NAME

INSTALL – Installation procedure for NetBSD/macppc

DESCRIPTION

About this Document

This document describes the installation procedure for NetBSD 1.4.3 on the *macppc* 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 1.4.3 release contains complete binary releases for fifteen different machine types. (The remaining ones 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.

Upgrade path to NetBSD 1.4.3

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 1.4.3.

NetBSD 1.4.3 is an upgrade of NetBSD 1.4.2, 1.4.1, NetBSD 1.4 and earlier major and patch releases of NetBSD such as versions 1.3.3, 1.2 etc.

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 1.4 was started are designated by version identifiers such as 1.4A, 1.4B, 1.4P etc. These identifiers do not designate releases, but indicate major changes in internal kernel APIs. Note that the kernel from NetBSD 1.4.3 can *not* be used to upgrade a system running one of those intermediate development versions. Trying to use the NetBSD 1.4.3 kernel on such a system *will* in all probability 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 1.4.3 to determine if a given feature is present or absent in 1.4.3. The development of 1.4 and the subsequent patch or ''point'' releases is done on a separate branch in the CVS repository which was created when the release cylcle for 1.4 was started, and during the release cycle of 1.4 and its patch releases, selective fixes have been imported from the main development trunk (the intent is to only import fixes with no or minor impact on the stability of the release branch). So, there are features in 1.4.3 which were not in e.g. 1.4H, but the reverse is also true.

Major Changes Between 1.4.2 and 1.4.3

The complete list of changes between NetBSD 1.4.2 and 1.4.3 can be found in the file CHANGES-1.4.3 in the top directory of the source tree. The following are the highlights only.

- A driver for the Lucent Wavelan (Orinoco) 802.11B wireless Ethernet PCMCIA card has been added, see `wi`(4).
- The PCI Cyclom-4Y and -8Y multiport serial cards are now supported.
- The Macintosh LC Ethernet Adapter is now supported.
- The on-board video on Macintosh Quadra 605 is now supported.
- Bugfixes to the Alteon Gigabit Ethernet driver, `ti`(4).
- Support for several new PCI IDE controllers have been added, see `pciide`(4.)
- The i386 port may now be installed on wd2 or wd3.
- A possible CPU hog problem related to large I/Os has been fixed. Fixes SA#2000-005.
- A denial-of-service problem related to handling of IP options has been fixed. Fixes SA#2000-002.
- A problem with /etc/ftpchroot has been fixed. Fixes SA#2000-006.
- A minor problem related to locking of semaphore resources has been fixed. Fixes SA#2000-004.
- The DHCP software has been updated to ISC 2.0pl3. This also fixes SA#2000-008 -- a security problem in the dhcp client code.
- A problem with use of user-supplied data as a format string in ftpd has been fixed. Fixes SA#2000-009.
- The sparc c++rt0.o code is now compiled with -fPIC. This means that libraries with global constructors (which must link in c++rt0.o on sparc/a.out) must also be compiled -fPIC.
- Most countries can now import the full release without restriction, including the previously restricted *domestic* portion. The only ''problem spots'' are US-embargoed countries. See
  http://www.NetBSD.ORG/Misc/crypto-export.html
  for the full details.
- An extensive audit of the code (and corresponding fixes) has been done to eliminate possible buffer overruns caused by possible user-specified format strings.

In addition, many bugs have been fixed -- more than 40 problems reported through our problem tracking system have been fixed, and some other non-reported problems have also been found and fixed. See the CHANGES-1.4.3 file for the complete list.

Known caveats with 1.4.3

The following are the major known issues with NetBSD 1.4.3.

- Some of the fixes in NetBSD 1.4.3 required the introduction of a new system call, `issetugid`(2). This means that you *will* have to upgrade the kernel before installing the new user-land code.
- The more strict format checking required a minor fix to the C compiler to allow NULL format strings. Thus, you will need to update your compiler before doing a ''make build'' during a source-based upgrade.
- PCMCIA support may require manual adjustment to function properly. See **Possible** PCMCIA **issues** under **Installing the NetBSD System** for more details.

- No major changes have been made to LFS in 1.4.3, so it is still of ''beta test'' quality.
- The version of the IPF packet filtering software in NetBSD 1.4.3 must be enabled with ''ipf -E'' before filtering rules can be set. Failure to do so may result in a panic. (Enabling NAT will however auto-enable IPF.)

Major Changes Between 1.4.1 and 1.4.2

The complete list of changes between NetBSD 1.4.1 and 1.4.2 can be found in the file CHANGES-1.4.2 in the top directory of the source tree. The following are the highlights only.

