NAME

INSTALL — Installation procedure for NetBSD/i386.

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DESCRIPTION

About this Document

This document describes the installation procedure for NetBSD 3.1_STABLE on the *i386* platform. It is available in four different formats titled `INSTALL.`*`ext`*, where *`.ext`* is one of `.ps`, `.html`, `.more`, or `.txt`:

`.ps` PostScript.

`.html` Standard Internet HTML.

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

`.txt` Plain old ASCII.

You are reading the *PostScript* version.

Quick install notes for the impatient

This section contains some brief notes describing what you need to install NetBSD 3.1_STABLE on a machine of the i386 architecture.

- Fetch the appropriate pair of boot floppy images from the `i386/installation/floppy/` directory, or a CD-ROM image. Most people will need the `boot1.fs` and `boot2.fs` images for VGA console installation, or the `boot-com1.fs` and `boot-com2.fs` images for installation via serial console. You may also possibly (but not necessarily) want to use `bootlap1.fs` and `bootlap2.fs` if installing on a laptop.
- The actual binary distribution is in the `i386/binary/sets/` directory. When you boot the install floppies, the installation program can fetch these files for you (using e.g. ftp), if you have a network connection. There are several other methods to get the binary sets onto your machine.

  You will at a minimum need one of the kernel sets, typically `kern-GENERIC.tgz`, as well as `base.tgz` and `etc.tgz`. In a typical workstation installation you will probably want all the installation sets.

- Write the floppy images directly to a pair of floppies. If you have problems writing a raw image to a floppy, the **`rawrite.exe`** MS-DOS program or the **`Rawrite32.exe`** Windows32 program (inside `rawrite32.zip`) in the `i386/installation/misc/` directory may be of help.

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

- For third-party programs which are not part of the base NetBSD distribution, you will want to explore the **`pkgsrc`** system with its more than 5400 program packages.

What is NetBSD?

The NetBSD Operating System is a fully functional Open Source UNIX -like operating system derived from the University of California, Berkeley Networking Release 2 (Net/2), 4.4BSD-Lite, and 4.4BSD-Lite2 sources. NetBSD runs on fifty four different system architectures (ports), featuring seventeen machine architectures across fifteen distinct CPU families, and is being ported to more. The NetBSD 3.1_STABLE release contains complete binary releases for many different system architectures. (A few ports 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.

Changes Between The NetBSD 3.0 and 3.1 Releases

The NetBSD 3.1 release is the first functional update release of the NetBSD 3 release branch. This provides numerous functional enhancements, including support for many new devices, hundreds of bug fixes, patches and updates to kernel subsystems, and many enhancements to the user environment. In addition, all of the security fixes and critical bug fixes from the NetBSD 3.0.1 update are included as well. 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 all the changes that have gone in over the over nine months since the release of NetBSD 3.0. Some highlights include:

Supported devices

- brgphy(4): added support for BCM5714 and BCM5780 PHY's.
- Added iteide(4): driver for ITE 8212 IDE controller.
- Added support for the Pentium M 710, 730, 740, 750, 760 and 770 CPU's.
- Added support for nForce430 ATA133 and SATA controllers.
- pdcsata(4): Added support for Promise PDC2057x, PDC20771, PDC20775, PDC40518 and PDC40718 SATA Controllers.
- ums(4): Added support for Apple's "Mighty Mouse", and USB mice with more than 7 buttons
- agp(4): Added support for Intel i915 chipset integrated graphics.
- pchb(4): Added support for Intel i925X, i945G/P and i955X hardware RNG's.
- Added ciss(4): driver for the Command Interface SCSI-3 Support implemented by recent HP/Compaq Smart Array RAID controllers.
- Added nfe(4): driver for NVIDIA nForce MCP Ethernet.
- Added svwsata(4): driver for Serverworks K2, Frodo4, Frodo8 and HT-1000 SATA controllers.
- sk(4): added support for the DLink DGE-530T and DGE-560T Gigabit Ethernet adapters.
- bge(4): added support for BCM5714, BCM5715, BCM5780/HT-2000 and BCM5752 chip variants.
- wi(4): added support for Siemens SS1021 WLAN.
- Added twa(4): driver for the 3ware Apache RAID controllers.
- viaide(4): added support for nForce3 250 SATA controllers.
- hptide(4): added support for HPT368 IDE controller.

