NAME

INSTALL – Installation procedure for NetBSD/sparc

DESCRIPTION

About this Document

This document describes the installation procedure for NetBSD 1.4.1 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.

What is NetBSD?

The NetBSD Operating System is a fully functional Open Source UN*X-like operating system derived from the Berkeley Networking Release 2 (Net/2), 4.4BSD-Lite, and 4.4BSD-Lite2 sources. NetBSD runs on twenty different system architectures featuring eight distinct families of CPUs, and is being ported to more. The NetBSD 1.4.1 release contains complete binary releases for fourteen different machine types. (The six 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, 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.

Changes Since The Last Release

The NetBSD 1.4.1 release is a substantial improvement over its predecessors. We have provided numerous significant functional enhancements, including support for many new devices, integration of hundreds of bug fixes, new and updated kernel subsystems, and many userland enhancements. The results of these improvements is a stable operating system fit for production use that rivals most commercially available systems.

It is impossible to completely summarize the nearly two years of development that went into the NetBSD 1.4.1 release. Some highlights include:

- Substantial improvements in the TCP/IP implementation, including numerous performance enhancements and bug fixes by Jason Thorpe and others.
- A new, high efficiency kernel memory pool allocator by Paul Kranenburg. This has been integrated into most kernel subsystems.
- A new, totally rewritten virtual memory subsystem, UVM, created by Chuck Cranor, which is substantially cleaner and better performing than the old Mach derived VM subsystem.
- Improved POSIX and XPG standards compliance.

- Completion of the integration of all remaining 4.4BSD Lite-2 kernel improvements and bug fixes that had not been previously integrated. (Integration of all userland components was completed before NetBSD 1.3)
- Several new ports, including macppc, bebox, sparc64, next68k, and others, have been integrated into the source tree.
- The system compilers have been upgraded to egcs 1.1.1, and the system compiler toolchain now (mostly) uses the latest versions of GNU binutils instead of the obsolete versions left over from 4.4BSD Lite.
- Everyone's favorite `ftp`(1) client has been improved even further. See the man page for details.
- A new architecture independent console driver, `wscons`(4), has been integrated into many ports.
- Numerous improvements have been made to the audio subsystem support, including support for MIDI device drivers.
- Linux compatibility support has been improved.
- A number of scheduler enhancements have yielded dramatic improvements in interactive performance and better control of background tasks.
- Several network tunneling protocols, including GRE and IP in IP, have been implemented.
- Kernel support for the CODA distributed file system has been added.
- Manuel Bouyer completed major changes to the IDE support. It is now architecture independent. Major changes have been made to the IDE code for better error handling, improved ATAPI support, 32 bit data I/O support and bus-master DMA support on PCI IDE controllers.
- Lennart Augustsson has added full USB support, permitting the use of a wide variety of Universal Serial Bus peripherals. The drivers should easily port to any future platforms that support the PCI bus. See `usb`(4) for an overview.
- RAIDframe, version 1.1, from the Parallel Data Laboratory at Carnegie Mellon University, has been integrated. Supports RAID levels 0, 1, 4, 5, and more.
- Luke Mewburn added `nsswitch.conf`(5) functionality to the system to specify the search order for system databases.
- `syslogd`(8) now supports listening on multiple sockets, to make the chrooting of servers easier.
- Most third party packages have been updated to the latest stable release.

As has been noted, there have also been innumerable bug fixes.

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.

NetBSD 1.4.1 is the fourth release for the sparc. Many more sparc models and devices are now supported.

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. In addition, we intend to provide Anonymous CVS access to the NetBSD source tree in the near future, so that anyone on the internet can examine the full NetBSD source code repository.

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

NetBSD Mirror Site List

The following sites mirror NetBSD as of April 03, 1999.

If you wish to become a distribution site for NetBSD, contact `mirrors@netbsd.org`.

FTP mirrors

Australia

ftp.au.netbsd.org
RMIT University, Melbourne
ftp://ftp.au.netbsd.org/pub/NetBSD/

ftp2.au.netbsd.org
University of Queensland, Brisbane
ftp://ftp2.au.netbsd.org/pub/NetBSD/

Austria

ftp.at.netbsd.org
University of Technology, Vienna
ftp://ftp.at.netbsd.org/pub/NetBSD/

Brazil

ftp.ravel.ufrj.br
Cidade Universitaria
ftp://ftp.ravel.ufrj.br/pub/NetBSD/

Denmark

ftp.dk.netbsd.org
Aalborg University
ftp://ftp.dk.netbsd.org/pub/NetBSD/

Finland

ftp.fi.netbsd.org
The Finnish University and Research Network, Espoo
ftp://ftp.fi.netbsd.org/pub/NetBSD/

France

ftp.fr.netbsd.org
Paris University
ftp://ftp.fr.netbsd.org/pub/NetBSD/

Germany

ftp.de.netbsd.org
University of Trier
ftp://ftp.de.netbsd.org/pub/NetBSD/

ftp2.de.netbsd.org
University of Erlangen-Nuremberg
ftp://ftp2.de.netbsd.org/pub/NetBSD/

ftp.uni-regensburg.de
University of Regensburg
ftp://ftp.uni-regensburg.de/pub/comp/os/NetBSD/

Japan

ftp.jp.netbsd.org
Internet Research Institute Inc., Tokyo
ftp://ftp.jp.netbsd.org/pub/NetBSD/

core.ring.gr.jp
Electrotechnical Laboratory
ftp://core.ring.gr.jp/pub/NetBSD/

ftp.dti.ad.jp
Dream Train Internet Inc., Tokyo
ftp://ftp.dti.ad.jp/pub/NetBSD/

mirror.nucba.ac.jp
Nagoya University of Commerce and Business
ftp://mirror.nucba.ac.jp/mirror/NetBSD/

netbsd.tohoku.ac.jp
Tohoku University, Sendai
ftp://netbsd.tohoku.ac.jp/NetBSD/

ring.asahi-net.or.jp
ASAHI Net
ftp://ring.asahi-net.or.jp/pub/NetBSD/

Netherlands

ftp.nl.netbsd.org
University of Amsterdam

ftp://ftp.nl.netbsd.org/pub/NetBSD/

Norway

ftp.no.netbsd.org
Bergen IT Consult AS
ftp://ftp.no.netbsd.org/pub/NetBSD/

ftp.ntnu.no
Norwegian University of Science and Technology
ftp://ftp.ntnu.no/pub/NetBSD/