- A driver for the Alteon Gigabit Ethernet cards has been added, see `ti`(4).
- A driver for the Realtek 8129/8239 Fast Ethernet PCI cards have been added, see `rl`(4).
- A driver for the DPT SmartCache and SmartRAID III or IV SCSI adapters has been added, see `dpt`(4).
- A driver for the BOCA IOAT66 6-port ISA serial adapter has been added, see `ioat`(4).
- Support for the X-surf Amiga board has been added.
- Support has been added for ext2fs revision 1, with read-only support for the ''sparse super'' and the ''filetype'' options.
- BIND has been upgraded to version 8.2.2-P5.
- The IPF packet filtering software has been updated to version 3.3.6.
- Tcpdump now does hex/ascii dumps of packet contents if asked to do so.
- An implementation of the System V user management utilities has been added.
- The name ''errno'' is now always a macro which expands to a function call. This is done to ease the integration of thread libraries with the code in both system and third-party libraries. Please include <errno.h> to access the correct definition of ''errno''.
- A utility for making temporary files for shell scripts has been added, see `mktemp`(1).
- The automounter utility `amd`(8) has been updated to fix a security problem.
- A security problem in procfs has been fixed. Procfs is not used by default in NetBSD.
- The floating point emulation on the ports using the m68k CPU has been reverted to the version in NetBSD 1.4 (the version in 1.4.1 had problems).
- Several subsystems have received substantial work, such as RAIDframe, LFS, and the package tools.

In addition, many, many bugs have been fixed -- more than 100 problems reported through our problem tracking system have been fixed, and many other non-reported problems have also been found and fixed. See the CHANGES-1.4.2 file for the complete list.

Known caveats with 1.4.2

The following are the major known issues with NetBSD 1.4.2.

- The upgrade of `ipf`(8) caused a change of the kernel API. Thus, if you are using `ipf`(8) you need to upgrade both the kernel and the user-land utilities to control that feature in order for it to work.
- As part of fixing a kernel bug, ''struct vfsnode'' needed to change size. This will unfortunately, and contrary to tradition for patch releases, cause incompatibilities for users of file system LKMs compiled for 1.4 and 1.4.1.

- Although LFS has been improved between 1.4.1 and 1.4.2, it can probably still be characterized as being of ''beta test'' quality, e.g. filling the file system still gives ''interesting'' effects. It should probably not be used to store critical data quite yet.
- The version of the IPF packet filtering software in NetBSD 1.4.2 must be enabled with ''ipf -E'' before filtering or NAT rules can be set. Failure to do so may result in a panic.

Major Changes Between 1.4 and 1.4.1

The complete list of changes between NetBSD 1.4 and 1.4.1 can be found in the file CHANGES-1.4.1 in the top directory of the source tree.

- The NetBSD/alpha port's compatibility for Digital UNIX executables has been greatly improved.
- Many bug fixes and improvements of the installation tools and utilities.
- Support for more PCI serial/parallel cards has been added.
- It is now possible to boot NetBSD/i386 on systems with 1GB of RAM.
- The floating point emulation on the ports using the m68k CPU has been upgraded.
- A fatal problem with /dev/random has been found and fixed.
- Support for Alpha 21264 ev6 based systems has been added to NetBSD/alpha.

Major Changes Between 1.3 and 1.4

The NetBSD 1.4 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 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 1.4.3 is the first official release of NetBSD for the Apple Power Macintosh and their compatibles.

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, Anonymous CVS access to the NetBSD source tree has been added since NetBSD 1.4.1; see

http://www.netbsd.org/Changes/#anoncvs-available

We have also added a browsable CVS repository on the web at

http://cvsweb.netbsd.org/cgi-bin/cvsweb.cgi/

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

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

NetBSD 1.4.3 Release Contents

The root directory of the NetBSD 1.4.3 release is organized as follows:

`.../NetBSD-1.4.3/`

`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 1.4.3 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 1.4.3 has a binary distribution. There are also 'README.export-control' files sprinkled liberally throughout the distribution tree, which spell out the current restrictions related to export of this code from the United States of America. Note that these regulations were recently changed so that most countries can import the entire release without significant restrictions. See

http://www.NetBSD.ORG/Misc/crypto-export.html

which contains up-to-date information on this issue.

