sboot
```

away for 11 seconds

```
!

147-Bug> g 4000
Effective address: 00004000

sboot: serial line bootstrap program (end = 6018)

>>>
```

Now, if you want to do it through serial line 1, then connect serial line one to a machine. At the 147-Bug> prompt type **tm 1** You should then login to the machine it is connected to. Then press CONTROL-A to escape to Bug. Do **lo 1;x=cat sboot** ... then when that is done you can reconnect **tm 1** and logout. Then do **go 4000** and you've got the >>> prompt of **sboot**.

Once you've got the >>> prompt, you can boot the RAMDISK kernel from the server:

```
>>> b


le0: ethernet address: 8:0:3e:20:cb:87
My ip address is: 192.168.1.4
Server ip address is: 192.168.1.1
4800
Download was a success!
```

See below for the next step in booting MVME147.

The MVME162, MVME167, MVME172 and MVME177 boards are able to download netboot directly using TFTP. To enable this, you must first configure the networking parameters on the board as described in the section entitled "Preparing your System for NetBSD Installation. On a properly con-

figured MVME162/172 or MVME167/177, all you need to type is:

```
1xx-Bug> nbo
```

For all board types, the boot messages are very similar:

```
Start @ 0x8000 ...
>> BSD MVME147 netboot (via sboot) [$Revision: 1.16.2.1 $]
device: le0 attached to 08:00:3e:20:cb:87
boot: client IP address: 192.168.1.4
boot: client name: soapy
root addr=192.168.1.1 path=/export/soapy
578616+422344+55540+[46032+51284]=0x11a6e4
Start @ 0x8000 ...
Copyright (c) 1996, 1997, 1998, 1999, 2000
    The NetBSD Foundation, Inc.  All rights reserved.
Copyright (c) 1982, 1986, 1989, 1991, 1993
    The Regents of the University of California.  All rights reserved.

NetBSD 1.5 (RAMDISK) #1: Sun Oct 29 16:19:04 GMT 2000
    steve@fatbob:/usr/src/sys/arch/mvme68k/compile/RAMDISK
Motorola MVME-147S: 25MHz MC68030 CPU+MMU, MC68882 FPU
real mem  = 7237632
avail mem = 6381568
using 88 buffers containing 360448 bytes of memory
mainbus0 (root)
pcc0 at mainbus0: Peripheral Channel Controller, rev 0, vecbase 0x40
clock0 at pcc0 offset 0x0 ipl 5: Mostek MK48T02, 2048 bytes of NVRAM
  .
  .
```

After the boot program loads the RAMDISK kernel, you should see the welcome screen as shown in the "tape boot" section above.

You now need to create a disklabel with partition information on the SCSI disk on which you intend to create your root file system (/). Follow the instructions in the previous section entitled **Installing from tape** to do this. (But stop short of the part which describes how to copy the miniroot from tape.)

You must now configure the network interface before you can access the NFS server containing the miniroot image. For example the command:

```
# ifconfig le0 inet 192.168.1.4 up
```

will bring up the MVME147 network interface le0 with that address. The command:

```
# ifconfig ie0 inet 192.168.1.4 up
```

will bring up the MVME162/172 or MVME167/177 network interface ie0 with that address. The next step is to copy the miniroot from your server. This can be done using either NFS or remote shell. (In the examples that follow, the server has IP address 192.168.1.1) You may then need to add a default route if the server is on a different subnet:

```
# route add default 192.168.1.2 1
```

You can look at the route table using:

```
# route show
```

Now mount the NFS file system containing the miniroot image:

```
# mount -r 192.168.1.1:/export/soapy /mnt
```

The procedure is simpler if you have space for an expanded (not compressed) copy of the miniroot image. In that case:

```
# dd bs=8k if=/mnt/miniroot of=/dev/rsd0b
```

Otherwise, you will need to use **gzcat** to expand the miniroot image while copying.

