NAME

INSTALL – Installation procedure for NetBSD/cats.

CONTENTS

About this Document....2
Dedication....2
What is NetBSD?....2
Upgrade path to NetBSD 1.6.2....3
Changes Between The NetBSD 1.6.1 and 1.6.2 Releases....3
  Kernel....3
  Networking....4
  Security....4
  System administration and user tools....4
  Miscellaneous....4
  cats specific....5
Changes Between The NetBSD 1.6 and 1.6.1 Releases....5
  Kernel....5
  Networking....5
  File system....6
  Security....6
  System administration and user tools....6
  Miscellaneous....6
Changes Between The NetBSD 1.5 and 1.6 Releases....7
  Kernel....7
  Networking....7
  File system....8
  Security....8
  System administration and user tools....9
  Miscellaneous....9
The Future of NetBSD....10
Sources of NetBSD....11
NetBSD 1.6.2 Release Contents....11
  NetBSD/cats subdirectory structure....12
  Binary distribution sets....13
NetBSD/cats System Requirements and Supported Devices....14
  Supported Chalice CATS devices....14
  Supported Intel EBSA285 & Chalice CATS PCI devices....14
Getting the NetBSD System on to Useful Media....15
Preparing your System for NetBSD installation....18
  Available Boot Media....18
  Preparing the Bootable Media....18
  Booting from CD-ROM....18
Installing the NetBSD System....18
  Running the sysinst installation program....18
    Introduction....18
    Possible PCMCIA issues....19
    General....19
    Quick install....19
    Booting NetBSD....21

Network configuration.....21
Installation drive selection and parameters.....21
Partitioning the disk.....21
Preparing your hard disk.....22
Getting the distribution sets.....22
Installation using ftp.....23
Installation using NFS.....23
Installation from CD-ROM.....23
Installation from an unmounted file system.....23
Installation from a local directory.....23
Extracting the distribution sets.....24
Finalizing your installation.....24
Post installation steps.....25
Upgrading a previously-installed NetBSD System.....27
Compatibility Issues With Previous NetBSD Releases.....28
Issues affecting an upgrade from NetBSD 1.5 28
Issues affecting an upgrade from NetBSD 1.4 or prior 29
Using online NetBSD documentation.....30
Administrivia.....31
Thanks go to.....31
We are.....34
Legal Mumbo-Jumbo.....40
The End.....42

DESCRIPTION

About this Document

This document describes the installation procedure for NetBSD 1.6.2 on the *cats* 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.

Dedication

The NetBSD Foundation would like to dedicate the NetBSD 1.6.2 release to the memory of Erik Reid, who went missing and is presumed dead in a sailing accident on 18 February 2004. Erik's contributions to NetBSD included work on support for SGI MIPS R4000, integrating XFree86 Direct Rendering Interface (DRI), and managing the build lab. His death came as a shock, and he will be greatly missed by all of us. May he rest in peace.

What is NetBSD?

The NetBSD Operating System is a fully functional Open Source UNIX-like operating system derived from the University of California, Berkeley Networking Release 2 (Net/2), 4.4BSD-Lite, and 4.4BSD-Lite2 sources. NetBSD runs on fifty three different system architectures (ports), featuring seventeen machine architectures across eleven distinct CPU families, and is being ported to more. The NetBSD 1.6.2 release contains com-

plete binary releases for thirty eight different system architectures. (The fifteen remaining are not fully supported at this time and are thus not part of the binary distribution. For information on them, please see the NetBSD web site at **http://www.netbsd.org/**.)

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

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

Upgrade path to NetBSD 1.6.2

If you are not installing your system ''from scratch'' but instead are going to upgrade an existing system already running NetBSD you need to know which versions you can upgrade with NetBSD 1.6.2.

NetBSD 1.6.2 is an upgrade of NetBSD 1.6.1 and earlier major and patch releases of NetBSD.

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

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

Changes Between The NetBSD 1.6.1 and 1.6.2 Releases

The NetBSD 1.6.2 release provides numerous significant functional enhancements, including support for many new devices, integration of hundreds of bug fixes, patches and updates to kernel subsystems, and many user-land enhancements. The result of these improvements is a stable operating system fit for production use that rivals most commercially available systems.

It is impossible to completely summarize over nine months of development that went into the NetBSD 1.6.2 release. Some highlights include:

Kernel

- With `pciide`(4), make Promise controllers do DMA with large disks requiring 48-bit LBA drives.
- Add error detection when running low on swap, to improve stability in low-memory situations.
- Support for more SiS controllers were added to `pciide`(4).
- Support for the new PowerBook G4 12-inch added.
- `mlx`(4) stability improved.
- Support for ICH5 added to `pciide`(4).
- A long-standing stability problem with the original Sun4c sparc systems (SS1, SS1+, and IPC) has been found and fixed. Some optimizations done for these systems as well.
- Sun3, Sun3x, and Sun2 may now boot from tape files, through addition of seek support for tape files.

- The USERCONF option has been added to the i386 kernels; see `userconf`(4) for more information.
- Hardware random number generator support for Intel 865 and 875P chipsets added.
- Fix `wdc`(4) to work with pre-ATA drives.
- Shared libraries and other files mapped executable now count as TEXT pages for vm-usage purposes. This should allow for more appropriate handling of these pages compared to other normal file buffer pages.
- General support for multi-function pcmcia cards has been fixed.
- Various fixes to linux emulation have been added.

Networking

- `rtk`(4) multicast problem fixed.
- `fxp`(4) support yet a few more chip variants.
- `tulip`(4) driver fixed so that the DEC Alpha PWS no longer panics.
- Path MTU discovery black-hole detection has been added.
- `bce`(4) driver added for Broadcom BCM4401 chipset, as seen in recent Dell laptops.
- A workaround has been added for a race condition in the networking code which could corrupt the callout data structure.
- Various networking stack fixes for IPv4, IPv6 and IPSEC.