Russia

ftp.ru.netbsd.org
Landau Institute for Theoretical Physics, Chernogolovka
ftp://ftp.ru.netbsd.org/pub/NetBSD/

Sweden

ftp.stacken.kth.se
Royal Institute of Technology, Stockholm
ftp://ftp.stacken.kth.se/pub/OS/NetBSD/

ftp.sunet.se
Swedish University NETwork, Uppsala
ftp://ftp.sunet.se/pub/os/NetBSD/

UK

ftp.uk.netbsd.org
Domino, London
ftp://ftp.uk.netbsd.org/pub/NetBSD/

sunsite.org.uk
ftp://sunsite.org.uk/packages/netbsd/

USA

ftp.netbsd.org
Silicon Valley, California
ftp://ftp.netbsd.org/pub/NetBSD/

ftp.cs.umn.edu
University of Minnesota
ftp://ftp.cs.umn.edu/pub/NetBSD

ftp.eecs.umich.edu
University of Michigan, Ann Arbor
ftp://ftp.eecs.umich.edu/pub/NetBSD/

ftp.iastate.edu
Iowa State University
ftp://ftp.iastate.edu/pub/netbsd/

ftp.op.net
ftp://ftp.op.net/pub/NetBSD/

AFS mirrors

Sweden

ftp.stacken.kth.se
Royal Institute of Technology, Stockholm
AFS path: /afs/stacken.kth.se/ftp/pub/OS/NetBSD

USA

ftp.iastate.edu
Iowa State University
AFS path: /afs/iastate.edu/public/ftp/pub/netbsd

NFS mirrors

UK

sunsite.org.uk
Instructions: mount -o ro sunsite.org.uk:/public/packages/netbsd /mnt

SUP mirrors

Australia

sup.au.netbsd.org
RMIT University, Melbourne
Instructions: ftp://sup.au.netbsd.org/pub/NetBSD/sup/README.sup

France

sup.fr.netbsd.org
Paris University
Instructions: Similar to sup.netbsd.org

Germany

sup.de.netbsd.org
University of Trier
Instructions: ftp://sup.de.netbsd.org/pub/NetBSD/sup/supfile.example

Japan

sup.jp.netbsd.org
Internet Research Institute Inc., Tokyo
Instructions: ftp://sup.jp.netbsd.org/pub/NetBSD/sup/README.sup

Norway

sup.no.netbsd.org
Norwegian University of Science and Technology
Instructions: See /usr/src/share/examples/supfiles/sup.no.netbsd.org

UK

sup.uk.netbsd.org
Domino, London
Instructions: See ftp://ftp.netbsd.org/pub/NetBSD/sup/README.sup

USA

sup.netbsd.org
Silicon Valley, California
Instructions: See ftp://ftp.netbsd.org/pub/NetBSD/sup/README.sup

ftp.cs.umn.edu
University of Minnesota
Instructions: hostbase=/ftp/ftp/packages/NetBSD, collections are the same as on sup.NetBSD.ORG

WWW mirrors

Australia

www.au.netbsd.org
RMIT University, Melbourne
http://www.au.netbsd.org/

Austria

www.at.netbsd.org
University of Technology, Vienna
http://www.at.netbsd.org/

Finland

www.fi.netbsd.org
Global Wire Oy, Lappeenranta
http://www.fi.netbsd.org/

France

www.fr.netbsd.org
Paris University
http://www.fr.netbsd.org/

Germany

www.de.netbsd.org
http://www.de.netbsd.org/

Japan

www.jp.netbsd.org
Internet Research Institute Inc., Tokyo
http://www.jp.netbsd.org/

Norway

www.no.netbsd.org
Bergen IT Consult AS
http://www.no.netbsd.org/

USA

www.netbsd.org
Western Washington State University
http://www.netbsd.org/

www2.us.netbsd.org
New York
http://www.us.netbsd.org/

NetBSD 1.4.1 Release Contents

The root directory of the NetBSD 1.4.1 release is organized as follows:

`.../NetBSD-1.4.1/`

`BUGS` Known bugs list (somewhat incomplete and out of date).

`CHANGES` Changes since earlier NetBSD releases.

`LAST_MINUTE` Last minute changes.

`MIRRORS` A list of sites that mirror the NetBSD 1.4.1 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 1.4.1 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 (i.e. the 'domestic' portion) that may be subject to export regulations of the United States. 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:

secrsrc.tgz: This set contains the "domestic" sources. These sources may be subject to United States export regulations.
421K gzipped, 2M uncompressed

gnusrc.tgz: This set contains the "gnu" sources, including the source for the compiler, assembler, groff, and the other GNU utilities in the binary distribution sets.
19M gzipped, 84.2M uncompressed

syssrc.tgz: This set contains the sources to the NetBSD 1.4.1 kernel, config(8), and dbsym(8).
13.5M gzipped, 66.7M uncompressed

sharesrc.tgz: 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.
3M gzipped, 11.9M uncompressed

src.tgz: This set contains all of the NetBSD 1.4.1 sources which are not mentioned above.
16.1M gzipped, 73.6M uncompressed

Most of the above source sets are located in the `source/sets` subdirectory of the distribution tree. The secrsrc.tgz set is contained in the `source/security` subdirectory. This set, which is available only to users in the United States and Canada, contains the sources normally found in `/usr/src/domestic` – primarily kerberos and other cryptographic security related software. (Remember, because of United States law, it may not be legal to distribute this set to locations outside of the United States and Canada.)