```
# gzcat miniroot.fs.gz | dd obs=8k of=/dev/rsd0b
```

You must now make the disk bootable. Refer to the previous section on installing from tape, where it describes how to run **installboot**. This is immediately following the part which explains how to copy the miniroot from tape.

Booting the miniroot

Assuming the miniroot is installed on partition 'b' of the disk with SCSI-ID 0, then the boot command is:

```
1xx-Bug> bo 0,,b:
```

The command line parameters above are:

0 controller (usually zero)

,, bug argument separators

b: tell the bootstrap code to boot from partition b

You should see a bunch of boot messages, followed by messages from the miniroot kernel just as you did when the RAMDISK kernel booted.

You will then be prompted to enter the root device. Since the miniroot was booted from the swap partition, you should enter sd0b. You will then be asked for the swap device and file system type. Just press RETURN twice to accept the defaults. When asked to enter a terminal type, either accept the default, or use whatever the TERM environment variable is set to in the shell of your host system:

```
boot device: sd0
root device (default sd0a): sd0b
dump device (default sd0b): (return)
file system (default generic): (return)
root on sd0b dumps on sd0b
mountroot: trying ffs...
root file system type: ffs
init: copying out path '/sbin/init' 11
erase ^H, werase ^W, kill ^U, intr ^C
Terminal type? [vt100] return
```

Congratulations! The system should now be running the miniroot installation program.

Miniroot install program:

The miniroot's install program is very simple to use. It will guide you through the entire process, and is well automated.

Starting with NetBSD version 1.6, you have the option of using **sysinst** instead of the old installation and upgrade shell scripts. At this time, **sysinst** is not capable of installing distribution sets from tape. In such a case, you should fallback to the shell script installation or upgrade procedure. In all other cases, **sysinst** should be used. Note that as soon as **sysinst** can deal with tapes, the shell script tools will be removed.

The miniroot's install program (both **sysinst** and the shell script version) will:

- Allow you to place disklabels on additional disks. The disk we are installing on should already have been partitioned using the RAMDISK kernel.

  Note that partition sizes and offsets are expressed in sectors. When you fill out the disklabel, you will need to specify partition types and file system parameters. If you're unsure what these values should be, use the following defaults:

  ```
  fstype: 4.2BSD
  fsize: 1024
  bsize: 4096
  cpg: 16
  ```

  If the partition will be a swap partition, use the following:

  ```
  fstype: swap
  fsize: 0 (or blank)
  bsize: 0 (or blank)
  cpg: 0 (or blank)
  ```

  Note that partition 'c' is special; it covers then entire disk and should not be assigned to a file system.

  The number of partitions is currently fixed at 8.

- Create file systems on target partitions.
- Allow you to set up your system's network configuration. Remember to specify host names without the domain name appended to the end. For example use foo instead of foo.bar.org. If, during the process of configuring the network interfaces, you make a mistake, you will be able to re-configure that interface by simply selecting it for configuration again.
- Mount target file systems. You will be given the opportunity to manually edit the resulting /etc/fstab.

- Extract binary sets from the media of your choice.
- Copy configuration information gathered during the installation process to your root file system (/).
- Make device nodes in your root file system under /dev.
- Copy a new kernel onto your root partition (/).
- Install a new boot block.
- Check your file systems for integrity.

First-time installation on a system through a method other than the installation program is possible, but strongly discouraged.

Running the sysinst installation program

1. *Introduction*

   Using **sysinst**, installing NetBSD is a relatively easy process. You still should read this document and have it in hand when doing the installation process. This document tries to be a good guideline for the installation and as such covers many details for the sake of completeness. Do not let this discourage you; the install program is not hard to use.

2. *General*

   The following is a walk-through of the steps you will take while getting NetBSD installed on your hard disk. **sysinst** is a menu driven installation system that allows for some freedom in doing the installation. Sometimes, questions will be asked and in many cases the default answer will be displayed in brackets (``[]'') after the question. If you wish to stop the installation, you may press CONTROL-C at any time, but if you do, you'll have to begin the installation process again from scratch by running the /sysinst program from the command prompt. It is not necessary to reboot.

3. *Quick install*

   First, let's describe a quick install. The other sections of this document go into the installation procedure in more detail, but you may find that you do not need this. If you want detailed instructions, skip to the next section. This section describes a basic installation, using a CD-ROM install as an example.

   - What you need.
     - The distribution sets (in this example, they are on CD).
     - One 1.44 MB 3.5" floppy.
     - A CD-ROM drive (SCSI), a harddisk and a minimum of 4 MB of memory installed.
     - The harddisk should have at least 100 + *n* megabytes of space free, where *n* is the number of megabytes of main memory in your system. If you wish to install the X Window System as well, you will need at least 60 MB more.

- The Quick Installation
  - Insert the first boot floppy you just created. Boot the computer. The main menu will be displayed.