Security

- NetBSD-SA2003-018 DNS negative cache poisoning
- NetBSD-SA2003-017 OpenSSL multiple vulnerability
- NetBSD-SA2003-016 Sendmail - another prescan() bug CAN-2003-0694
- NetBSD-SA2003-015 Remote and local vulnerabilities in XFree86 font libraries
- NetBSD-SA2003-014 Insufficient argument checking in sysctl(2)
- NetBSD-SA2003-012 Out of bounds memset(0) in sshd
- NetBSD-SA2003-011 off-by-one error in realpath(3)
- NetBSD-SA2003-010 remote panic in OSI networking code

System administration and user tools

- Possible crash in `vi`(1) triggered by an error was fixed.
- XFree86 upgraded to version 4.3.0 for those architectures which use XFree86 version 4.
- `scsictl`(8) now supports a few new commands.
- BIND has been upgraded to version 8.3.7.
- DHCP has been upgraded to version 3.0.1rc11 with various fixes.
- CVS has been upgraded to version 1.11.10.

Miscellaneous

- At least one problem causing sysinst to crash has been fixed, and a progress bar has been added as an option to monitor the progress of the extraction of the install sets.
- Package tools upgraded to version 20030918.

And of course there have also been innumerable bug fixes and other miscellaneous enhancements. You can look for this trend to continue.

cats specific

Changes Between The NetBSD 1.6 and 1.6.1 Releases

The NetBSD 1.6.1 release provides numerous significant functional enhancements, including support for many new devices, integration of hundreds of bug fixes, patches and updates to kernel subsystems, and many user-land enhancements. The result of these improvements is a stable operating system fit for production use that rivals most commercially available systems.

It is impossible to completely summarize over seven months of development that went into the NetBSD 1.6.1 release. Some highlights include:

Kernel

- Hardware random number support for some Intel chipsets has been added.
- Support for additional Adaptec RAID controllers has been added to `aac`(4).
- A number of bugs in the VM system have been fixed.
- Bug fixes to `audio`(4), `dpt`(4), `eap`(4), `emuxki`(4), `iop`(4), `siop`(4) and `umass`(4).
- Some Linux compatibility bugs have been fixed.
- A number of USB bugs have been fixed.
- acorn32 and acorn26 module recognition overhauled; APDL IDE should now work.
- `pciide`(4) support has been extended to support Promise Ultra133TX2, Promise Ultra133TX2v2, HighPoint HPT372, Ultra/133 on VIA VT8233A, and the VIA VT8235.
- Many changes to the arm architecture support, mostly triggered by evbarm port infrastructure changes.
- Amiga boot handling has been modified to better handle certain machine configurations.

Networking

- IPv6 fixes to various tools.
- Bug fixes to the `tlp`(4) and `xi`(4) drivers.
- Enhancements to the `pcn`(4) driver.
- `rtk`(4) now supports Planex FNW-3603 cardbus ethernet card.
- `ex`(4) multicast handling has been fixed.
- `wi`(4) now supports Netgear MA401RA card.
- `wm`(4) now supports more chip variants.
- `aue`(4) now supports SMC 2206USB/ETH EZ Connect adapter.

- `sip`(4) now has some Tx interrupt mitigation code, and improved support for 64-bit DP83820 cards.
- The `fxp`(4) driver has been improved for better support of certain i82558 revisions, and has been fixed to recognize some more chips.
- IPFilter has been upgraded to version 3.4.29. Please note that this requires a synchronized upgrade of kernel and the ipf user programs to work properly.
- Support for Broadcom Gigabit Ethernet devices has been added by the addition of the `bge`(4) driver.
- Some IPsec bugs have been fixed (from KAME).
- Some `ftpd`(8) interoperability bugs have been fixed.
- `mopd`(8) fixes to make the program load correctly.
- A number of `pppoe`(4) bugs have been fixed.

File system

- A number of FFS and NFS bugs have been fixed.
- Several fixes to `ffs`(4) soft dependencies handling have been incorporated.
- Some NFSv3 fixes have been applied to `amd`(8).
- Some `fsck`(8) bugs have been fixed.

Security

- BIND has been updated to 8.3.4 and security patches applied to `named`(8) and the libc resolver.
- Various security patches have been applied to sendmail.
- Padding has been added to minimum-sized IP packets in several ethernet drivers to prevent unintented information leakage.
- OpenSSL has been updated to 0.9.6g and a number of security patches applied.
- A potential buffer overflow in zlib has been fixed.
- Buffer overflow bugs in `file`(1) have been fixed.
- Some Kerberos 4 security bugs have been addressed.
- A umask security problem in GNU `tar`(1) has been fixed.

System administration and user tools

- `user`(8) has seen several fixes, some of them related to MD5 and blowfish password encryption support.
- Changes to gcc for the arm architecture introduces a minor flag day: new and old object files can not be mixed. Required for proper soft-VFP support.
- MDC2 build has been made optional, as the algorithm is patended.
- The package tools have been updated to the 20030202 version.

Miscellaneous

- Bug fixes to sysinst, the NetBSD installer.
- Various cross-build fixes have been incorporated.

- Various fixes to the toolchain and build process.
- Various fixes to the rc.d subsystem.
- A large number of sparc64 fixes have been applied.
- Timezone files have been updated to tz2002d.
- Many new packages have been added to The NetBSD *packages collection,* including the latest open source desktop KDE3, OpenOffice.org, as well as a large number of bugs fixed, many addressing security issues.

And of course there have also been innumerable bug fixes and other miscellaneous enhancements. You can look for this trend to continue.

Changes Between The NetBSD 1.5 and 1.6 Releases

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

It is impossible to completely summarize over eighteen months of development that went into the NetBSD 1.6.2 release. Some highlights include:

Kernel

- Ports to new platforms including: algor, dreamcast, evbarm, hpcarm, hpcsh, newsmips, sandpoint, sgimips, sun2, and walnut.
- Unified Buffer Cache (UBC) removes size restriction of the file system's buffer cache to use all available RAM (if not otherwise used!) and improves overall system performance.
- Round-robin page colouring implemented for various ports for better cache utilisation, more deterministic run-time behaviour, and faster program execution.
- A rewritten SCSI middle layer to provide a cleaner interface between the different kernel layers, including a kernel thread to handle error recovery outside of the interrupt context. See `scsipi`(9).
- A new pipe implementation with significantly higher performance due to lower overheads, which uses the UVM Page Loan facility.
- New boot loader flags **`-v`** (*bootverbose*) and **`-q`** (*bootquiet*), to be used by kernel code to optionally print information during boot.
- An in-kernel boot time device configuration manager `userconf`(4), activated with the **`-c`** boot loader flag.
- A work-in-progress snapshot of ACPI support, based on the 20010831 snapshot of the Intel ACPICA reference implementation.
- USB 2.0 support, in the form of a preliminary driver for the `ehci`(4) host controller.
- Basic kernel support for IrDA in the form of the `irframe`(4) IrDA frame level driver. Serial dongles and the `oboe`(4) driver are currently supported.
- Kernel configuration files can be embedded into the kernel for later retrieval. Refer to `INCLUDE_CONFIG_FILE` in `options`(4) for more information.