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.
423K 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, 84.3M uncompressed

syssrc.tgz: This set contains the sources to the NetBSD 1.4.3 kernel, config(8), and dbsym(8).
13.9M gzipped, 68.8M 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.
3.1M gzipped, 11.8M uncompressed

src.tgz: This set contains all of the NetBSD 1.4.3 sources which are not mentioned above.
14.5M gzipped, 67.5M 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 contains the sources normally found in `/usr/src/domestic` – primarily Kerberos (version 4) and other cryptographic security related software. This code can now be exported from the US to most countries. The document on

http://www.NetBSD.ORG/Misc/crypto-export.html

spells out the current (rather lenient) restrictions applicable for the export of this code.

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/macppc Subdirectory Structure

The macppc-specific portion of the NetBSD 1.4.3 release is found in the `macppc` subdirectory of the distribution: `.../NetBSD-1.4.3/macppc/`

`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/` macppc binary distribution sets; see below.
`security/` macppc security distribution; see below.
`installation/`
`floppy/` macppc boot and installation floppies; see below.

Binary Distribution Sets

The NetBSD macppc binary distribution sets contain the binaries which comprise the NetBSD 1.4.3 release for the macppc. There are eight binary distribution sets and the *security* distribution set. The binary distribution sets can be found in the `macppc/binary/sets` subdirectory of the NetBSD 1.4.3 distribution tree, and are as follows:

base The NetBSD 1.4.3 macppc **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.
11.1M gzipped, 30.5M 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.
8.5M gzipped, 32.3M 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.)
56K gzipped, 330K uncompressed

games This set includes the games and their manual pages.
2.8M gzipped, 6.9M uncompressed

kern This set contains a NetBSD/macppc 1.4.3 GENERIC kernel, named `/netbsd`. You *must* install this distribution set.
846k gzipped, 1.9M 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.
3.8M gzipped, 15.2M uncompressed

misc This set includes the (rather large) system dictionaries, the typesettable document set, and other files from `/usr/share`.
2.2M gzipped, 8.5M uncompressed

text This set includes NetBSD's text processing tools, including `groff`(1), all related programs, and their manual pages.
1.2M gzipped, 4.4M uncompressed

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

`macppc/binary/security`

subdirectory of the NetBSD 1.4.3 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. See

http://www.NetBSD.ORG/Misc/crypto-export.html

for updated information on this issue.

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.
2.8M gzipped, 8.3M uncompressed

xcomp The extra libraries and include files needed to compile X source code.
1.9M gzipped, 8.2M uncompressed

xcontrib Programs that were contributed to X.
188k gzipped, 580k uncompressed

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

xserver The Xmacppc server which supports 256 colors with man pages.
1.7M gzipped, 4.4M uncompressed

The macppc 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 Each directory in the macppc 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/macppc System Requirements and Supported Devices

NetBSD/macppc 1.4.3 runs on PCI-based Power Macs and several compatibles. The minimal configuration requires 4M of RAM and ˜80M 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 models:

- Apple Power Macintosh 7300/7600/8500/8600/9500/9600
- Apple Power Macintosh G3 MT266/DT233
- Apple PowerBook 2400c/180
- Apple iMac (netboot only)
- UMAX Apus2000
- PowerComputing PowerWave 604/120
- Motorola StarMax 3000/240
- PowerCity 4000/200 (StarMax 4000/200 OEM)
- APS M*Power 604e/200

NetBSD/macppc 1.4.3 does *not* run on these machines (yet):

- Systems without Open Firmware. (e.g. PowerBook 5xxx)
- NuBus-based systems.
- PowerPC601-based systems.
- m68k-based systems with a PowerPC upgrade card.

Supported devices include:

Ethernet:
on-board 79C950-based Ethernet interface. ("mace")
on-board bmac Ethernet interface. (10Base-T only)
PCI NE2000 compatible Ethernet adapters. ("ne")

SCSI: on-board 53c94 SCSI controler.
on-board MESH SCSI controler. ("mesh")
Adaptec AHA-2940[U][W] SCSI controller.
AdvanSys 1200[A,B], 9xx[U,UA] SCSI controler. (Since it has no OpenFirmware support, you cannot boot from drive connected to this card)
Most of SCSI disk/tape/CD-ROM devices should work.

PCI controler:
bandit/MPC106

IDE: on-board IDE controler which is found in several models. (e.g. iMac)
Most of hard drive and CD-ROM should work.

ADB devices:
Most ADB keyboards and mice.

PS/2 devices: (PowerMac 4400 and several compatibles have Em0
PS/2 Keyboards
PS/2 Mice (middle button of 3-button one does not work)

Video (video card/on-board video):
PCI frame buffers which have Open Firmware support.

Serial ports:
ttya and ttyb can be used as console if needed. AKA serial/printer port.