Networking

- Enabled SSL support in BIND.
- A second dhclient(8) instance now exists gracefully instead of leaving the system in a broken state.
- Removed the date from the dhclient(8) generated resolv.conf(5) file, since changes to this file are tracked by /etc/security.
- Changed the default sshd_config(8) to enable SSH version 2 only.
- Don't accept TCP connections to broadcast addresses.

File system

- The stability of the LFS file system has been vastly improved.
- Added scan_ffs(4) from OpenBSD (modified to also support FFSv2 and LFS), a utility to recover lost disklabels.
- Write performance of large files to msdos filesystems has been improved.
- We now drop into single-user mode when /etc/rc.d/fsck is interrupted by ^C at boot-time.

Libraries

- Password aging works again.

Security

- Fixed a denial of service vulnerability in sendmail when handling malformed multipart MIME messages (SA2006-017).
- Fixed a buffer overflow in the in-kernel PPP code share by ISDN PPP interfaces `ippp`(4) and `pppoe`(4) (SA2006-019).
- X11: fixed an integer overflow in FreeType (SA2006-020).
- Fixed a potential DoS attack with `sendmail`(8) (SA2006-017).
- Fixed a DoS vulnerability in BIND (SA2006-022).
- Fixed a RSA signature forgery in `openssl`(1) (SA2006-023).
- X11: fixed a vulnerability in Adobe Type 1 font handling (SA2006-021).
- Fixed a number of DoS vulnerabilities in `openssl`(1) (SA in preparation, CVE entries: 2006-2937, 2940, 3738 and 4343).
- Fixed a number of DoS vulnerabilities in `sshd`(8) (SA in preparation, CVE entries: 2006-4924 and 5051).

Miscellaneous

- Various RAIDframe bugfixes.
- Updated Postfix to 2.2.11.
- Updated BIND to 9.3.2.
- Added `ex`(1) to /rescue.
- Fixed some special case expansions in `sh`(1).
- Fixed cross-building from GCC 4.x hosts.
- Many, many more additions, improvements and bug fixes.

alpha specific

- Support booting from FFSv2 filesystems.

amd64 specific

- Make sure that the system reboots after a panic instead of halting.

mac68k specific

- sysinst now newfs'es and mounts the target filesystem(s).

sparc specific

- Disabled threading in `named`(8) on sparc and sparc64 to avoid a crash.

xen specific

- Added Xen-3 domU support.
- Renamed XEN kernel config files to be more consistent: XEN2_DOM0, XEN2_DOMU, XEN3_DOMU, INSTALL_XEN2_DOMU and INSTALL_XEN3_DOMU.

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/mirrors/**

NetBSD 3.1_STABLE Release Contents

The root directory of the NetBSD 3.1_STABLE release is organized as follows:

`.../NetBSD-3.1_STABLE/`

`CHANGES`	Changes since earlier NetBSD releases.
`LAST_MINUTE`	Last minute changes.
`MIRRORS`	A list of sites that mirror the NetBSD 3.1_STABLE 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 3.1_STABLE has a binary distribution.

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.
79 MB gzipped, 367 MB uncompressed

pkgsrc This set contains the "pkgsrc" sources, which contain the infrastructure to build third-party packages.
24 MB gzipped, 200 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.
5 MB gzipped, 20 MB uncompressed

src This set contains all of the base NetBSD 3.1_STABLE sources which are not in **gnusrc**, **sharesrc**, or **syssrc**.
37 MB gzipped, 176 MB uncompressed

syssrc This set contains the sources to the NetBSD 3.1_STABLE kernel for all architectures; `config`(8); and `dbsym`(8).
26 MB gzipped, 140 MB uncompressed