- Many more kernel tunable variables added to `sysctl`(8).
- Linux binary emulation has been greatly improved, and now supports Linux kernel version 2.4.18.

Networking

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

File system

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

Security

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

System administration and user tools

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

Miscellaneous

- Support for multibyte LC_CTYPE locales has been integrated from the Citrus project. Many Chinese, Japanese, Korean, and other encodings are now available.
- Full support for cross-compilation of the base system, even as a non-root user! `src/build.sh` is available for doing arbitrary cross-builds; see `src/BUILDING` for more information. At least 38 ports for the NetBSD 1.6.2 release were cross-built on a NetBSD/i386 system using this mechanism.
- Migrated the following CPU platforms to ELF: arm, and m68k (including amiga, hp300, mac68k, mvme68k, sun2, and x68k).
- Updates of most third party packages that are shipped in the base system to the following latest stable releases:
  - amd 6.0.6
  - BIND 8.3.3
  - binutils 2.11.2
  - bzip2 1.0.2
  - cvs 1.11
  - dhcp 3.0.1rc9
  - file 3.38
  - gcc 2.95.3
  - groff 1.16.1
  - Heimdal 0.4e
  - IPfilter 3.4.27

  - kerberos4 1.1
  - ksh from pdksh 5.2.14p2
  - less 374
  - nvi 1.79
  - OpenSSH 3.4
  - OpenSSL 0.9.6g
  - Postfix 1.1.11
  - ppp 2.4.0
  - routed 2.24
  - sendmail 8.11.6
  - tcpdump 3.7.1

- Many new packages in the *pkgsrc* system, including the latest open source desktop KDE3, OpenOffice, perl, Apache and many more. At the time of writing, there are over 3000 third party packages available in pkgsrc.
- Added AGP GART driver `agp`(4) for faster access to graphics boards.
- `init`(8) will create an mfs (memory based file system) `/dev` if `/dev/console` is missing.
- `vmstat`(8) displays kernel hash statistics with **`-H`** and **`-h`** *`hash`*.
- `wscons`(4) supports blanking of VGA consoles.

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

This is the first major release of NetBSD/cats. Previous versions of NetBSD supported the cats platform as part of NetBSD/arm32.

Unlike previous releases of NetBSD for the ARM architecture, the cats port uses the ELF binary format. However, NetBSD 1.6.2 on cats is, as usual, fully backward compatible with old NetBSD a.out binaries, so you don't need to recompile all your local programs provided you set the appropriate binary compatibility options in your kernel configuration.

The Future of NetBSD

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

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

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

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

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

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

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

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

Sources of NetBSD

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

NetBSD 1.6.2 Release Contents

The root directory of the NetBSD 1.6.2 release is organized as follows:

`.../NetBSD-1.6.2/`

`CHANGES`	Changes since earlier NetBSD releases.
`LAST_MINUTE`	Last minute changes.
`MIRRORS`	A list of sites that mirror the NetBSD 1.6.2 distribution.
`README.files`	README describing the distribution's contents.
`TODO`	NetBSD 's todo list (also somewhat incomplete and out of date).
`patches/`	Post-release source code patches.
`source/`	Source distribution sets; see below.

In addition to the files and directories listed above, there is one directory per architecture, for each of the architectures for which NetBSD 1.6.2 has a binary distribution. There are also `README.export-control` files sprinkled liberally throughout the distribution tree, which point out that there are some portions of the distribution that may be subject to export regulations of the United States, e.g. code under `src/crypto` and `src/sys/crypto`. It is your responsibility to determine whether or not it is legal for you to export these portions and to act accordingly.

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

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

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

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

src This set contains all of the base NetBSD 1.6.2 sources which are not in **gnusrc**, **sharesrc**, or **syssrc**.
27 MB gzipped, 136 MB uncompressed

syssrc This set contains the sources to the NetBSD 1.6.2 kernel for all architectures; `config`(8); and `dbsym`(8).
22 MB gzipped, 114 MB uncompressed

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

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

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

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

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

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

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

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

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

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

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

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

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

NetBSD/cats subdirectory structure

The cats-specific portion of the NetBSD 1.6.2 release is found in the `cats` subdirectory of the distribution:

```
.../NetBSD-1.6.2/cats/
INSTALL.html
INSTALL.ps
```

`INSTALL.txt`

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

`binary/`

`kernel/`

`netbsd-GENERIC.gz`
A gzipped NetBSD kernel containing code for everything supported in this release.

`sets/` cats binary distribution sets; see below.

`installation/`

`kernel/` cats installation kernels.

Binary distribution sets

The NetBSD cats binary distribution sets contain the binaries which comprise the NetBSD 1.6.2 release for the cats. There are eight binary distribution sets. The binary distribution sets can be found in the `cats/binary/sets` subdirectory of the NetBSD 1.6.2 distribution tree, and are as follows:

base The NetBSD 1.6.2 cats **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.
21 MB gzipped, 50 MB uncompressed

comp Things needed for compiling programs. This set includes the system include files (`/usr/include`) and the various system libraries (except the shared libraries, which are included as part of the **base** set). This set also includes the manual pages for all of the utilities it contains, as well as the system call and library manual pages.
16 MB gzipped, 57 MB uncompressed

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

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

kern-GENERIC
This set contains a NetBSD/cats 1.6.2 `GENERIC` kernel, named `/netbsd`. You *must* install this distribution set. This set also contains an a.out kernel named `/netbsd.aout` that your system may need to boot.
4 MB gzipped, 8 MB uncompressed

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

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

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

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

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

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

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

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

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

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

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

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

NetBSD/cats System Requirements and Supported Devices

NetBSD/cats 1.6.2 runs on a Chalice CATS systems from Simtec Electronics and Intel EBSA boards. The minimal configuration is said to require 8 MB of RAM and 50 MB of disk space, though we do not know of anyone running with a system quite this minimal today. To install the entire system requires much more disk space (the unpacked binary distribution, without sources, requires at least 65 MB without counting space needed for swap space, etc), and to run X or compile the system, more RAM is recommended. (8 MB of RAM will actually allow you to run X and/or compile, but it won't be speedy. Note that until you have around 16 MB of RAM, getting more RAM is more important than getting a faster CPU.)