Hardware the we do NOT currently support yet:

Floppy disk:
Though NetBSD/macppc can boot from it, no kernel support yet.

AWACS internal audio:
No kernel support yet.

Getting the NetBSD System on to Useful Media

Installation is supported from several media types, including:

- NFS
- FTP
- CD-ROM

Note Installing on a "bare" machine requires some bootable device; either an MO drive or a floppy. When the target has on-board Ethernet, NFS installation is also available.

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-1.4.3/macppc/installation
.../NetBSD-1.4.3/macppc/binary
```

Boot/Install from NFS server:

If your machine has a disk and network connection and on-board Ethernet, 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 `disklabel`(8) manual page for guidlines 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).

Since NetBSD/macppc does not have floppy disk support yet, you need MacOS or another machine that can write the install kernel image to floppy.

Preparing your System for NetBSD Installation

Note Currently NetBSD 1.4.3 requires a dedicated drive if it is going to be run from a local disk drive. In other words, NetBSD 1.4.3 cannot be installed on the hard drive on which MacOS and/or any other oparating systems reside. This is because the NetBSD 1.4.3 install tools currently do not support Apple's Disk Partition Map.

Before you start, you must choose a boot medium. There are several possibilities:

- Boot from the network
- Boot from floppy (if your machine has one)
- Boot from a CD-ROM
- Boot from a disk drive prepared on another machine

This latter option is not described further here.

If you have a newer Macintosh, want to boot from the network, and don't want to pass any special options to the boot command, you can net-boot by resetting and holding the "N" key down during the boot sequence. In any other case, you will need to issue commands to the OpenFirmware in your Macintosh.

The various Apple Macintosh machines have slightly different versions of OpenFirmware, and they vary somewhat in their capabilities, so the documentation provided here is more hints than the definitive all-encompassing truth about OpenFirmware on Macintosh machines. Some versions of OpenFirmware also have bugs -- check with Apple at

http://asu.info.apple.com/

if a firmware update is available for your particular model.

To get into OpenFirmware, reset the Macintosh and hold down Command-Option-O-F while booting. The firmware checks the state of the keys some time after the startup chime -- exactly when varies from model to model. The G3 PowerBooks seem to be the pickiest about timing. If you're having problems, try waiting until the startup chime starts, then quickly press the keys before it finishes (and hold them down until you see the OpenFirmware screen). It's also been reported that it's easier to get into Open Firmware from a powered-off state than it is from a reboot.

If your screen remains dark after this procedure, you have an old Macintosh where you must interact with OpenFirmware via the serial port at 38400 baud, parity none, 8 bits. Newer machines will give you a prompt on the screen.

The OpenFirmware prompt looks like this:

```
ok
0 >
```

If you want to always boot to OpenFirmware, enter the following at an OpenFirmware prompt

```
setenv auto-boot? false
```

This can always be set back with

```
setenv auto-boot? true
```

or you can reset all the settings to their defaults with

```
set-defaults
```

If you want to boot from floppy, you can use

```
boot fd:0
```

If you want to boot from the network, you can use

```
boot enet:0
```

or possibly simply

```
boot enet
```

When booting from the network the Macintosh will issue a BOOTP/DHCP query to get its IP address, and load the file given in the reply using TFTP. The file loaded is typically "ofwboot.elf." This second-stage boot loader will in turn use DHCP again to get the Mac's IP address, the IP address of an NFS file server, and the root path to mount. ofwboot.elf will then use NFS to load the kernel, typically "netbsd."

You may want to inspect the Diskless NetBSD HOWTO for further information about setting up the environment for diskless use at

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

Note Older Macintosh machines' OpenFirmware may not have support for loading an ELF executable -- the error message may say "OBJECT FILE FORMAT NOT RECOGNIZED." In that case, you need to use an XCOFF boot loader, named "ofwboot.xcf." Once that boot loader runs, it can boot the normal ELF kernel just fine.

Also note that some older Macintoshes which use BOOTP will need to have the ‘‘Vendor Extensions’’ flag set, typically by ‘‘always-reply-rfc1048’’ in the DHCP daemon configuration file.

If you want to run your Macintosh diskless, you will need to populate the NFS server's area used for your Macintosh with macppc binaries. Please also remember to do ‘‘cd dev; ./MAKEDEV all’’ to create the required device nodes, and edit etc/rc.conf and etc/fstab. If, on the other hand, you just want to load the install kernel via the network to install or upgrade your machine, you only need the install kernel installed in the root directory on the NFS server.

In some cases you may want to interact with the ofwboot program to tell it which file to load. You can do that by passing the ‘‘-a’’ flag to the boot loader, i.e.:

```
boot enet:0 -a
```

Note Using DHCP for network boot has the annoying problem that if you have some other network device which responds to ‘‘anonymous’’ DHCP queries on your network (cable modem, DSL box or the like), you may need to disconnect these devices in order to make the network boot of the Macintosh work.

An example dhcpd.conf file follows.