xsrc This set contains the sources to the X Window System.
84 MB gzipped, 450 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
```

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 ATT 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/i386 subdirectory structure

The i386-specific portion of the NetBSD 3.1_STABLE release is found in the `i386` subdirectory of the distribution: `.../NetBSD-3.1_STABLE/i386/`. It contains the following files and directories:

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

`binary/`

`kernel/`

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

`netbsd-GENERIC.MP.gz`
: A gzipped NetBSD kernel containing code for everything supported in this release. This kernel also supports SMP on systems with more than one CPU.

`netbsd-GENERIC_DIAGNOSTIC.gz`
: A gzipped NetBSD kernel containing code for everything supported in this release, with diagnostic messages enabled.

`netbsd-GENERIC_LAPTOP.gz`
: A version of `GENERIC` that has USB, PCMCIA and CardBus enabled to allow installing on laptop machines.

`netbsd-GENERIC_TINY.gz`
: A version of `GENERIC` intended to run on machines with less than 8 MB.

`netbsd-GENERIC_PS2TINY.gz`
: A version of `GENERIC` intended to run on IBM PS/2 machines.

`netbsd-INSTALL.gz`
: A somewhat smaller kernel, which you can use to boot the system on memory-tight systems. This is the same kernel as present on the miniroot and on many install floppies.

`netbsd-INSTALL_TINY.gz`
: A version of `INSTALL` intended to run on machines with less than 8 MB.

`netbsd-INSTALL_SMALL.gz`
: A version of `INSTALL` intended to fit on 5.25"/1.2 MB diskettes.

`netbsd-INSTALL_LAPTOP.gz`
: A version of `INSTALL` that has USB, PCMCIA and CardBus enabled to allow installing on laptop machines.

`netbsd-INSTALL_PS2.gz`
: A version of `INSTALL` that has MCA stuff enabled to allow installing on IBM PS/2 machines.

`sets/` i386 binary distribution sets; see below.