Supported Chalice CATS devices

- ALI M1543 southbridge inc PS/2 keyboard & mouse, ide, serial
- Parallel, USB and ISA bus
- RTC

Supported Intel EBSA285 & Chalice CATS PCI devices

- PCI - PCI bridges
  - DC21150
  - DC21152
  - DC21153
  - DC21154

  - Hint HB1

- Digital DC21x4x-based PCI Ethernet adapters
  - Cogent EM1X0, EM960 (a.k.a. Adaptec ANA-69XX)
  - Cogent EM964 [b]
  - Cogent EM4XX [b]
  - Compex Readylink PCI
  - DANPEX EN-9400P3
  - Digital Celebris GL, GLST on-board ethernet
  - DEC (Digital) PCI Ethernet/Fast Ethernet adapters (all)
  - JCIS Condor JC1260
  - Linksys PCI Fast Ethernet
  - SMC EtherPower 10, 10/100 (PCI only!)
  - SMC EtherPower
  - SVEC
  - PN0455
  - SVEC FD1000-TP
  - Znyx ZX34X
- Qlogic ISP [12]0x0 SCSI/FibreChannel boards
- Adaptec AHA-2910, 2915, 2920, and 2930C adapters
- Adaptec AHA-2x4x[U][2][W] cards and onboard PCI designs using the AIC-7770, AIC-7850, AIC-7860, AIC-7870, AIC-7880 and AIC-789x chipsets
- Adaptec AHA-394x[U][W] cards [b]
- Adaptec AHA-3950U2 cards
- Adaptec AHA-3960, 19160 and 29160 Ultra-160 adapters
- NE2000 PCI ethernet adapters
- Universal Serial Bus
  - UHCI host controllers
  - OHCI host controllers
  - Hubs
  - Keyboards using the boot protocol
  - Mice
  - Printers
  - Generic support for HID devices
- Video cards
  - Diamond Stealth 3D 2000 Pro
  - ATI Charger 4MB
  - STB Velocity 128
  - Cirrus Logic 5446
  - IGS 2010
  - IGS 5000
  - S3 based interfaces

Drivers for hardware marked with "[*]" are *not* present in installation kernels.

Other PCI devices may be supported by Intel EBSA285 & Chalice CATS but have not been tested.

Getting the NetBSD System on to Useful Media

You will need to create a CD with an install kernel on it or have another machine available to allow net booting.

Installation is supported from several media types, including:

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

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

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

Proceed to the instruction on installation.

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

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

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

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

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

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

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

NFS

Place the NetBSD distribution sets you wish to install into a directory on an NFS server, and make that directory mountable by the machine on which you are installing or upgrading NetBSD. This will probably require modifying the `/etc/exports` file on of the NFS server and resetting its mount daemon (mountd). (Both of these actions will probably require superuser privileges on the server.)

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

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

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

Tape

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

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

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

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

```
# cd .../NetBSD-1.6.2
# cd cats/binary
# tar -cf tape_device misc etc kern
```

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

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

Upgrade

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

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

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

Preparing your System for NetBSD installation

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

Available Boot Media

Currently the cats Cyclone firmware allows for system booting using:

- Ethernet (netboot) using DHCP, BOOTP, TFTP, or NFS.
- Local harddisk or CD ROM with the following file systems:
  - Berkeley FFS
  - Linux ext2
  - ISO9660 CD-ROM file system
  - MS-DOS file system

Booting from floppy disk is not currently supported.

Preparing the Bootable Media

This section desribes how to get a NetBSD/cats install kernel onto a CD-R.

Go to one of the NetBSD mirror sites and download CD-R image from the `pub/NetBSD/iso` directory. **http://www.netbsd.org/mirrors/#iso**

Get and install cdrecord. This is available in the packages collection under pkgsrc/sysutils/cdrecord. Systems not supported by the packages collection should get it from the official website:

ftp://ftp.netbsd.org/pub/NetBSD/packages/pkgsrc/sysutils/cdrecord/README.html
http://www.fokus.gmd.de/research/cc/glone/employees/joerg.schilling/private/cdrecord.html

```
# cdrecord -v speed=4 dev=/dev/cd1d output.iso
```

You will need to substitute the correct name of the disk image file, speed for your CD writer, and the correct device for your system (for i386 it would be /dev/cd1d).

Booting from CD-ROM

To boot from a CD-ROM simply issue the following command

```
boot> boot cd0:/netbsd
```

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 for the sake of completeness. Do not let this discourage you; the install program is not hard to use.

2. *Possible* PCMCIA *issues*

   Machines with PCMCIA slots may have problems during installation. With the improvements of the PCMCIA code in this release, this will not happen very frequently. 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. If you do have PCMCIA in your machine, you can safely ignore this section and the ``[PCMCIA]'' the first time, as you are likely to not have problems. Should troubles occur during floppy boot, they may be PCMCIA specific. You should then re-read this section and try again, following the instructions in 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.

   As of NetBSD 1.5, the kernel attempts to probe for available interrupts that are usable by the PCIC (PCMCIA interrupt controller). Assuming that this functions correctly, it should alleviate interrupt conflicts; however, I/O port conflicts are still possible.

   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 press CONTROL-C

at any time, but if you do, you'll have to begin the installation process again from scratch by running the /sysinst program from the command prompt. It is not necessary to reboot.

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 the next section. This section describes a basic installation, using a CD-ROM install as an example.

- What you need.
  - The distribution sets (in this example, they are on CD).
  - Some form of bootable media, described above.
  - A CD-ROM drive (SCSI or ATAPI), a harddisk and a minimum of 8 MB of memory installed.
  - The harddisk should have at least 200 + *n* megabytes of space free, where *n* is the number of megabytes of main memory in your system. If you wish to install the X Window System as well, you will need at least 60 MB more.
- The Quick Installation
  - Boot the system as described above. You should be at the **sysinst** main menu.