```
# Notes:
# To set up dhcpd, install this file and ensure that /var/db/dhcpd.leases
# exists.
#
get-lease-hostnames true;             # DNS lookup for dynamic IP's
use-host-decl-names true;             # take fixed-ip hostname from the
                                      # host <x> declaration

        subnet 10.50.100.5 netmask 255.255.255.248 {
        # no dynamically assigned addrs in this subnet
                option routers 10.50.100.1;
                option subnet-mask 255.255.255.248;
                option broadcast-address 10.50.100.7;
        }

host majic {
        hardware ethernet 00:05:02:f7:22:d3;
        filename "ofwboot.elf";
        next-server 10.50.100.3;
        option root-path "/usr/export/majic";
        fixed-address majic;
#       always-reply-rfc1048 true;
}
```

Note The root-path has a rather short maximum length, and this may cause ofwboot.elf not to load your kernel. The above reportedly works, but adding ‘‘/netbsd-nfsroot’’ makes it not work.

To boot from CD-ROM (if your Macintosh supports it; apparently only later models do), do

```
boot cd:,ofwboot.elf
```

A few commands which may make it easier to get your machine going are:

```
boot scsi/sd@1:0
```

boots from the first bootable partition on target 1 on (of one of) the SCSI bus(es).

```
devalias
```

shows the device aliases on your machine, ''scsi'' is typically a device alias. The command

```
dev / ls
```

lists the entire device tree.

```
printenv
```

displays the current ''environment'' variable settings in your OpenFirmware. Lastly,