The source sets are distributed as compressed tar files. They may be unpacked into `/usr/src` with the command:

```
cat set_name.tgz | gunzip | (cd /; tar xpf - )
```

The `sets/Split/` and `security/Split/` subdirectories contain 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 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.?? | gunzip | (cd /; tar xpf - )
```

In each of the source distribution set directories, there is a file named `CKSUMS` which contains the checksums of the files in that directory, as generated by the `cksum`(1) utility. You can use cksum to check the integrity of the archives, if you suspect that one of the files is corrupt and have access to a cksum binary. Checksums based on other algorithms may also be present – see the `release`(7) man page for details.

NetBSD/sparc Subdirectory Structure

The sparc-specific portion of the NetBSD 1.4.1 release is found in the `sparc` subdirectory of the distribution:

`.../NetBSD-1.4.1/sparc/`

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

`binary/`

`sets/`	sparc binary distribution sets; see below.
`kernel/`	Base GENERIC kernels.
`security/`	sparc security distribution; see below.

`installation/`

`miniroot/`	Sparc miniroot boot-image.
`netboot/`	Server boot-file image for diskless machines.
`misc/`	Statically-linked versions of gzip (GNU gzip) and gtar (GNU tar).

Binary Distribution Sets

The NetBSD sparc binary distribution sets contain the binaries which comprise the NetBSD 1.4.1 release for the sparc. There are eight binary distribution sets and the *security* distribution set. The binary distribution sets can be found in the `sparc/binary/sets` subdirectory of the NetBSD 1.4.1 distribution tree, and are as follows:

base The NetBSD 1.4.1 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.
11.9M gzipped, 33.4M 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.
9.6M gzipped, 31.8M 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. (If you are upgrading, it's recommended that you get a copy of this set and *carefully* upgrade your configuration files by hand.)
60K gzipped, 350K uncompressed

games This set includes the games and their manual pages.
2.9M gzipped, 7.3M uncompressed

kern This set contains a NetBSD/sparc 1.4.1 GENERIC kernel, named `/netbsd`. You *must* install this distribution set.
2.9M gzipped, 6.7M 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.
4M gzipped, 16.0M uncompressed

misc This set includes the (rather large) system dictionaries, the typesettable document set, and other files from `/usr/share`.
2.2M gzipped, 8.4M uncompressed

text This set includes NetBSD's text processing tools, including `groff`(1), all related programs, and their manual pages.
1.4M gzipped, 4.8M uncompressed

The sparc security distribution set is named **secr** and can be found in the

`sparc/binary/security`

subdirectory of the NetBSD 1.4.1 distribution tree. It contains security-related binaries which depend on cryptographic source code. You do not need this distribution set to use encrypted passwords in your password file; the **base** distribution includes a crypt library which can perform only the one-way encryption function. The security distribution includes a version of the Kerberos IV network security system, and a Kerberized version of `telnet`(1) program. The **secr** distribution set can be found only on those sites which carry the complete NetBSD distribution and which can legally obtain it. Because of United States law, it may not be legal to distribute this set to locations outside of the United States and Canada.

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 3.3.3.1. 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.
2.7M gzipped, 8.6M uncompressed

xcomp The extra libraries and include files needed to compile X source code.
1.7M gzipped, 7.4M uncompressed

xcontrib Programs that were contributed to X.
205k gzipped, 750k uncompressed

xfont Fonts needed by X.
5.7M gzipped, 7.0M uncompressed

xserver The Xsun, Xsun24, XsunMono and Xprt servers with man pages.
3.3M gzipped, 8.4M 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 files are /-relative and therefore are extracted *below* the current directory. That is, if you want to extract the binaries into your system, i.e. replace the system binaries with them, you have to run the **`tar xfp`** command from /.

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:

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

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

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

All SYSVSUM files are 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 System Requirements and Supported Devices

NetBSD/sparc 1.4.1 runs on the following classes of machines:
- sun4c (e.g. the SS1, SS1+, SS2, IPC, ELC, IPX, and SLC)
- sun4 (e.g. the 4/100, 4/200, and 4/300 – note that support for the 4/400 processor is incomplete)
- sun4m (e.g. Classic, LX, SS4, SS5, SS10, and SS20)

NetBSD/sparc 1.4.1 does *not* run on these machines (yet):
- sun-4/400 (lacking support for the I/O cache, and has ethernet problems)
- sun4d (e.g. sparc center 2000)
- sun4u (e.g. Ultrasparcs)

The minimal configuration requires 4M of RAM and ˜60M 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. (NetBSD with 4M of RAM feels like Solaris with 4M of RAM.) Note that until you have around 16M of RAM, getting more RAM is more important than getting a faster CPU.)

Supported devices include:

sun4c/sun4m sbus video:
cgsix, cgthree, and bwtwo frame buffers
cgfourteen and tcx frame buffers (limited "emulation" mode)

sun4 video (not thoroughly tested?):
P4 on-board bwtwo, and VME cgtwo card

serial ports:
ttya and ttyb (can be used as console if needed)

ethernet:
on-board AMD Lance ethernet ("le0"),
Sbus AMD Lance ethernet cards,
on-board Intel 82586 ethernet (ie0 on 4/100's and 4/200's),
VME Intel 82586 ethernet cards

SCSI: on-board "esp" SCSI controller (sun4c, sun4m and the 4/300),
sbus "esp" SCSI controller,
Sun "SUN-3"/"si" VME SCSI controller (polled mode only, slow),
Sun "SCSI Weird"/"sw" on-board controller (4/110 only, polled)

VME disks:
Xylogics 7053 VME/SMD disk controller ("xd"),
Xylogics 450/451 VME disk controller ("xy")
[note: VME/IPI disks are not supported]

sun floppy disk drive

sun keyboard and mouse

sun4c audio

sun4m audio on Sparcstation Classic

Hardware the we do NOT currently support, but get many questions about:
- multiprocessor sun4m machines
- audio drivers for sun4m machines (other than the Sparcstation Classic)
- interrupt driven SCSI driver for sun-4/100's and sun-4/200's

Getting the NetBSD System on to Useful Media

Installation is supported from several media types, including:

- CDROM
- DOS Floppy
- Tape
- Remote NFS partition
- FTP

Note that, if you are installing or upgrading from a writable media, the media can be write-protected if you wish. These systems mount a root image from inside the kernel, and will not need to write to the media.

The distribution sets for installation or upgrade depend on which installation medium you choose. The steps for the various media are outlined below.

- To install or upgrade NetBSD using CDROM, you need to do the following:

  Find out where the distribution set files are on the CDROM.

  Proceed to the instruction on installation.

- To install or upgrade NetBSD using DOS floppies, you need to do the following:

  Count the number of "set_name.xx" files that make up the distribution sets you want to install or upgrade. You will need that number of 1.44M floppies.

  Format all of the floppies with DOS. DO NOT make any of them bootable DOS floppies. (If the floppies are bootable, then the 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 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 DOS disks.

Once you have the files on 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.

- To install or upgrade NetBSD using a tape, you need to do the following:

  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 UN∗X-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-1.4.1          # the top of the tree
  cd sparc/binary
  ```