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

  - If you wish, you can configure some network settings immediately by choosing the **Utility menu** and then **Configure network**. It isn't actually required at this point, but it may be more convenient. Go back to the main menu.
  - Choose **install**.
  - You will be guided through some steps regarding the setup of your disk, and the selection of distributed components to install. When in doubt, refer to the rest of this document for details.
  - After your disk has been prepared, choose **CD-ROM** as the medium. The default values for the path and device should be ok.

- After all the files have been unpacked, go back to the main menu and select **reboot**, after you have removed the bootfloppy from the drive.
- NetBSD will now boot. If you haven't already done so in **sysinst**, you should log in as root, and set a password for that account. You are also advised to edit the file /etc/rc.conf to match your system needs.
- Your installation is now complete.
- For configuring the X window system, if installed, see the files in /usr/X11R6/lib/X11/doc. Further information can be found on **http://www.xfree86.org/**.

5. *Booting NetBSD*

   You may want to read the boot messages, to notice your disk's name and capacity. Its name will be something like sd0 or wd0 and the geometry will be printed on a line that begins with its name. As mentioned above, you may need your disk's geometry when creating NetBSD 's partitions. You will also need to know the name, to tell **sysinst** on which disk to install. 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.

   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*

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

7. *Installation drive selection and parameters*

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

   The first thing is to identify the disk on which you want to install NetBSD. **sysinst** will report a list of disks it finds and ask you for your selection. Depending on how many disks are found, you may get a different message. You should see disk names like wd0, wd1, sd0 or sd1.

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.

9. *Editing the NetBSD disklabel*

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

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

a Root partition (/)

b Swap partition.

c The NetBSD portion of the disk.

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

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

10. *Preparing your hard disk*

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

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

11. *Getting the distribution sets*

The NetBSD distribution consists of a number of *sets*, that come in the form of gzipped tarfiles. A few sets must be installed for a working system, others are optional. At this point of the installation, you will be presented with a menu which enables you to choose from one of

the following methods of installing the sets. Some of these methods will first load the sets on your hard disk, others will extract the sets directly.

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

12. *Installation using ftp*

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

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

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

13. *Installation using NFS*

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

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

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

14. *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.

15. *Installation from an unmounted file system*

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

16. *Installation from a local directory*

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

17. *Extracting the distribution sets*

After the install sets containing the NetBSD distribution have been made available, you can either extract all the sets (a full installation), or only extract sets that you have selected. In the latter case, you will be shown the currently selected sets, and given the opportunity to select the sets you want. Some sets always need to be installed (**kern, base**) and **etc** they will not be shown in this selection menu.

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

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

18. *Finalizing your installation*

Congratulations, you have successfully installed NetBSD 1.6.2.

To finalize the installation of NetBSD/cats certain parameters on the Cyclone firmware need to changed. The reason is that the Cyclone firmware is unable to boot anything other than an a.out format kernels.

Kernels created on a NetBSD/cats 1.6.2 system are natively ELF and converted to a.out. This conversion process loses the symbol information used for, amongst other things, kernel memory grovelers such as vmstat. The workaround to the problem is to provide both the native ELF kernel (with all the symbol information) and the a.out kernel. These are available as /netbsd and /netbsd.aout respectively. As the a.out format kernel is not named in such a way that the Cyclone firmware will automatically find it the following command should be

issued as the firmware prompt.

```
boot> set boot wd0:/netbsd.aout
```

You can now reboot the machine, and boot NetBSD from harddisk.

Post installation steps

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

1. Configuring /etc/rc.conf

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

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

   and with the root file system (/) mounted read-only. When the system asks you to choose a shell, simply press RETURN to get to a /bin/sh prompt. If you are asked for a terminal type, respond with **vt220** (or whatever is appropriate for your terminal type) and press RETURN. You may need to type one of the following commands to get your delete key to work properly, depending on your keyboard:

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

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

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

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

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

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

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

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

   ```
   ifconfig_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 may require modification or setting up include /etc/mailer.conf, /etc/nsswitch.conf, and /etc/wscons.conf.

For the savecore(8) facility to work with the a.out and elf kernel images supplied with cats installations you will need to set savecore_flags="-z -N /netbsd"

2. Logging in

   After reboot, you can log in as root at the login prompt. Unless you've set a password in **sysinst**, there is no initial password. If you're using the machine in a networked environment, you should create an account for yourself (see below) and protect it and the ''root'' account with good passwords. Unless you have connected an unusual terminal device as the console you can just press RETURN when it prompts for Terminal type? [...].

3. Adding accounts

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

4. The X Window System

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

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

5. Installing third party packages

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

   - More information on the package system is at
     http://www.NetBSD.org/Documentation/software/packages.html
   - A list of available packages suitable for browsing is at
     ftp://ftp.NetBSD.org/pub/NetBSD/packages/pkgsrc/README.html
   - Precompiled binaries can be found at
     ftp://ftp.NetBSD.org/pub/NetBSD/packages,
     usually in the 1.6.2/cats/All subdir. You can install them with the following commands:

```
# PKG_PATH=ftp://ftp.NetBSD.org/pub/NetBSD/packages/1.6.2/cats/All
# export PKG_PATH
# pkg_add -v tcsh
# pkg_add -v apache
# pkg_add -v perl
...
```

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

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

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

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

6. Misc

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

     # **man 5** *filename*

     is likely to give you more information on these files.

Upgrading a previously-installed NetBSD System

The upgrade to NetBSD 1.6.2 is a binary upgrade; it can be quite difficult to update the system from an earlier version by recompiling from source, primarily due to interdependencies in the various components.

To do the upgrade, you must 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 files already installed on the system are overwritten in place, you only need additional free space for files which weren't previously installed or to account for growth of the sets between releases. If you have a few megabytes free on each of your root (/) and /usr partitions, you should have enough space.

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

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

After a new kernel has been copied to your hard disk, your machine is a complete NetBSD 1.6.2 system. However, that doesn't mean that you're finished with the upgrade process. You will probably want to update the set of device nodes you have in /dev. If you've changed the contents of /dev by hand, you will need to be careful about this, but if not, you can just cd into /dev, and run the command:

```
# sh MAKEDEV all
```

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

NetBSD/cats has switched its executable format from the old a.out format to ELF, the now more commonly used and supported format. Your old binaries will continue to work just fine. The installation procedure will try to take the necessary steps to accomplish this.

The most important step is to move the old a.out shared libraries in /usr/lib and /usr/X11R6/lib (if X was installed) to /emul/aout, where they will be automatically found if an older a.out binary is executed. **sysinst** will use an existing /emul and / or /emul/aout directory if available, and will create it (as a symbolic link to /usr/aout) if necessary.

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

Compatibility Issues With Previous NetBSD Releases

Users upgrading from previous versions of NetBSD may wish to bear the following problems and compatibility issues in mind when upgrading to NetBSD 1.6.2.

Issues affecting an upgrade from NetBSD 1.5

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

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

Issues fixed by *postinstall*:

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

The following issues need to be resolved manually:

- postfix(8) configuration files require upgrading.

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

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

Issues affecting an upgrade from NetBSD 1.4 or prior

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

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

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

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

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

- named(8) leaks version information.

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

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

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

- sendmail(8) configuration file pathname changed.

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

Using online NetBSD documentation

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

- intro(1),
- man(1),

- 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), enter

```
# man 5 passwd
```

instead.

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

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

Administrivia

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

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

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

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

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

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

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

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 sunlamp 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, SUP, and WWW servers.

- Redback Networks, Inc. for hosting the NetBSD mail and GNATS server.

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

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

- The many organisations that provide NetBSD mirror sites.

- 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 organizations (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
Søren Jørvang
Scott Kaplan
Noah M. Keiserman
Harald Koerfgen
John Kohl
Chris Legrow
Ted Lemon
Norman R. McBride
Neil J. McRae
Perry E. Metzger
Luke Mewburn
Toru Nishimura
Herb Peyerl
Mike Price
Dave Rand
Michael Richardson
Heiko W. Rupp
Brad Salai
Chuck Silvers
Thor Lancelot Simon
Bill Sommerfeld
Paul Southworth
Eric and Rosemary Spahr
Ted Spradley

Kimmo Suominen
Jason R. Thorpe
Steve Wadlow
Krister Walfridsson
Rob Windsor
Jim Wise
Reinoud Zandijk
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
Distributed Processing Technology
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.
Precedence Technologies Ltd
Salient Systems Inc.
VMC Harald Frank, Germany
Warped Communications, Inc.
Whitecross Database Systems Ltd.

(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:

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):

Simon Burge	simonb@netbsd.org	**pmax**
Simon Burge	simonb@netbsd.org	**sbmips**
Jeremy Cooper	jeremy@netbsd.org	**sun3x**
Matt Fredette	fredette@netbsd.org	**sun2**
Chris Gilbert	chris@netbsd.org	**cats**
Ross Harvey	ross@netbsd.org	**alpha**
Jun-ichiro itojun Hagino	itojun@netbsd.org	**sh3**
Ben Harris	bjh21@netbsd.org	**acorn26**
Eduardo Horvath	eeh@netbsd.org	**sparc64**
Darrin Jewell	dbj@netbsd.org	**next68k**
Søren Jørvang	soren@netbsd.org	**cobalt**
Søren Jørvang	soren@netbsd.org	**sgimips**
Wayne Knowles	wdk@netbsd.org	**mipsco**
Paul Kranenburg	pk@netbsd.org	**sparc**
Frank van der Linden	fvdl@netbsd.org	**i386**
Anders Magnusson	ragge@netbsd.org	**vax**
Phil Nelson	phil@netbsd.org	**pc532**
NISHIMURA Takeshi	nsmrtks@netbsd.org	**x68k**
Tohru Nishimura	nisimura@netbsd.org	**luna68k**
NONAKA Kimihiro	nonaka@netbsd.org	**prep**
Scott Reynolds	scottr@netbsd.org	**mac68k**
Kazuki Sakamoto	sakamoto@netbsd.org	**bebox**
Noriyuki Soda	soda@netbsd.org	**arc**
Wolfgang Solfrank	ws@netbsd.org	**ofppc**
Ignatios Souvatzis	is@netbsd.org	**amiga**
Jonathan Stone	jonathan@netbsd.org	**pmax**
Shin Takemura	takemura@netbsd.org	**hpcmips**
Jason Thorpe	thorpej@netbsd.org	**alpha**
Jason Thorpe	thorpej@netbsd.org	**hp300**
Tsubai Masanari	tsubai@netbsd.org	**macppc**
Tsubai Masanari	tsubai@netbsd.org	**newsmips**
Izumi Tsutsui	tsutsui@netbsd.org	**news68k**
Leo Weppelman	leo@netbsd.org	**atari**