```
reset-all
```

reinitializes OpenFirmware.

Installing the NetBSD System

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 to be completed. Do not let this discourage you, the install program is not hard to use.

2. *Possible* PCMCIA *issues*

   There is a serious problem that may make installation of NetBSD on PCMCIA machines difficult. This problem does not make *using* PCMCIA difficult once a machine is installed. If you do not have PCMCIA on your machine (PCMCIA is only really used on laptop machines), you can skip this section, and ignore the ''[PCMCIA]'' notes.

   This section explains how to work around the installation problem.

   The kernel keeps careful track of what interrupts and I/O ports are in use during autoconfiguration. It then allows the PCMCIA devices to pick unused interrupts and I/O ports. Unfortunately, the `INSTALL` kernel may not detect all devices in your system. This may be because the `INSTALL` kernel only supports the minimum set of devices to install NetBSD on your system, or it may be that NetBSD does not have support for the device causing the conflict.

   For example, suppose your laptop has a soundblaster device built in; the `INSTALL` kernel has no sound support. The PCMCIA code might allocate your soundblaster's IRQ and I/O ports to PCMCIA devices, causing them not to work, or to lock up the system. This is especially bad if one of the devices in question is your ethernet card.

   This problem will impact some, but not all, users of PCMCIA. If this problem is affecting you, watch the ''[PCMCIA]'' notes that will appear in this document.

3. *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 hit Control-C at any time, but if you do, you'll have to begin the installation process again from scratch.

4. *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 section 3. 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 1.44M 3.5" floppy.
     - A CD-ROM drive (SCSI or ATAPI), a harddisk and a minimum of of memory installed.
     - The harddisk should have at least + *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 60Mb more.
   - The Quick Installation
     - Insert the boot floppy you just created. Boot the computer. The main menu will be displayed.
     - If you wish, you can configure some network settings immediately by choosing the **utilities** 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. 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/**

5. *Booting* NetBSD

   [PCMCIA] Unplug your PCMCIA devices, so that they won't be found by NetBSD.

   Boot your machine using the boot floppy. 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.

6. *Network configuration*

   [PCMCIA] You can skip this section, as you will only get data from floppy in the first part of the install.

   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 utilities menu, and select **`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 Domain Name Service (DNS), you can give an empty response in reply to answers relating to this.

7. *Installation drive selection and parameters*

   To start the installation, select the menu option to install NetBSD 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 `wd0`, `wd1`, `sd0`, or `sd1`.

   Next, depending on whether you are using a wd*x* or wd*x* disk, you will either be asked for the type of disk (wd*x*) you are using or you will be asked if you want to specify a fake geometry for your SCSI disk (sd*x*). The types of disk are be IDE, ST-506 or ESDI. If you're installing on an ST-506 or ESDI drive, you'll be asked if your disk supports automatic sector forwarding. If you are *sure* that it does, reply affirmatively. Otherwise, the install program will automatically reserve space for bad144 tables.

8. *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.

     If you want to use the entire disk for NetBSD, you can skip the following section and go to *Editing the* NetBSD *disklabel*.

   - *Editing the* NetBSD *disklabel*.

     The partition table of the NetBSD part of a disk is called a *disklabel*. There are 3 layouts for the NetBSD part of the disk that you can pick from: **`Standard, Standard with X`** and **`Custom`**. The first two use a set of default values (that you can change) suitable for a normal installation, possibly including X. The last option lets you specify everything yourself.

     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. Partition **a** is always the root partition, **b** is the swap partition, and **c** is the whole disk. Partitions **e-h** are available for other use. Traditionally, **d** is the partition mounted on the `/usr` directory, but this is historical practice, 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 filesystems 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 9

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 number, 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, and the account name and password used to log into that host using ftp. If you did not set up DNS when answering the questions to configure networking, you will need to specify an IP number 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 number, 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 number 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 filesystem*

    In order to install from a local filesystem, you will need to specify the device that the filesystem resides on (for example `wd1e`) the type of the filesystem, and the directory on the specified filesystem 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 filesystem 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.

17. *Finalizing your installation.*

    Congratulations, you have successfully installed NetBSD 1.4.3. You can now reboot the machine, and boot 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 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

   They are typically extracted into /usr/pkgsrc (though other locations work fine), as with the command:

   ```
   cat pkgsrc.tar.gz | gunzip | (mkdir /usr/pkgsrc;
   cd /usr/pkgsrc; tar xpf - )
   ```

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

The upgrade to NetBSD 1.4.3 is a binary upgrade; it can be quite difficult to advance to a later version by recompiling from source due primarily to interdependencies in the various components.

To do the upgrade, you must have the boot floppy available. You must also have at least the **base** and **kern** binary distribution sets available, so that you can upgrade with them, using one of the upgrade methods described above. Finally, you must have sufficient disk space available to install the new binaries. Since the old binaries are being overwritten in place, you only need space for the new binaries, which weren't previously on the system. If you have a few megabytes free on each of your root and `/usr` partitions, you should have enough space.

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

The upgrade procedure using the **sysinst** tool is similar to an installation, but without the hard disk partitioning. Another difference is that existing configuration files in `/etc` are backed up and merged with the new files. Getting the binary sets is done in the same manner as the installation procedure; refer to the installation part of the document for how to do this. Also, some sanity checks are done, i.e. filesystems are checked before unpacking the sets.

After a new kernel has been copied to your hard disk, your machine is a complete NetBSD 1.4.3 system. However, that doesn't mean that you're finished with the upgrade process. You will probably want to update the set of device nodes you have in `/dev`. If you've changed the contents of `/dev` by hand, you will need to be careful about this, but if not, you can just cd into `/dev` , and run the command