```
installation/
        floppy/ i386 boot and installation floppies; see below.
        misc/
```

Binary distribution sets

The NetBSD i386 binary distribution sets contain the binaries which comprise the NetBSD 3.1_STABLE release for the i386. The binary distribution sets can be found in the `i386/binary/sets` subdirectory of the NetBSD 3.1_STABLE distribution tree, and are as follows:

base The NetBSD 3.1_STABLE i386 **base** binary distribution. You *must* install this distribution set. It contains the base NetBSD utilities that are necessary for the system to run and be minimally functional. It includes shared library support, and excludes everything described below.
17 MB gzipped, 47 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.
20 MB gzipped, 73 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/i386 3.1_STABLE `GENERIC` kernel, named `/netbsd`. You *must* install this distribution set.
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.
8 MB gzipped, 30 MB uncompressed

misc This set includes the (rather large) system dictionaries, the typesettable document set, and other files from `/usr/share`.
3 MB gzipped, 9 MB uncompressed

text This set includes NetBSD's text processing tools, including `groff`(1), all related programs, and their manual pages.
2 MB gzipped, 7 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 4.4.0. 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.
6 MB gzipped, 17 MB uncompressed

xcomp The extra libraries and include files needed to compile X source code.
11 MB gzipped, 37 MB uncompressed

xfont Fonts needed by X.
31 MB gzipped, 39 MB uncompressed

xetc Configuration files for X which could be locally modified.
0.03 MB gzipped, 0.17 MB uncompressed

xserver The X server. This includes all XFree86 X servers. Because all of them are included, this set is large. However, you will only need one of the servers provided in this set. (Typically, **`XFree86`**).
8 MB gzipped, 22 MB uncompressed

The i386 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 i386 binary distribution also has its own checksum files, just as the source distribution does.

NetBSD/i386 System Requirements and Supported Devices

NetBSD 3.1_STABLE runs on ISA (AT-Bus), EISA, MCA, PCI, and VL-bus systems with 386-family processors, with or without math coprocessors. The minimal configuration is said to require 4 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. (4 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 devices

Explanation of bracketted footnote tags [] follows this listing.

- Floppy controllers.
- MFM, ESDI, IDE, and RLL hard disk controllers.
  There is complete support (including IDE DMA or Ultra-DMA) for the following PCI controllers
  - Acard ATA-850 and 860 based IDE Controllers
  - Acer labs M5229 IDE Controller
  - Advanced Micro Devices AMD-756, 766, and 768 IDE Controllers
  - CMD Tech PCI0643, 0646, 0648, and 0649 IDE Controllers
  - Contaq Microsystems/Cypress CY82C693 IDE Controller
  - HighPoint HPT366, HPT370, HPT372, and HPT374.
  - IBM ESDI Fixed Disk Controllers [m]
  - Intel PIIX, PIIX3, and PIIX4 IDE Controllers
  - Intel 82801 (ICH/ICH0/ICH2/ICH4/ICH5/ICH6) IDE Controllers
  - Promise PDC20246 (Ultra/33), PDC20262 (Ultra/66), PDC20265/PDC20267 (Ultra/100), PDC20268 (Ultra/100TX2 and Ultra/100TX2v2), Ultra/133, Ultra/133TX2, and Ultra/133TX2v2.
  - Promise SATA150 serial-ATA controllers: PDC20318, PDC20319, PDC20371, PDC20375, PDC20376, PDC20377, PDC20378 and PDC20379.

- Silicon Integrated System 5597/5598 IDE controller
- VIA Technologies VT82C586, VT82C586A, VT82C596A, VT82C686A, and VT8233A IDE Controllers