```
.*******************************************.
* NetBSD-1.6 Install System                  *
*                                            *
*>a: Install NetBSD to hard disk             *
* b: Upgrade NetBSD on a hard disk           *
* c: Re-install sets or install additional sets *
* d: Reboot the computer                     *
* e: Utility menu                            *
* x: Exit Install System                     *
.*******************************************.
```

  - If you wish, you can configure some network settings immediately by choosing the **Utility menu** and then **Configure network**. It isn't actually required at this point, but it may be more convenient. Go back to the main menu.
  - Choose **install**.
  - You will be guided through some steps regarding the setup of your disk, and the selection of distributed components to install. When in doubt, refer to the rest of this document for details.
  - After your disk has been prepared, choose **CD-ROM** as the medium. The default values for the path and device should be ok.
  - After all the files have been unpacked, go back to the main menu and select **reboot**, after you have removed the bootfloppy from the drive.
  - NetBSD will now boot. If you haven't already done so in **sysinst**, you should log in as root, and set a password for that account. You are also advised to edit the file /etc/rc.conf to match your system needs.
  - Your installation is now complete.
  - For configuring the X window system, if installed, see the files in /usr/X11R6/lib/X11/doc. Further information can be found on **http://www.xfree86.org/**.

4. *Booting NetBSD*

Boot your machine. The boot loader will start, and will print a countdown and begin booting.

If the boot loader messages do not appear in a reasonable amount of time, you either have a bad boot floppy or a hardware problem. Try writing the install floppy image to a different disk, and using that.

It will take a while to load the kernel from the floppy, probably around a minute or so, then, the kernel boot messages will be displayed. This may take a little while also, as NetBSD will be probing

your system to discover which hardware devices are installed. The most important thing to know is that wd0 is NetBSD 's name for your first IDE disk, wd1 the second, etc. sd0 is your first SCSI disk, sd1 the second, etc.

Note that once the system has finished booting, you need not leave the floppy in the disk drive.

Once NetBSD has booted and printed all the boot messages, you will be presented with a welcome message and a main menu. It will also include instructions for using the menus.

5. *Network configuration*

If you will not use network operation during the installation, but you do want your machine to be configured for networking once it is installed, you should first go to the **Utility menu**, and select the **Configure network** option. If you only want to temporarily use networking during the installation, you can specify these parameters later. If you are not using the Domain Name System (DNS), you can give an empty response in reply to answers relating to this.

6. *Installation drive selection and parameters*

To start the installation, select **Install NetBSD to hard disk** from the main menu.

The first thing is to identify the disk on which you want to install NetBSD. **sysinst** will report a list of disks it finds and ask you for your selection. Depending on how many disks are found, you may get a different message. You should see disk names like sd0 or sd1.

7. *Partitioning the disk*

- Which portion of the disk to use.

  You will be asked if you want to use the entire disk or only part of the disk. If you decide to use the entire disk for NetBSD, it will be checked if there are already other systems present on the disk, and you will be asked to confirm whether you want to overwrite these.

8. *Editing the NetBSD disklabel*

The partition table of the NetBSD part of a disk is called a *disklabel*. There are 4 layouts for the NetBSD part of the disk that you can pick from: **Standard**, **Standard with X**, **Custom** and **Use Existing**. The first two use a set of default values (that you can change) suitable for a normal installation, possibly including X. With the **Custom** option you can specify everything yourself. The last option uses the partition info already present on the disk.

You will be presented with the current layout of the NetBSD disklabel, and given a chance to change it. For each partition, you can set the type, offset and size, block and fragment size, and the mount point. The type that NetBSD uses for normal file storage is called **4.2BSD**. A swap partition has a special type called **swap**. Some partitions in the disklabel have a fixed purpose.

a Root partition (/)

b Swap partition.

c The NetBSD portion of the disk.

d–h Available for other use. Traditionally, d is the partition mounted on /usr, but this is historical practice and not a fixed value.

You will then be asked to name your disk's disklabel. The default response is **``mydisk''**. For most purposes this will be OK. If you choose to name it something different, make sure the name is a single word and contains no special characters. You don't need to remember this name.

9. *Preparing your hard disk*

You are now at the point of no return. Nothing has been written to your disk yet, but if you confirm that you want to install NetBSD, your hard drive will be modified. If you are sure you want to proceed, enter yes at the prompt.