  And then:

  ```
  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.

- To install or upgrade NetBSD using a remote partition, mounted via NFS, you must do the following:

  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.

  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 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.

- To install or upgrade NetBSD by using FTP to get the installation sets, you must do the following:

  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.

  The preparations for this installation/upgrade method are easy; all you make sure that there's some 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.

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.

- 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. Please note that the /dev on the floppy used for upgrades only knows about wd0, wd1, sd0, sd1 and sd2. If you have more than two IDE drives or more than three SCSI drives, you should take care not to place the sets on the high numbered drives.

  At a bare minimum, you must upgrade the "base" binary distribution, and so must put the "base" set somewhere in your file system. If you wish, you can do the other sets, as well, but you should NOT upgrade the "etc" distribution; the "etc" distribution 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

Before you start you might need to consider your disk configuration to sort out a quirk in SCSI-ID to SD-UNIT mapping that exists on Sun Sparcstations.

Upon leaving the factory, SunOS and the OpenBOOT ROM map according to this table:

SCSI-ID	*SunOS SD-Unit*
0	sd3
1	sd1
2	sd2
3	sd0
4	sd4
5	sd5
6	sd6

Unlike SunOS and the OpenBOOT ROM, a generic NetBSD kernel numbers scsi drives sequentially as it finds them. The drive with the lowest scsi-id will be called sd0, the next one sd1, etc.

To ease the installation process, the default NetBSD kernel in the distribution is setup to match the Sun mapping above by hard-wiring scsi-id#3 to sd0 and scsi-id#0 to sd3. The remaining drives will be dynamically mapped to other sd* numbers.

A truely generic NetBSD kernel is also provided as '/netbsd.GENERIC', which will do the standard NetBSD probe ordering. If your configuration differs from the default Sun setup, you can try to use this kernel to complete the installation.

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

Your OpenBOOT ROM may need some setup. make sure you boot from 'new command mode'. If your machine comes up and gives you a '>' prompt instead of 'ok', type:

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

This is needed because the NetBSD kernel relies on functionality provided by OpenBOOT ROMs -- the ability to pass down Forth commands and have them executed in the ROM -- that appears to go away when the OpenBOOT ROM operates in 'old monitor compatibility' mode.

Also, you cannot use the security modes of the sparc OpenBOOT ROM.

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

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 on.

Asumming a classic partition scheme with root ('/') and /usr filesystems, a comfortable size for the NetBSD root filesystem partition is about 20MB; 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 60MB in '/usr'.

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. The 'le' driver supports automatic detection of the port which is actually connected to the wire.

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/AUI'' to select the AUI connector, or ''10baseT/UTP'' to select the UTP connector.

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 a disk. The easiest way in terms of preliminary setup is to use the NetBSD miniroot that can be booted off your local disk's swap partition. Alternatively, if your Sparcstation is hooked up in a network you can find a server and arrange for a diskless setup which is a convenient way to install on a machine whose disk does not currently hold a usable operating system (see the section 'Installing NetBSD by using a diskless setup' below). There is also a bootable 1.4MB floppy available that contains a slightly less featureful miniroot environment.

Installing NetBSD by using the NetBSD miniroot.

The miniroot is a self-contained NetBSD filesystem holding all utilities necessary to install NetBSD on a local disk. It is distributed as a plain file designed to be transferred to a raw disk partition from which it can be booted using the appropriate PROM command. Usually, the miniroot will be loaded into the swap partition of a disk. If needed, you can use any other unused partition, but remember that the partition will then not available during the installation process.

Loading the miniroot onto your raw partition is simple. On NetBSD as well as SunOS you use a command like:

```
# dd if=miniroot-1.4.1.fs of=/dev/rsd0b bs=20b conv=sync
```

(Here, '/dev/rsd0b' is assumed to be your swap partition.) There's a potential problem here if /dev/rsd0b is actually in use as a swap partition by your currently running system. If you don't have another disk or partition to spare, you can usually get away with running this command anyway after first booting into single-user mode to ensure a quiet system.

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

```
# halt
```

Then boot the miniroot by typing the appropriate command at the PROM:

```
> b sd(,,1)netbsd -s              # for sun4 monitors
ok boot sd(,,1)netbsd -s          # for version 1 OpenBOOT ROMs
ok boot disk:b netbsd -s          # for version 2 OpenBOOT ROMs
```

If you've loaded the miniroot onto some other disk than 'sd0' adapt the boot specifier accordingly, e.g.:

```
ok boot disk1:b netbsd -s
```

to boot from SCSI disk target 1 from a version 2 OpenBOOT ROM. If you have to use the old-style **sd(***c*,*u*,*p***)** syntax to boot from a SCSI disk, you can calculate the parameters as follows:

c specifies the controller number

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).

The monitor boot command will cause the NetBSD kernel contained in the miniroot image to be booted. 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 floppy.

The NetBSD install floppy works only on the sun4c and sun4m class machines. From the OpenBOOT prompt, the following should boot the floppy.