Most of these controllers are only available in multifunction PCI chips. Other PCI IDE controllers are supported, but performance may not be optimal. ISA, ISA Plug and Play and PCMCIA IDE controllers are supported as well.

- SCSI host adapters
  - Adaptec AHA-154xA, -B, -C, and -CF
  - Adaptec AHA-1640 cards (MCA variant of AHA-1540) [m]
  - Adaptec AHA-174x
  - Adaptec AIC-6260 and AIC-6360 based boards, including the Adaptec AHA-152x, Adaptec APA-1460 (PCMCIA) and APA-1480 (CardBus), and the SoundBlaster SCSI host adapter.

    Note: You cannot boot from these boards if they do not have a boot ROM; consequently only the AHA-152x and motherboards using this chip are likely to be bootable.

  - 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
  - AdvanSys ABP-9x0[U][A] cards
  - AdvanSys ABP-940UW[68], ABP-970UW[68], and ASB3940UW-00 cards
  - AMD PCscsi-PCI (Am53c974) based SCSI adapters, including Tekram DC-390
  - BusLogic 54x (Adaptec AHA-154x clones)
  - BusLogic 445, 74x, 9xx (but not the new 'FlashPoint' series of BusLogic SCSI adapters)
  - Qlogic ISP [12]0x0 SCSI/FibreChannel boards
  - Seagate/Future Domain ISA SCSI adapter cards
    - ST01/02
    - Future Domain TMC-885
    - Future Domain TMC-950
  - Symbios Logic (NCR) 53C8xx-based PCI SCSI host adapters
    - Acculogic PCIpport
    - ASUS SC-200 (requires NCR BIOS on motherboard to boot from disks)
    - ASUS SC-875
    - ASUS SP3[G] motherboard onboard SCSI
    - DEC Celebris XL/590 onboard SCSI
    - Diamond FirePort 40
    - Lomas Data SCSI adapters
    - NCR/SYM 8125 (and its many clones; be careful, some of these cards have a jumper to set the PCI interrupt; leave it on INT A!)
    - Promise DC540 (a particularly common OEM model of the SYM 8125)
    - Tekram DC-390U/F
    - Tyan Yorktown
  - Symbios Logic (NCR) 5380/53C400-based ISA SCSI host adapters [*]
  - Ultrastor 14f, 34f, and (possibly) 24f
  - Western Digital WD7000 SCSI and TMC-7000 host adapters (ISA cards only)
- MDA, CGA, VGA, SVGA, and HGC Display Adapters.

Note: Not all of the display adapters NetBSD/i386 can work with are supported by X. See the XFree86 FAQ for more information.

- Serial ports
  - 8250/16450-based ports
  - 16550/16650/16750-based ports
  - AST-style 4-port serial cards [*]
  - BOCA 8-port serial cards [*]
  - BOCA 6-port (ioat) serial cards [*]
  - IBM PC-RT 4-port serial cards [*]
  - TCOM TC-400 (4-port), TC-800 (8-port) serial cards [*]
  - Single-port Hayes ESP serial cards [*]
  - Cyclades Cyclom-Y serial cards [*] [+]
  - Addonics FlexPort 8S 8-port serial cards [*]
  - Byte Runner Technologies TC-400 and TC-800 serial cards [*]
  - PCI universal communication cards
- Parallel ports. [*] [+]
- Ethernet adapters
  - AMD LANCE and PCnet-based ISA Ethernet adapters [*]
    - Novell NE1500T
    - Novell NE2100
    - Kingston 21xx
    - Digital EtherWORKS II ISA adapters (DE200/DE201/DE202)
  - AMD LANCE and PCnet-based MCA Ethernet adapters [m]
    - SKNET Personal
    - SKNET MC+
  - AMD PCnet-based PCI Ethernet adapters
    - Addtron AE-350
    - BOCALANcard/PCI
    - SVEC FD0455
    - X/Lan Add-On Adapter
    - IBM #13H9237 PCI Ethernet Adapter
  - ATT StarLAN 10, EN100, and StarLAN Fiber
  - 3COM 3c501
  - 3COM 3c503
  - 3COM 3c505 [*]
  - 3COM 3c507
  - 3COM 3c509, 3c579, 3c589, and 3c59X
  - 3COM 3c523 EtherLink/MC [m]
  - 3COM 3c529 EtherLink III [m]
  - 3COM 3c90X (including 3c905B), 3c450, 3c55X, 3c575, 3c980, 3cSOHO100
  - Digital DC21x4x-based PCI Ethernet adapters
    - Accton EN2242
    - ASUS PCI-DEC100TX+
    - 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)
    - DLINK DFE500-TX
    - JCIS Condor JC1260
    - Linksys PCI Fast Ethernet