Nathan Williams	nathanw@netbsd.org	**sun3**
Steve Woodford	scw@netbsd.org	**mvme68k**
Steve Woodford	scw@netbsd.org	**mvmeppc**
Reinoud Zandijk	reinoud@netbsd.org	**acorn32**

The NetBSD 1.6.2 Release Engineering team:

Erik Berls	cyber@netbsd.org
Håvard Eidnes	he@netbsd.org
Perry Metzger	perry@netbsd.org
Luke Mewburn	lukem@netbsd.org
Jason Thorpe	thorpej@netbsd.org
Todd Vierling	tv@netbsd.org

NetBSD Developers:

Nathan Ahlstrom	nra@netbsd.org
Steve Allen	wormey@netbsd.org
Julian Assange	proff@netbsd.org
Lennart Augustsson	augustss@netbsd.org
Christoph Badura	bad@netbsd.org
Bang Jun-Young	junyoung@netbsd.org
Dieter Baron	dillo@netbsd.org
Robert V. Baron	rvb@netbsd.org
Jason Beegan	jtb@netbsd.org
Erik Berls	cyber@netbsd.org
Hiroyuki Bessho	bsh@netbsd.org
John Birrell	jb@netbsd.org
Mason Loring Bliss	mason@netbsd.org
Rafal Boni	rafal@netbsd.org
Manuel Bouyer	bouyer@netbsd.org
John Brezak	brezak@netbsd.org
Allen Briggs	briggs@netbsd.org
Mark Brinicombe	mark@netbsd.org
Aaron Brown	abrown@netbsd.org
Andrew Brown	atatat@netbsd.org
David Brownlee	abs@netbsd.org
Frederick Bruckman	fredb@netbsd.org
Jon Buller	jonb@netbsd.org
Simon Burge	simonb@netbsd.org
Robert Byrnes	byrnes@netbsd.org
D'Arcy J.M. Cain	darcy@netbsd.org
Dave Carrel	carrel@netbsd.org
James Chacon	jmc@netbsd.org
Bill Coldwell	billc@netbsd.org
Julian Coleman	jdc@netbsd.org
Jeremy Cooper	jeremy@netbsd.org
Chuck Cranor	chuck@netbsd.org
Alistair Crooks	agc@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
Tracy Di Marco White	gendalia@netbsd.org
Jaromír Dolecek	jdolecek@netbsd.org
Andy Doran	ad@netbsd.org
Roland Dowdeswell	elric@netbsd.org
Emmanuel Dreyfus	manu@netbsd.org
Matthias Drochner	drochner@netbsd.org
Jun Ebihara	jun@netbsd.org
Håvard Eidnes	he@netbsd.org
Stoned Elipot	seb@netbsd.org

Enami Tsugutomo	enami@netbsd.org
Bernd Ernesti	veego@netbsd.org
Erik Fair	fair@netbsd.org
Gavan Fantom	gavan@netbsd.org
Hubert Feyrer	hubertf@netbsd.org
Jason R. Fink	jrf@netbsd.org
Matt Fredette	fredette@netbsd.org
Thorsten Frueauf	frueauf@netbsd.org
Castor Fu	castor@netbsd.org
Ichiro Fukuhara	ichiro@netbsd.org
Thomas Gerner	thomas@netbsd.org
Simon J. Gerraty	sjg@netbsd.org
Justin Gibbs	gibbs@netbsd.org
Chris Gilbert	chris@netbsd.org
Adam Glass	glass@netbsd.org
Michael Graff	explorer@netbsd.org
Brian C. Grayson	bgrayson@netbsd.org
Matthew Green	mrg@netbsd.org
Andreas Gustafsson	gson@netbsd.org
Jun-ichiro itojun Hagino	itojun@netbsd.org
Juergen Hannken-Illjes	hannken@netbsd.org
Charles M. Hannum	mycroft@netbsd.org
Ben Harris	bjh21@netbsd.org
Ross Harvey	ross@netbsd.org
Eric Haszlakiewicz	erh@netbsd.org
John Hawkinson	jhawk@netbsd.org
HAYAKAWA Koichi	haya@netbsd.org
René 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
Eduardo Horvath	eeh@netbsd.org
Nick Hudson	skrll@netbsd.org
Shell Hung	shell@netbsd.org
Martin Husemann	martin@netbsd.org
Dean Huxley	dean@netbsd.org
Bernardo Innocenti	bernie@netbsd.org
Tetsuya Isaki	isaki@netbsd.org
ITOH Yasufumi	itohy@netbsd.org
IWAMOTO Toshihiro	toshii@netbsd.org
Matthew Jacob	mjacob@netbsd.org
Lonhyn T. Jasinskyj	lonhyn@netbsd.org
Darrin Jewell	dbj@netbsd.org
Chris Jones	cjones@netbsd.org
Søren Jørvang	soren@netbsd.org
Takahiro Kambe	taca@netbsd.org
Antti Kantee	pooka@netbsd.org
Masanori Kanaoka	kanaoka@netbsd.org

Mattias Karlsson	keihan@netbsd.org
KAWAMOTO Yosihisa	kawamoto@netbsd.org
Mario Kemper	magick@netbsd.org
Thomas Klausner	wiz@netbsd.org
Klaus Klein	kleink@netbsd.org
Wayne Knowles	wdk@netbsd.org
John Kohl	jtk@netbsd.org
Paul Kranenburg	pk@netbsd.org
Martti Kuparinen	martti@netbsd.org
Kevin Lahey	kml@netbsd.org
Johnny C. Lam	jlam@netbsd.org
Martin J. Laubach	mjl@netbsd.org
Ted Lemon	mellon@netbsd.org
Frank van der Linden	fvdl@netbsd.org
Joel Lindholm	joel@netbsd.org
Mike Long	mikel@netbsd.org
Warner Losh	imp@netbsd.org
Tomasz Luchowski	zuntum@netbsd.org
Federico Lupi	federico@netbsd.org
Brett Lymn	blymn@netbsd.org
Paul Mackerras	paulus@netbsd.org
Anders Magnusson	ragge@netbsd.org
MAEKAWA Masahide	gehenna@netbsd.org
David Maxwell	david@netbsd.org
Dan McMahill	dmcmahill@netbsd.org
Gregory McGarry	gmcgarry@netbsd.org
Jared D. McNeill	jmcneill@netbsd.org
Neil J. McRae	neil@netbsd.org
Perry Metzger	perry@netbsd.org
Minoura Makoto	minoura@netbsd.org
Luke Mewburn	lukem@netbsd.org
der Mouse	mouse@netbsd.org
Joseph Myers	jsm@netbsd.org
Ken Nakata	kenn@netbsd.org
Phil Nelson	phil@netbsd.org
Bob Nestor	rnestor@netbsd.org
NISHIMURA Takeshi	nsmrtks@netbsd.org
Tohru Nishimura	nisimura@netbsd.org
NONAKA Kimihiro	nonaka@netbsd.org
Jesse Off	joff@netbsd.org
Tatoku Ogaito	tacha@netbsd.org
Masaru Oki	oki@netbsd.org
Atsushi Onoe	onoe@netbsd.org
Greg Oster	oster@netbsd.org
Herb Peyerl	hpeyerl@netbsd.org
Matthias Pfaller	matthias@netbsd.org
Chris Pinnock	cjep@netbsd.org
Dante Profeta	dante@netbsd.org
Chris Provenzano	proven@netbsd.org

Michael Rauch	mrauch@netbsd.org
Darren Reed	darrenr@netbsd.org
Scott Reynolds	scottr@netbsd.org
Michael Richardson	mcr@netbsd.org
Tim Rightnour	garbled@netbsd.org
Gordon Ross	gwr@netbsd.org
Heiko W. Rupp	hwr@netbsd.org
David Sainty	dsainty@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
SATO Kazumi	sato@netbsd.org
Jan Schaumann	jschauma@netbsd.org
Matthias Scheler	tron@netbsd.org
Karl Schilke (rAT)	rat@netbsd.org
Amitai Schlair	schmonz@netbsd.org
Konrad Schroder	perseant@netbsd.org
Reed Shadgett	dent@netbsd.org
Tim Shepard	shep@netbsd.org
Takeshi Shibagaki	shiba@netbsd.org
Takao Shinohara	shin@netbsd.org
Takuya SHIOZAKI	tshiozak@netbsd.org
Chuck Silvers	chs@netbsd.org
Thor Lancelot Simon	tls@netbsd.org
Jeff Smith	jeffs@netbsd.org
Noriyuki Soda	soda@netbsd.org