The install program will now label your disk and make the file systems you specified. The file systems will be initialized to contain NetBSD bootstrapping binaries and configuration files. You will see messages on your screen from the various NetBSD disk preparation tools that are running. There should be no errors in this section of the installation. If there are, restart from the beginning of the installation process. Otherwise, you can continue the installation program after pressing the return key.

10. *Getting the distribution sets*

The NetBSD distribution consists of a number of *sets*, that come in the form of gzipped tarfiles. A few sets must be installed for a working system, others are optional. At this point of the installation, you will be presented with a menu which enables you to choose from one of the following methods of installing the sets. Some of these methods will first load the sets on your hard disk, others will extract the sets directly.

For all these methods, the first step is making the sets available for extraction, and then do the actual installation. The sets can be made available in a few different ways. The following sections describe each of those methods. After reading the one about the method you will be using, you can continue to section labeled 'Extracting the distribution sets'.

11. *Installation using ftp*

To be able to install using ftp, you first need to configure your network setup, if you haven't already at the start of the install procedure. **sysinst** will do this for you, asking you to provide some data, like IP address, hostname, etc. If you do not have name service set up for the machine that you are installing on, you can just press RETURN in answer to these questions, and DNS will not be used.

You will also be asked to specify the host that you want to transfer the sets from, the directory on that host, the account name and password used to log into that host using ftp, and optionally a proxy server to use. If you did not set up DNS when answering the questions to configure networking, you will need to specify an IP address instead of a hostname for the ftp server.

sysinst will proceed to transfer all the default set files from the remote site to your hard disk.

12. *Installation using NFS*

To be able to install using NFS, you first need to configure your network setup, if you haven't already at the start of the install procedure. **sysinst** will do this for you, asking you to provide some data, like IP address, hostname, etc. If you do not have name service set up for the machine that you are installing on, you can just press RETURN in answer to these questions, and DNS will not be used.

You will also be asked to specify the host that you want to transfer the sets from, and the directory on that host that the files are in. This directory should be mountable by the machine you are installing on, i.e. correctly exported to your machine.

If you did not set up DNS when answering the questions to configure networking, you will need to specify an IP address instead of a hostname for the NFS server.

13. *Installation from CD-ROM*

When installing from a CD-ROM, you will be asked to specify the device name for your CD-ROM player (usually cd0), and the directory name on the CD-ROM where the distribution files are.

sysinst will then check if the files are indeed available in the specified location, and proceed to the actual extraction of the sets.

14. *Installation from an unmounted file system*

In order to install from a local file system, you will need to specify the device that the file system resides on (for example sd1e) the type of the file system, and the directory on the specified file system where the sets are located. **sysinst** will then check if it can indeed access the sets at that location.

15. *Installation from a local directory*

This option assumes that you have already done some preparation yourself. The sets should be located in a directory on a file system that is already accessible. **sysinst** will ask you for the name of this directory.

16. *Extracting the distribution sets*

After the install sets containing the NetBSD distribution have been made available, you can either extract all the sets (a full installation), or only extract sets that you have selected. In the latter case, you will be shown the currently selected sets, and given the opportunity to select the sets you want. Some sets always need to be

installed (**kern, base**) and **etc** they will not be shown in this selection menu.

Before extraction begins, you can elect to watch the files being extracted; the name of each file that is extracted will be shown. This can slow down the installation process considerably, especially on machines with slow graphics consoles or serial consoles.

After all the files have been extracted, all the necessary device node files will be created. If you have already configured networking, you will be asked if you want to use this configuration for normal operation. If so, these values will be installed in the network configuration files. The next menu will allow you to select the time zone that you're in, to make sure your clock has the right offset from UTC. Finally you will be asked to select a password encryption algorithm and can than set a password for the "root" account, to prevent the machine coming up without access restrictions.

17. *Finalizing your installation*

Congratulations, you have successfully installed NetBSD 1.6. You can now reboot the machine, and boot NetBSD from harddisk.

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 **vt220** (or whatever is appropriate for your terminal type) 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=vt220
```