```
sh MAKEDEV all
```

You must also deal with certain changes in the formats of some of the configuration files. The most notable change is that the options given to many of the file systems in `/etc/fstab` have changed, and some of the file systems have changed names. To find out what the new options are, it's suggested that you read the manual page for the file systems' mount commands, for example `mount_nfs`(8) for NFS.

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

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 1.4.3

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),
- `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)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, WWW 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:

  Steve Allen
  Jason Birnschein
  Mason Loring Bliss
  Jason Brazile
  Mark Brinicombe
  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
Castor Fu
Greg Gingerich
William Gnadt
Michael Graff
Guenther Grau
Ross Harvey
Charles M. Hannum
Michael L. Hitch
Kenneth Alan Hornstein
Jordan K. Hubbard
Soren Jorvang
Scott Kaplan
Noah M. Keiserman
John Kohl
Chris Legrow
Ted Lemon
Neil J. McRae
Perry E. Metzger
Herb Peyerl
Mike Price
Dave Rand
Michael Richardson
Heiko W. Rupp
Brad Salai
Chuck Silvers
Thor Lancelot Simon
Bill Sommerfeld
Paul Southworth
Ted Spradley
Kimmo Suominen
Jason R. Thorpe
Steve Wadlow
Krister Walfridsson
Jim Wise
Christos Zoulas

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

Co-operative Research Centre for Enterprise Distributed Systems Technology
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
Warped Communications, Inc.

(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:

Alistair Crooks	agc@NetBSD.ORG
Jun-ichiro itojun Hagino	itojun@NetBSD.ORG
Frank van der Linden	fvdl@NetBSD.ORG
Luke Mewburn	lukem@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**
Jun-ichiro itojun Hagino	itojun@NetBSD.ORG	**sh3**
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**
Kazuki Sakamoto	sakamoto@NetBSD.ORG	**bebox**
Wolfgang Solfrank	ws@NetBSD.ORG	**ofppc**
Jonathan Stone	jonathan@NetBSD.ORG	**pmax**
Shin Takemura	takemura@NetBSD.ORG	**hpcmips**

Jason Thorpe	thorpej@NetBSD.ORG	**hp300**
Frank van der Linden	fvdl@NetBSD.ORG	**i386**
Leo Weppelman	leo@NetBSD.ORG	**atari**
Nathan Williams	nathanw@NetBSD.ORG	**sun3**
Steve Woodford	scw@NetBSD.ORG	**mvme68k**

The NetBSD 1.4.3 Release Engineering team:

Chris G. Demetriou	cgd@NetBSD.ORG
Havard Eidnes	he@NetBSD.ORG
Ted Lemon	mellon@NetBSD.ORG
Perry Metzger	perry@NetBSD.ORG
Curt Sampson	cjs@NetBSD.ORG

Developers and other contributors:

Steve Allen	wormey@NetBSD.ORG
Julian Assange	proff@NetBSD.ORG
Lennart Augustsson	augustss@NetBSD.ORG
Christoph Badura	bad@NetBSD.ORG
Robert V. Baron	rvb@NetBSD.ORG
Erik Berls	cyber@NetBSD.ORG
John Birrell	jb@NetBSD.ORG
Mason Loring Bliss	mason@NetBSD.ORG
Manuel Bouyer	bouyer@NetBSD.ORG
John Brezak	brezak@NetBSD.ORG
Allen Briggs	briggs@NetBSD.ORG
Aaron Brown	abrown@NetBSD.ORG
David Brownlee	abs@NetBSD.ORG
Frederick Bruckman	fredb@NetBSD.ORG
Jon Buller	jonb@NetBSD.ORG
Simon Burge	simonb@NetBSD.ORG
Dave Burgess	burgess@cynjut.infonet.net
Robert Byrnes	byrnes@NetBSD.org
D'Arcy J.M. Cain	darcy@NetBSD.ORG
Dave Carrel	carrel@NetBSD.ORG
Bill Coldwell	billc@NetBSD.ORG
Julian Coleman	jdc@NetBSD.ORG
Chuck Cranor	chuck@NetBSD.ORG
Aidan Cully	aidan@NetBSD.ORG
Johan Danielsson	joda@NetBSD.ORG
Matt DeBergalis	deberg@NetBSD.ORG
Rob Deker	deker@NetBSD.ORG
Chris G. Demetriou	cgd@NetBSD.ORG
Jaromir Dolecek	jdolecek@NetBSD.ORG
Andy Doran	ad@NetBSD.ORG
Roland Dowdeswell	elric@NetBSD.ORG
Matthias Drochner	drochner@NetBSD.ORG
Jun Ebihara	jun@NetBSD.ORG

Havard Eidnes	he@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
Castor Fu	castor@NetBSD.ORG
Ichiro Fukuhara	ichiro@NetBSD.ORG
Brian R. Gaeke	brg@dgate.org
Thomas Gerner	thomas@NetBSD.ORG
Simon J. Gerraty	sjg@NetBSD.ORG
Justin Gibbs	gibbs@NetBSD.ORG
Adam Glass	glass@NetBSD.ORG