```
ok boot fd(,,1)                   # for version 1 OpenBOOT ROMs
ok boot /fd                       # either of these for version
ok boot floppy                    # 2 OpenBOOT ROMs
```

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 diskless setup.

First, you must setup a diskless client configuration on a server. 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, you'll have to consult documentation that came with it. (On SunOS systems, add_client(8) is a good start.)

Your Sparcstation expects to be able to download a second stage bootstrap program via TFTP after having acquired its IP address through RevARP when instructed to boot "over the net". It will look for a filename composed of the machine's IP address followed by the machine's architecture, separated by a period. For example, a sun4c machine which has been assigned IP address 130.115.144.11, will make an TFTP request for '8273900B.SUN4C'. Normally, this file is a symbolic link to an appropriate second-stage boot 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). You can find the boot program in `/usr/mdec/boot.net` in the NetBSD/sparc distribution.

Note The only difference between `/usr/mdec/boot.net` and `/usr/mdec/boot` is in the a.out header, which has been magically transformed in a way that makes it usable on all versions of Sparc PROMs.

After the boot program has been loaded into memory and given control by the PROM, it starts locating the machine's remote root directory through the BOOTPARAM protocol. First a BOOTPARAM WHOAMI request is broadcast on the local net. The answer to this request (if it comes in) contains the client's name. This name is used in next step, a BOOTPARAM GETFILE request -- sent to the server that responded to the WHOAMI request -- requesting the name and address of the machine that will serve the client's root directory, as well as the path of the client's root on that server.

Finally, this information (if it comes in) is used to issue a REMOTE MOUNT request to the client's root filesystem server, asking for an NFS file handle corresponding to the root filesystem. If successful, the boot program starts reading from the remote root filesystem in search of the kernel which is then read into memory.

As noted above in the section `Preparing your System for NetBSD Installation` you have several options when choosing a location to store the installation filesets. However, the easiest way is to put the `*.tar.gz` files you want to install into the root directory for your client on the server.

Next, unpack 'base.tar.gz' and 'etc.tar.gz' on the server in the root directory for your machine. If you elect to use a separately NFS-mounted filesystem for '/usr' with your diskless setup, make sure the "./usr" base files in base.tar.gz end up in the correct location. One way to do this is to temporarily use a loopback mount on the server, re-routing *root*`/usr` to your server's exported NetBSD `/usr` directory. Also put the kernel and the install/upgrade scripts into the root directory.

A few configuration files need to be edited:

root`/etc/hosts`
: Add the IP addresses of both server and client.

root`/etc/myname`
: This files contains the client's hostname; use the same name as in <root>/etc/hosts.

root`/etc/fstab`
: Enter the entries for the remotely mounted filesystems. For example:

```
server:/export/root/client / nfs rw 0 0
server:/export/exec/sun4.netbsd /usr nfs rw 0 0
```

Now you must populate the the '/dev' directory for your client. If yoarserver runs SunOS 4.x, you can simply change your working directory to *root*`/dev` and run the MAKEDEV script: **`sh MAKEDEV all`**.

On SunOS 5.x systems, MAKEDEV can also be used, but there'll be error messages about unknown user and groups. These errors are inconsequential for the purpose of installing NetBSD. However, you may want to correct them if you plan to use the diskless setup regularly. In that case, you may re-run MAKEDEV on your NetBSD machine once it has booted.

Boot your workstation 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:

```
> b le()netbsd -s              # for sun4 monitors
ok boot le()netbsd -s          # for version 1 OpenBOOT ROMs
ok boot net netbsd -s          # for version 2 OpenBOOT ROMs
```

This will boot the NetBSD kernel in single-user mode.

Note The latter two examples assume you operate the OpenBOOT ROM in "new command mode". If your machine comes up and gives you a '>' prompt instead of 'ok', type:

```
>n                                    # enter native OpenBOOT
mode
ok setenv sunmon-compat? false        # make it permanent
ok
```

If you use a diskless setup with a separately NFS-mounted /usr filesystem, mount `/usr` by hand now:

```
netbsd# mount /usr
```

NOTE: For floppy installs, the text editor provided is ed. For miniroot installs, the text editor is vi. When using `disklabel`(8) to edit disklabels the -e switch will invoke the editor on the label. The -i switch will run an interactive session.

At this point, it's worth checking the disk label and partition sizes on the disk you want to install NetBSD onto. NetBSD understands SunOS-style disklabels, so if your disk was previously used by SunOS there will be a usable label on it. Use 'disklabel -e <disk>' or 'disklabel -i <disk>' (where <disk> is the device name assigned by the NetBSD kernel, e.g. 'sd0') to view and modify the partition sizes. See the section **Preparing your System for NetBSD Installation** above for suggestions about disk partition sizes.

If you are installing on a SCSI disk that does *not* have a SunOS or NetBSD label on it, you may still be able to use disklabel(8) but you'll have to create all partitions from scratch. If your disk is listed in '/etc/disktab', you may use the entry (which in most cases only defines a 'c' partition to describe the whole disk) to put an initial label on the disk. Then proceed with 'disklabel -e <disk>' or 'disklabel -i <disk>' to create a partition layout that suits your needs.

Note Because of the built-in compatibility with SunOS-style labels, *Always make sure all your partitions start and end on cylinder boundaries.*

Here follows an example of what you'll see while in the dislabel editor. Do not touch any of the parameters except for the 'label: ' entry and the actual partition size information at the bottom (the lines starting with 'a:', 'b:', ...).

The size and offset fields are given in sector units. Be sure to make these numbers multiples of the of the number of sectors per cylinder: the kernel might be picky about these things, but aside from this you'll have the least chance of wasting disk space. Partitions on which you intend to have a mountable filesystem, should be given fstype '4.2BSD'. Remember, the 'c' partition should describe the whole disk. The '(Cyl. x - y)' info that appears after the hash ('#') character is treated as a comment and need not be filled in when altering partitions.

Note The line containing '8 partitions:' is best left alone, even if you define less then eight partitions. If this line displays a different number and the program complains about it (after you leave the editor), then try setting it to '8 partitions:'.

Sample Disklabel Screen

```
netbsd# disklabel sd2
 # /dev/rsd2c:
type: SCSI
disk: SCSI disk
label: Hold Your Breath
flags:
bytes/sector: 512
sectors/track: 64
tracks/cylinder: 7
sectors/cylinder: 448
cylinders: 1429
rpm: 3600
interleave: 1
trackskew: 0
cylinderskew: 0
headswitch: 0            # milliseconds
track-to-track seek: 0   # milliseconds
drivedata: 0