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. 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 installa-

tion (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 1.6/mvme68k/All subdir. You can install them with the following commands:

  ```
  # PKG_PATH=ftp://ftp.netbsd.org/pub/NetBSD/packages/1.6/mvme68k/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

It is possible to easily upgrade your existing NetBSD/mvme68k system using the upgrade program in the miniroot or by manually performing the same steps as the miniroot upgrade program.

Upgrading using the miniroot

If you wish to upgrade your system by this method, simply select the **upgrade** option once the miniroot has booted. The upgrade program with then guide you through the procedure. The upgrade program will:

1. Enable the network based on your system's current network configuration.
2. Mount your existing file systems.
3. Extract binary sets from the media of your choice.
4. Fixup your system's existing /etc/fstab, changing the occurrences of **ufs** to **ffs** and let you edit the resulting file.
5. Make new device nodes in your root file system under /dev.
6. Don't forget to extract the **kern** set from the distribution.

   Note: The existing kernel *will not* be backed up; doing so would be pointless, since older kernels may not be capable of running NetBSD 1.6executables.
7. Install a new boot block.
8. Check your file systems for integrity.
9. You'll have to reboot your system manually

Manual upgrade

While using the miniroot's upgrade program is the preferred method of upgrading your system, it is possible to upgrade your system manually. To do this, follow the following procedure:

1. Place *at least* the **base** binary set in a file system accessible to the target machine. A local file system is preferred, since the NFS subsystem in the NetBSD 1.6 kernel may be incompatible with your old binaries.
2. Back up your pre-existing kernel and copy the 1.6 kernel into your root partition (/).
3. Reboot with the 1.6 kernel into single-user mode.
4. Check all file systems:

   # **/sbin/fsck -pf**
5. Mount all local file systems:

   # **/sbin/mount -a -t nonfs**

6. If you keep /usr or /usr/share on an NFS server, you will want to mount those file systems as well. To do this, you will need to enable the network:

   ```
   # sh /etc/rc.d/network start
   ```

7. Make sure you are in the root file system (/) and extract the **base** binary set:

   ```
   # cd /
   # pax -zrvpe -f /path/to/base.tgz
   ```

8. Install a new boot block:

   ```
   # cd /usr/mdec
   # cp bootsd /.bootsd
   # ./installboot /.bootsd bootxx < root-disk
   ```

   E.g.: *root-disk* could be /dev/rsd0a.

9. Sync the file systems:

   ```
   # sync
   ```

10. At this point you may extract any other binary sets you may have placed on local file systems, or you may wish to extract additional sets at a later time. To extract these sets, use the following commands:

    ```
    # cd /
    # pax -zrvpe -f path_to_set
    ```

Note: You *should not* extract the **etc** set if upgrading. Instead, you should extract that set into another area and carefully merge the changes by hand.

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 1.6.

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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- The Helsinki University of Technology in Finland for hosting the NetBSD CVS server.

- The Internet Research Institute in Japan for hosting the server which runs the CVSweb interface to the NetBSD source tree.

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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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