Michael Graff	explorer@NetBSD.ORG
Brian C. Grayson	bgrayson@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
HAYAKAWA Koichi	haya@NetBSD.ORG
Rene Hexel	rh@NetBSD.ORG
Michael L. Hitch	mhitch@NetBSD.ORG
Christian E. Hopps	chopps@NetBSD.ORG
Ken Hornstein	kenh@NetBSD.ORG
Marc Horowitz	marc@NetBSD.ORG
Dean Huxley	dean@netbsd.org
ITOH Yasufumi	itohy@NetBSD.ORG
IWAMOTO Toshihiro	toshii@NetBSD.ORG
Matthew Jacob	mjacob@NetBSD.ORG
Lonhyn T. Jasinskyj	lonhyn@NetBSD.ORG
Chris Jones	cjones@NetBSD.ORG
Soren Jorvang	soren@NetBSD.ORG
Takahiro Kambe	taca@NetBSD.ORG
Antti Kantee	pooka@NetBSD.ORG
Lawrence Kesteloot	kesteloo@cs.unc.edu
Thomas Klausner	wiz@NetBSD.ORG
Klaus Klein	kleink@NetBSD.ORG
John Kohl	jtk@NetBSD.ORG
Kevin Lahey	kml@NetBSD.ORG
Johnny C. Lam	jlam@NetBSD.ORG
Martin J. Laubach	mjl@NetBSD.ORG
Ted Lemon	mellon@NetBSD.ORG
Joel Lindholm	joel@NetBSD.ORG
Mike Long	mikel@NetBSD.ORG
Warner Losh	imp@NetBSD.ORG
Brett Lymn	blymn@NetBSD.ORG
Paul Mackerras	paulus@NetBSD.ORG
Dan McMahill	dmcmahill@NetBSD.ORG

Neil J. McRae	neil@NetBSD.ORG
Perry Metzger	perry@NetBSD.ORG
der Mouse	mouse@NetBSD.ORG
Joseph Myers	jsm@NetBSD.ORG
Ken Nakata	kenn@NetBSD.ORG
Bob Nestor	rnestor@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
Waldi Ravens	waldi@moacs.indiv.nl.net
Darren Reed	darrenr@NetBSD.ORG
Michael Richardson	mcr@NetBSD.ORG
Tim Rightnour	garbled@NetBSD.ORG
Gordon Ross	gwr@NetBSD.ORG
Heiko W. Rupp	hwr@NetBSD.ORG
SAITOH Masanobu	msaitoh@NetBSD.ORG
Curt Sampson	cjs@NetBSD.ORG
Wilfredo Sanchez	wsanchez@NetBSD.ORG
Ty Sarna	tsarna@NetBSD.ORG
SATO Kazumi	sato@NetBSD.ORG
Matthias Scheler	tron@NetBSD.ORG
Karl Schilke (rAT)	rat@NetBSD.ORG
Konrad Schroder	perseant@NetBSD.ORG
Tim Shepard	shep@NetBSD.ORG
Takao Shinohara	shin@NetBSD.ORG
Takuya SHIOZAKI	tshiozak@NetBSD.ORG
Chuck Silvers	chs@NetBSD.ORG
Thor Lancelot Simon	tls@NetBSD.ORG
Noriyuki Soda	soda@NetBSD.ORG
Bill Sommerfeld	sommerfeld@NetBSD.ORG
Bill Studenmund	wrstuden@NetBSD.ORG
Kevin Sullivan	sullivan@NetBSD.ORG
SUNAGAWA Keiki	kei@NetBSD.ORG
Kimmo Suominen	kim@NetBSD.ORG
Matt Thomas	matt@NetBSD.ORG
Christoph Toshok	toshok@NetBSD.ORG
Izumi Tsutsui	tsutsui@NetBSD.ORG
UCHIYAMA Yasushi	uch@NetBSD.ORG
Todd Vierling	tv@NetBSD.ORG
Aymeric Vincent	aymeric@NetBSD.ORG
Paul Vixie	vixie@NetBSD.ORG
Krister Walfridsson	kristerw@NetBSD.ORG
Lex Wennmacher	wennmach@NetBSD.ORG
Assar Westerlund	assar@NetBSD.ORG
Rob Windsor	windsor@NetBSD.ORG

Dan Winship	danw@NetBSD.ORG
Jim Wise	jwise@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 Niklas Hallqvist, C Stone and Job de Haas.

This product includes software developed by Allen K. Briggs.

This product includes software developed by Apple Computer, Inc.

This product includes software developed by Bill Studenmund.

This product includes software developed by Bradley A. Grantham.

This product includes software developed by Carnegie-Mellon University.

This product includes software developed by Charles M. Hannum.

This product includes software developed by Chris P. Cputo.

This product includes software developed by Christopher G. Demetriou.

This product includes software developed by Colin Wood.

This product includes software developed by David Huang.

This product includes software developed by Gordon W. Ross.

This product includes software developed by Internet Reseach Institute, Inc.

This product includes software developed by John P. Wittkoski.

This product includes software developed by Open Software Foundation, Inc.

This product includes software developed by Per Fogelstrom, Opsycon AB and RTMX Inc, USA.

This product includes software developed by Takashi Hamada.

This product includes software developed by The NetBSD Foundation, Inc.

This product includes software developed by Tools GmbH.

This product includes software developed by Tsubai Masanari.

This product includes software developed by University of Utah.

This product includes software developed by Wolfgang Solfrank.