8 partitions:
```

```
#        size   offset    fstype [fsz bsz cpg]
  a:    50176        0    4.2BSD   0   0   0   # (Cyl.    0 - 111)
  b:    64512    50176      swap               # (Cyl.  112 - 255)
  c:   640192        0   unknown               # (Cyl.    0 - 1428)
  d:   525504   114688    4.2BSD   0   0   0   # (Cyl.  256 - 1428)
```

If you are upgrading a NetBSD installation, start the upgrade script:

netbsd# **sh upgrade.sh**

else, start the installation script:

netbsd# **sh install.sh**

Running the installation scripts.

The installation scripts will do most of the work of transferring the system from the distribution sets onto your disk. You will frequently be asked for confirmation before the script 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 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.

The installation script goes through the following phases:

- determination of the disk to install NetBSD on
- checking of the partition information on the disk
- creating and mounting the NetBSD filesystems
- setup of IP configuration
- extraction of the distribution tar files
- installation of boot programs

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

netbsd# **mount -u /dev/sd0a /**

The Sun monitor might have been setup to instruct the boot program to load a file called "vmunix". On OpenBOOT ROM systems you can change it to load "netbsd" instead using the following commands:

On version 1 OpenBOOT ROMs:

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

On version 2 OpenBOOT ROMs:

```
ok setenv boot-file netbsd
ok setenv boot-device /sbus/esp/sd@0,0
```

Congratulations, you have successfully installed NetBSD 1.4.1.

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 propperly configured state, with the most important ones described below.

1. Configuring `/etc/rc.conf`

   If you haven't done any configuration of `/etc/rc.conf`, 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 filesystem mounted read-write. When the system asks you to choose a shell, simply hit return to get to a prompt. If you are asked for a terminal type, respond with **vt220** (or whatever is appropriate for your terminal type) and hit return. At this point, you need to configure at least one file in the /etc directory. 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. If your /usr directory is on a separate partition and you do not know how to use 'ed' or 'ex', you will have to mount your /usr partition to gain access to 'vi'. Do the following:

```
mount /usr
export TERM=vt220
```

If you have /var on a seperate 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 interface <int>, along the lines of

```
ifconfig_de0="inet 123.45.67.89 netmask 255.255.255.0"
```

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

```
ifconfig_de0="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 are new to NetBSD 1.4 and 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. There is no initial password, but 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.

3. Adding accounts

   Use the vipw(8) command to add accounts to your system, *do not* edit /etc/passwd directly. See adduser(8) for more information on the process of 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 3rd party packages

   There is a lot of software freely available for Unix-based systems, almost all of which can run on NetBSD. Modifications are usually needed to when transferring programs between different Unix-like systems, so the NetBSD packages collection incorporates any such changes necessary to make that software run on NetBSD, and makes the installation (and deinstallation) of the software packages easy. There's also the option of building a package from source, in case there's no precompiled binary available.

   Precompiled binaries can be found at

   ftp://ftp.netbsd.org/pub/NetBSD/packages/

   Package sources for compiling packages can be obtained by retrieving the file

   ftp://ftp.netbsd.org/pub/NetBSD/NetBSD-current/tar_files/pkgsrc.tar.gz

and extracting it into `/usr/pkgsrc`. See `/usr/pkgsrc/README` then for more information.

6. Misc

   - To adjust the system to your local timezone, point the `/etc/localtime` symlink to the appropriate file under `/usr/share/zoneinfo`.
   - Edit `/etc/aliases` to forward root mail to the right place (run `newaliases`(1) afterwards.)
   - The `/etc/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` *`filename`*
     is likely to give you more information on these files.

Upgrading a previously-installed NetBSD System

To upgrade to NetBSD _VER from a previous version follow the instructions in the section **Installing NetBSD**, but run the script `upgrade.sh` instead of `install.sh`.

The upgrade script will use the existing disk partitions to install the new system in, and also preserves the files in `/etc`.

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 1.4.1

Note Only issues effecting an upgrade from NetBSD 1.3 or NetBSD 1.3.x are decribed here.

- "machine" directory/link in "/usr/include"

  Description
  Some architecture may fail to install the **`comp`** set because the
  `/usr/include/machine`
  directory changed to a symbolic link in NetBSD 1.4.

  Fix If this happens, you can use the command
  `#` **`rm -r /usr/include/machine`**
  to remove the old directory and it contents and reinstall the **`comp`** set.

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),
- `apropros`(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)m 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. 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 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.

Thanks go to

- The former members of UCB's Computer Systems Research Group, including (but not limited to):

  Keith Bostic
  Ralph Campbell
  Mike Karels
  Marshall Kirk McKusick

  for their ongoing work on BSD systems, support, and encouragement.

- Also, our thanks go to:

  Mike Hibler
  Rick Macklem
  Jan-Simon Pendry
  Chris Torek

  for answering lots of questions, fixing bugs, and doing the various work they've done.

- UC Berkeley's Experimental Computing Facility provided a home for sun-lamp in the past, people to look after it, and a sense of humor. Rob Robertson, too, has added his unique sense of humor to things, and for a long time provided the primary FTP site for NetBSD.

- Vixie Enterprises for hosting the NetBSD FTP and SUP server.
- Redback Networks, Inc. for hosting the NetBSD Mail server.
- Without CVS, this project would be impossible to manage, so our hats go off to Brian Berliner, Jeff Polk, and the various other people who've had a hand in making CVS a useful tool.
- Dave Burgess `burgess@cynjut.infonet.net` has been maintaining the 386BSD/NetBSD/FreeBSD FAQ for quite some time, and deserves to be recognized for it.
- The following individuals and organiztions (each in alphabetical order) have made donations or loans of hardware and/or money, to support NetBSD development, and deserve credit for it:

  Jason Birnschein
  Jason Brazile
  David Brownlee
  Simon Burge
  Dave Burgess
  Ralph Campbell
  Brian Carlstrom
  James Chacon
  Bill Coldwell
  Charles Conn
  Tom Coulter
  Charles D. Cranor
  Christopher G. Demetriou
  Scott Ellis
  Hubert Feyrer
  Greg Gingerich
  Guenther Grau
  Ross Harvey
  Charles M. Hannum
  Michael L. Hitch
  Jordan K. Hubbard
  Scott Kaplan
  Noah M. Keiserman
  Chris Legrow
  Neil J. McRae
  Perry E. Metzger
  Herb Peyerl
  Mike Price
  Thor Lancelot Simon
  Bill Sommerfeld
  Paul Southworth
  Ted Spradley
  Kimmo Suominen
  Jason R. Thorpe
  Steve Wadlow

  Advanced System Products, Inc.
  Avalon Computer Systems
  Bay Area Internet Solutions
  Canada Connect Corporation

Demon Internet, UK
Digital Equipment Corporation
Easynet, UK
Free Hardware Foundation
Innovation Development Enterprises of America
Internet Software Consortium
MS Macro System GmbH, Germany
Numerical Aerospace Simulation Facility, NASA Ames Research Center
Piermont Information Systems Inc.
VMC Harald Frank, Germany

(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.)