    - SMC EtherPower 10, 10/100 (PCI only!)
    - SMC EtherPower^2 [b]
    - Sundance ST-201 based ethernet adapters (including DLINK DFE550-TX and DFE580-TX)
    - SVEC PN0455
    - SVEC FD1000-TP
    - Znyx ZX34X
  - Digital EtherWORKS III ISA adapters (DE203/DE204/DE205) [*]
  - Digital DEPCM-BA (PCMCIA) and DE305 (ISA) NE2000-compatible cards
  - BICC Isolan [* and not recently tested]
  - Efficient Networks EN-155 and Adaptec AIC-590x ATM interfaces
  - Essential Communications Hippi (800 Mbit/s)
  - Fujitsu MB86960A/MB86965A based cards
    - Fujitsu FMV-180 series
    - Allied-Telesis AT1700 series
    - Allied-Telesis AT1700 series MCA [m]
    - Allied-Telesis RE2000 series
  - Intel EtherExpress 16
  - Intel EtherExpress PRO/10
  - Intel EtherExpress 100 Fast Ethernet adapters
  - Intel Intel PRO/1000 Gigabit Ethernet adapters
  - Novell NE1000, NE2000 (ISA, PCI, PCMCIA, ISA PnP)
  - Realtek 8129/8139 based boards
  - Realtek 8139C+/8169/8169S/8110S based boards
  - SMC/WD 8003, 8013, and the SMC 'Elite16' ISA boards
  - SMC/WD 8003, 8013 and IBM PS/2 Adapter/A MCA boards [m]
  - SMC/WD 8216 (the SMC 'Elite16 Ultra' ISA boards)
  - SMC 91C9x-based boards (ISA and PCMCIA)
  - SMC EPIC/100 Fast Ethernet boards
    - SMC Etherpower-II
  - Texas Instruments ThunderLAN based ethernet boards
    - Compaq Netelligent 10/100 TX
    - Compaq ProLiant Integrated Netelligent 10/100 TX
    - Compaq Netelligent 10 T (untested)
    - Compaq Integrated NetFlex 3/P
    - Compaq NetFlex 3/P in baseboard variant (the PCI variant doesn't use the same chip!)
    - Compaq Dual Port Netelligent 10/100 TX
    - Compaq Deskpro 4000 5233MMX (untested)
    - Texas Instruments TravelMate 5000 series laptop docking station Ethernet board
  - VIA VT3043 (Rhine) and VT86C100A (Rhine-II) based ethernet boards
    - D-Link DFE530TX

- FDDI adapters
  - Digital DEFPA PCI FDDI adapters [*] [+]
  - Digital DEFEA EISA FDDI adapters [*] [+]

- Token-Ring adapters
  - IBM Token-Ring Network PC Adapter [+]
  - IBM Token-Ring Network PC Adapter II [+]
  - IBM Token-Ring Network Adapter/A [+]
  - IBM Token-Ring Network 16/4 Adapter [+]
  - IBM Token-Ring Network 16/4 Adapter/A [m]
  - IBM 16/4 ISA Adapter [+]
  - IBM Auto 16/4 Token-Ring ISA Adapter [+]
  - 3COM 3C619 TokenLink [+]
  - 3COM 3C319 TokenLink Velocity [+]
- Wireless network adapters
  - 3Com AirConnect Wireless LAN
  - ATT/Lucent/Agere WaveLAN/ORiNOCO IEEE (802.11) PCMCIA cards
  - Aironet 4500/4800 and Cisco 340 series PCMCIA cards
  - BayStack 650 802.11FH PCMCIA cards [*] [+]
  - Corega Wireless LAN PCC-11 cards [*] [+]
  - DEC/Cabletron RoamAbout 802.11 DS High Rate cards [*] [+]
  - ELSA AirLancer MC-11 card [*] [+]
  - Intersil Prism II
  - Melco AIR CONNECT WLI-PCM-L11 cards [*] [+]
  - NetWave AirSurfer PCMCIA cards [*] [+]
- High Speed Serial
  - LAN Media Corporation SSI/LMC10000 (up to 10 Mbps) [*] [+]
  - LAN Media Corporation HSSI/LMC5200 [*] [+]
  - LAN Media Corporation DS3/LMC5245 [*] [+]
- Tape drives
  - Most SCSI tape drives
  - Seagate and OnStream ATAPI tape drives, possibly others
  - QIC-02 and QIC-36 format (Archive- and Wangtek- compatible) tape drives [*] [+]
- CD-ROM drives
  - Non-IDE Mitsumi CD-ROM drives [*] [+]

    Note: The Mitsumi driver device probe is known to cause trouble with several devices!

  - Most SCSI CD-ROM drives
  - Most ATAPI CD-ROM drives.

    Note: Some low-priced IDE CD-ROM drives are known for being not or not fully ATAPI compliant, and thus require some hack (generally an entry to a quirk table) to work with NetBSD.

- Mice
  - "Logitech" -style bus mice [*] [+]
  - Microsoft-style bus mice [*] [+]
  - "PS/2" -style mice [*] [+]