Wolfgang Solfrank	ws@netbsd.org
SOMEYA Yoshihiko	someya@netbsd.org
Bill Sommerfeld	sommerfeld@netbsd.org
Ignatios Souvatzis	is@netbsd.org
Bill Squier	groo@netbsd.org
Jonathan Stone	jonathan@netbsd.org
Bill Studenmund	wrstuden@netbsd.org
Kevin Sullivan	sullivan@netbsd.org
SUNAGAWA Keiki	kei@netbsd.org
Kimmo Suominen	kim@netbsd.org
Shin Takemura	takemura@netbsd.org
TAMURA Kent	kent@netbsd.org
Shin'ichiro TAYA	taya@netbsd.org
Matt Thomas	matt@netbsd.org
Jason Thorpe	thorpej@netbsd.org
Christoph Toshok	toshok@netbsd.org
Tsubai Masanari	tsubai@netbsd.org
Izumi Tsutsui	tsutsui@netbsd.org
UCHIYAMA Yasushi	uch@netbsd.org
Masao Uebayashi	uebayasi@netbsd.org
Shuichiro URATA	ur@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
Leo Weppelman	leo@netbsd.org
Assar Westerlund	assar@netbsd.org
Todd Whitesel	toddpw@netbsd.org
Nathan Williams	nathanw@netbsd.org
Rob Windsor	windsor@netbsd.org
Dan Winship	danw@netbsd.org
Jim Wise	jwise@netbsd.org
Michael Wolfson	mbw@netbsd.org
Steve Woodford	scw@netbsd.org
Colin Wood	ender@netbsd.org
YAMAMOTO Takashi	yamt@netbsd.org
Yuji Yamano	yyamano@netbsd.org
Reinoud Zandijk	reinoud@netbsd.org
Maria Zevenhoven	maria7@netbsd.org
Christos Zoulas	christos@netbsd.org

Other contributors:

Dave Burgess	burgess@cynjut.infonet.net
Brian R. Gaeke	brg@dgate.org
Brad Grantham	grantham@tenon.com
Lawrence Kesteloot	kesteloo@cs.unc.edu
Waldi Ravens	waldi@moacs.indiv.nl.net

Legal Mumbo-Jumbo

All product names mentioned herein are trademarks or registered trademarks of their respective owners.

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 NetBSD Foundation, Inc.
This product includes software developed by the NetBSD Foundation, Inc. and its contributors.
This product includes software developed by the Computer Systems Engineering Group at Lawrence Berkeley Laboratory.
This product includes software developed by Adam Glass and Charles Hannum.
This product includes software developed by Adam Glass and Charles M. Hannum.
This product includes software developed by Adam Glass.
This product includes software developed by Alistair G. Crooks.
This product includes software developed by Amancio Hasty and Roger Hardiman.
This product includes software developed by Berkeley Software Design, Inc.
This product includes software developed by Bill Paul.
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 Pro-
ject.
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 Gardner Buchanan.
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 Hauke Fath.
This product includes software developed by HAYAKAWA Koichi.
This product includes software developed by Hellmuth Michaelis and Joerg Wunsch.
This product includes software developed by Herb Peyerl.
This product includes software developed by Holger Veit and Brian Moore for use with
"386BSD" and similar operating systems.
This product includes software developed by Hubert Feyrer for the NetBSD Project.
This product includes software developed by Iain Hibbert.
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 Manuel Bouyer.
This product includes software developed by Marc Horowitz.
This product includes software developed by Mark Brinicombe for the NetBSD Project.
This product includes software developed by Mark Brinicombe.
This product includes software developed by Mark Tinguely and Jim Lowe.
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 Michael L. Hitch.
This product includes software developed by Niels Provos.
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 Roland C. Dowdeswell.
This product includes software developed by Rolf Grossmann.
This product includes software developed by Scott Bartram.
This product includes software developed by SigmaSoft, Th. Lockert.
This product includes software developed by Tatoku Ogaito for the NetBSD Project.
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 Tohru Nishimura for the NetBSD Project.
This product includes software developed by TooLs GmbH.
```

```
This product includes software designed by William Allen Simpson.
This product includes software developed by Winning Strategies, Inc.
This product includes software developed by Zembu Labs, Inc.
This product includes software developed by the Center for Software Science at the Univer-
sity of Utah.
This product includes software developed by the Computer Systems Laboratory at the Univer-
sity of Utah.
This product includes software developed by the University of Calgary Department of Comput-
er Science and its contributors.
This product includes software developed by the University of Vermont and State Agricultur-
al 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 for the NetBSD Project by Wasabi Systems, Inc.
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 Eric Young (eay@mincom.oz.au).
This product includes software developed by the OpenSSL Project for use in the OpenSSL
Toolkit (http://www.openssl.org/).
This product includes software developed by the University of Oregon.
This product includes software developed by the University of Southern California and/or
Information Sciences Institute.
This product includes software developed by Internet Initiative Japan Inc.
This product includes software developed by Reinoud Zandijk.
This product includes software developed at the Information Technology Division, US Naval
Research Laboratory.

This product includes software developed by Advanced Risc Machines Ltd.
This product includes software developed by Neil Carson.
This product includes software developed by the RiscBSD kernel team.
This product includes software developed by Scott Stevens.
```

The End