- Finally, we thank all of the people who've put sweat and tears into developing NetBSD since its inception in January, 1993. (Obviously, there are a lot more people who deserve thanks here. If you're one of them, and would like to mentioned, tell us!)

We are...

(in alphabetical order)

The NetBSD core group:

Paul Kranenburg	`pk@NetBSD.ORG`
Scott Reynolds	`scottr@NetBSD.ORG`
Christos Zoulas	`christos@NetBSD.ORG`

The portmasters (and their ports):

Mark Brinicombe	`mark@NetBSD.ORG`	**arm32**
Jeremy Cooper	`jeremy@NetBSD.ORG`	**sun3x**
Ross Harvey	`ross@NetBSD.ORG`	**alpha**
Ignatios Souvatzis	`is@NetBSD.ORG`	**amiga**
Eduardo Horvath	`eeh@NetBSD.ORG`	**sparc64**
Paul Kranenburg	`pk@NetBSD.ORG`	**sparc**
Anders Magnusson	`ragge@NetBSD.ORG`	**vax**
Tsubai Masanari	`tsubai@NetBSD.ORG`	**macppc**
Tsubai Masanari	`tsubai@NetBSD.ORG`	**newsmips**
Minoura Makoto	`minoura@NetBSD.ORG`	**x68k**
Phil Nelson	`phil@NetBSD.ORG`	**pc532**
Scott Reynolds	`scottr@NetBSD.ORG`	**mac68k**
Darrin Jewell	`dbj@NetBSD.ORG`	**next68k**
Gordon Ross	`gwr@NetBSD.ORG`	**sun3, sun3x**
Kazuki Sakamoto	`sakamoto@NetBSD.ORG`	**bebox**
Wolfgang Solfrank	`ws@NetBSD.ORG`	**powerpc**
Jonathan Stone	`jonathan@NetBSD.ORG`	**pmax**
Jason Thorpe	`thorpej@NetBSD.ORG`	**hp300**
Frank van der Linden	`fvdl@NetBSD.ORG`	**i386**
Leo Weppelman	`leo@NetBSD.ORG`	**atari**
Steve Woodford	`scw@NetBSD.ORG`	**mvme68k**

The NetBSD 1.4.1 Release Engineering team:

Ted Lemon	mellon@NetBSD.ORG
Perry Metzger	perry@NetBSD.ORG
Curt Sampson	cjs@NetBSD.ORG

Developers and other contributors:

Steve Allen	wormey@NetBSD.ORG
Lennart Augustsson	augustss@NetBSD.ORG
Christoph Badura	bad@NetBSD.ORG
Manuel Bouyer	bouyer@NetBSD.ORG
Robert V. Baron	rvb@NetBSD.ORG
John Brezak	brezak@NetBSD.ORG
Allen Briggs	briggs@NetBSD.ORG
Aaron Brown	abrown@NetBSD.ORG
David Brownlee	abs@NetBSD.ORG
Simon Burge	simonb@NetBSD.ORG
Dave Burgess	burgess@cynjut.infonet.net
Dave Carrel	carrel@NetBSD.ORG
Bill Coldwell	billc@NetBSD.ORG
Chuck Cranor	chuck@NetBSD.ORG
Alistair Crooks	agc@NetBSD.ORG
Aidan Cully	aidan@NetBSD.ORG
Rob Deker	deker@NetBSD.ORG
Chris G. Demetriou	cgd@NetBSD.ORG
Matthias Drochner	drochner@NetBSD.ORG
Enami Tsugutomo	enami@NetBSD.ORG
Bernd Ernesti	veego@NetBSD.ORG
Erik Fair	fair@NetBSD.ORG
Hubert Feyrer	hubertf@NetBSD.ORG
Thorsten Frueauf	frueauf@NetBSD.ORG
Brian R. Gaeke	brg@dgate.org
Thomas Gerner	thomas@NetBSD.ORG
Justin Gibbs	gibbs@NetBSD.ORG
Adam Glass	glass@NetBSD.ORG
Michael Graff	explorer@NetBSD.ORG
Brad Grantham	grantham@tenon.com
Matthew Green	mrg@NetBSD.ORG
Juergen Hannken-Illjes	hannken@NetBSD.ORG
Charles M. Hannum	mycroft@NetBSD.ORG
Eric Haszlakiewicz	erh@NetBSD.ORG
Michael L. Hitch	osymh@NetBSD.ORG
Ken Hornstein	kenh@NetBSD.ORG
Marc Horowitz	marc@NetBSD.ORG
ITOH Yasufumi	itohy@NetBSD.ORG
Matthew Jacob	mjacob@NetBSD.ORG
Lonhyn T. Jasinskyj	lonhyn@NetBSD.ORG
Darrin Jewell	dbj@NetBSD.ORG

Lawrence Kesteloot	kesteloo@cs.unc.edu
Klaus Klein	kleink@NetBSD.ORG
John Kohl	jtk@NetBSD.ORG
Kevin Lahey	kml@NetBSD.ORG
Ted Lemon	mellon@NetBSD.ORG
Mike Long	mikel@NetBSD.ORG
Paul Mackerras	paulus@NetBSD.ORG
Neil J. McRae	neil@NetBSD.ORG
Perry Metzger	perry@NetBSD.ORG
Luke Mewburn	lukem@NetBSD.ORG
der Mouse	mouse@NetBSD.ORG
Tohru Nishimura	nisimura@NetBSD.ORG
Masaru Oki	oki@NetBSD.ORG
Greg Oster	oster@NetBSD.ORG
Herb Peyerl	hpeyerl@NetBSD.ORG
Matthias Pfaller	matthias@NetBSD.ORG
Dante Profeta	dante@NetBSD.ORG
Chris Provenzano	proven@NetBSD.ORG
Darren Reed	darrenr@NetBSD.ORG
Tim Rightnour	garbled@NetBSD.ORG
Heiko W. Rupp	hwr@NetBSD.ORG
SAITOH Masanobu	msaitoh@NetBSD.ORG
Kazuki Sakamoto	sakamoto@NetBSD.ORG
Curt Sampson	cjs@NetBSD.ORG
Wilfredo Sanchez	wsanchez@NetBSD.ORG
Ty Sarna	tsarna@NetBSD.ORG
Matthias Scheler	tron@NetBSD.ORG
Karl Schilke (rAT)	rat@NetBSD.ORG
Tim Shepard	shep@NetBSD.ORG
Chuck Silvers	chs@NetBSD.ORG
Thor Lancelot Simon	tls@NetBSD.ORG
Noriyuki Soda	soda@NetBSD.ORG
Wolfgang Solfrank	ws@NetBSD.ORG
Bill Sommerfeld	sommerfeld@NetBSD.ORG
Ignatios Souvatzis	is@NetBSD.ORG
Bill Studenmund	wrstuden@NetBSD.ORG
Kevin Sullivan	sullivan@NetBSD.ORG
Kimmo Suominen	kim@NetBSD.ORG
Matt Thomas	matt@NetBSD.ORG
Jason Thorpe	thorpej@NetBSD.ORG
Christoph Toshok	toshok@NetBSD.ORG
Todd Vierling	tv@NetBSD.ORG
Paul Vixie	vixie@NetBSD.ORG
Krister Walfridsson	kristerw@NetBSD.ORG
Nathan Williams	nathanw@NetBSD.ORG
Colin Wood	ender@NetBSD.ORG

Legal Mumbo-Jumbo

The following notices are required to satisfy the license terms of the software that we have mentioned in this document:

This product includes software developed by the University of California, Berkeley and its contributors.

This product includes software developed by the Computer Systems Engineering Group at Lawrence Berkeley Laboratory.

This product includes software developed by the NetBSD Foundation, Inc. and its contributors.

This product includes software developed by Adam Glass and Charles Hannum.

This product includes software developed by Adam Glass.

This product includes software developed by Berkeley Software Design, Inc.

This product includes software developed by Charles D. Cranor and Washington University.

This product includes software developed by Charles D. Cranor.

This product includes software developed by Charles Hannum, by the University of Vermont and State Agricultural College and Garrett A. Wollman, by William F. Jolitz, and by the University of California, Berkeley, Lawrence Berkeley Laboratory, and its contributors.

This product includes software developed by Charles Hannum.

This product includes software developed by Charles M. Hannum.

This product includes software developed by Chris Provenzano.

This product includes software developed by Christian E. Hopps.

This product includes software developed by Christopher G. Demetriou for the NetBSD Project.

This product includes software developed by Christopher G. Demetriou.

This product includes software developed by Christos Zoulas.

This product includes software developed by David Jones and Gordon Ross.

This product includes software developed by Dean Huxley.

This product includes software developed by Eric S. Hvozda.

This product includes software developed by Ezra Story.

This product includes software developed by Gordon Ross.

This product includes software developed by Gordon W. Ross and Leo Weppelman.

This product includes software developed by Gordon W. Ross.

This product includes software developed by Herb Peyerl.

This product includes software developed by Ian W. Dall.

This product includes software developed by Ignatios Souvatzis for the NetBSD Project.

This product includes software developed by Jason R. Thorpe for And Communications, http://www.and.com/.

This product includes software developed by Joachim Koenig-Baltes.

This product includes software developed by Jochen Pohl for The NetBSD Project.

This product includes software developed by John Polstra.

This product includes software developed by Jonathan Stone and Jason R. Thorpe for the NetBSD Project.

This product includes software developed by Jonathan Stone for the NetBSD Project.

This product includes software developed by Jonathan Stone.

This product includes software developed by Julian Highfield.

This product includes software developed by Kenneth Stailey.

This product includes software developed by Leo Weppelman.

This product includes software developed by Lloyd Parkes.

This product includes software developed by Mark Brinicombe.

This product includes software developed by Markus Wild.

This product includes software developed by Martin Husemann and Wolfgang Solfrank.

This product includes software developed by Mats O Jansson and Charles D. Cranor.

This product includes software developed by Mats O Jansson.

This product includes software developed by Matthias Pfaller.

This product includes software developed by Paul Kranenburg.

This product includes software developed by Paul Mackerras.

This product includes software developed by Peter Galbavy.

This product includes software developed by Philip A. Nelson.

This product includes software developed by Rodney W. Grimes.

This product includes software developed by Scott Bartram.

This product includes software developed by SigmaSoft, Th. Lockert.

This product includes software developed by Terrence R. Lambert.

This product includes software developed by Theo de Raadt and John Brezak.

This product includes software developed by Theo de Raadt.

This product includes software developed by TooLs GmbH.

This product includes software developed by Winning Strategies, Inc.

This product includes software developed by the Center for Software Science at the University of Utah.

This product includes software developed by the University of Calgary Department of Computer Science and its contributors.

This product includes software developed by the University of Vermont and State Agricultural College and Garrett A. Wollman.

This product includes software developed for the FreeBSD project.

This product includes software developed for the Internet Software Consortium by Ted Lemon.

This product includes software developed for the NetBSD Project by Frank van der Linden.

This product includes software developed for the NetBSD Project by Jason R. Thorpe.

This product includes software developed for the NetBSD Project by John M. Vinopal.

This product includes software developed for the NetBSD Project by Matthias Drochner.

This product includes software developed for the NetBSD Project by Matthieu Herrb.

This product includes software developed for the NetBSD Project by Perry E. Metzger.

This product includes software developed for the NetBSD Project by Piermont Information Systems Inc.

This product includes software developed for the NetBSD Project by Ted Lemon.

This product includes software developed by LAN Media Corporation and its contributors.

This product includes software developed by Michael Graff for the NetBSD Project.

This product includes software developed by the Alice Group.

This product includes software developed by Charles D. Cranor.

This product includes software developed by Peter Galbavy.

This product includes software developed by Rolf Grossmann.

This product includes software developed by David Miller.

This product includes software developed by Gordon W. Ross.

This product includes software developed by Charles Hannum, by the University of Vermont and State Agricultural College and Garrett A. Wollman, by William F. Jolitz, and by the University of California, Berkeley, Lawrence Berkeley Laboratory, and its contributors.