  - Serial mice (no kernel support necessary)
- Sound Cards
  - Aria based sound cards [*]
  - Cirrus Logic CS461x, CS4280 and CS4281 audio [*] [+]

  - Ensoniq AudioPCI [*] [+]
  - ESS Technology ESS 1688 Audiodrive, ES1777/1868/1869/1887/1888/888, Maestro 1/2/2E and Solo-1 ES1938/1946 [*] [+]
  - Gravis Ultrasound Plug and Play [*] [+]
  - Gravis Ultrasound and Ultrasound Max [*] [+]
  - NeoMagic MagicMedia 256AV / 256ZX AC'97 audio [*] [+]
  - Personal Sound System [*] [+]
  - ProAudio Spectrum [*] [+]
  - S3 SonicVibes [*] [+]
  - SoundBlaster, SoundBlaster Pro, SoundBlaster 16 [*] [+]
  - VIA VT82C686A southbridge integrated AC97 audio [*] [+]
  - Windows Sound System [*] [+]
  - Yamaha YMF724/740/744/754 audio (DS-1 series) [*] [+]
  - Yamaha OPL3-SA3 audio [*] [+]
- Game Ports (Joysticks) [*] [+]
- Miscellaneous
  - Advanced power management (APM) [*]
- Universal Serial Bus (USB)
  - UHCI host controllers [*] [+]
  - OHCI host controllers [*] [+]
  - Hubs [*] [+]
  - Keyboards using the boot protocol [*] [+]
  - Mice [*] [+]
  - Printers [*] [+]
  - Modems using Abstract Control Model [*] [+]
  - Generic support for HID devices [*] [+]
  - Ethernet adapters [*] [+]
  - Audio devices [*] [+]
  - driver for FTDI based serial adapters [*] [+]
  - Mass storage devices such as disks, ZIP drives and digital cameras [*] [+]
  - driver for the Prolific host-to-host adapter [*] [+]
  - Handspring Visor driver [*] [+]
- PCMCIA Controllers.
  ISA, PCI, and ISA Plug and Play attachments
  - Intel 82365 PCIC, rev 0 and rev 1
  - Cirrus PD6710
  - Cirrus PD672X

  Note: This will work with most laptops as well as with ISA cards which provide PCMCIA slots for desktops.
- RAID Controllers
  - 3ware Escalade family of controllers
  - Compaq Integrated Array (PCI) [b]
  - Compaq IAES (EISA)
  - Compaq IDA, IDA-2 (EISA)
  - Compaq Smart Array 221, 3100ES, 3200, 4200, 4250ES (PCI) [b]
  - Compaq Smart Array 431, RAID LC2 [b]

- Compaq SMART 2, 2/E (EISA)
- Compaq SMART 2/E, 2/P, 2DH, 2SL (PCI) [b]
- DELL RAID controllers
  - PERC 2/SC
  - PERC 2/DC
  - PERC 4/Di
  - PERC 4/SC
  - PERC 4e/Si
  - CERC 1.5
- DPT SCSI RAID boards (ISA [*], EISA and PCI)
  - SmartCache III
  - SmartCache IV
  - SmartRAID III
  - SmartRAID IV
- MegaRAID controllers
  - 320-1
  - 320-2
  - Series 418
  - Enterprise 1200 (Series 428)
  - Enterprise 1300 (Series 434)
  - Enterprise 1400 (Series 438)
  - Enterprise 1500 (Series 467)
  - Enterprise 1600 (Series 471)
  - Elite 1500 (Series 467)
  - Elite 1600 (Series 493)
  - Express 100 (Series 466WS)
  - Express 200 (Series 466)
  - Express 300 (Series 490)
  - Express 500 (Series 475)

Specific driver footnotes:

[*] Drivers are *not* present in kernels on the distribution floppies. Except as noted above, all drivers are present on all disks. Also, at the present time, the distributed kernels support only one SCSI host adapter per machine. NetBSD normally allows more, though, so if you have more than one, you can use all of them by compiling a custom kernel once NetBSD is installed.

[+] Support *is* included in the `GENERIC` kernels, although it is not in the kernels which are on the distribution floppies.

[b] Devices require BIOS support for PCI-PCI bridging on your motherboard. Most reasonably modern Pentium motherboards have this support, or can acquire it via a BIOS upgrade.

[m] Devices are only supported by MCA-enabled kernels.

Unsupported devices

Hardware the we do *not* currently support, but get many questions about:

- PCI WD-7000 SCSI host adapters.
- QIC-40 and QIC-80 tape drives. (Drives that connect to the floppy disk controller.)

We are planning future support for many of these devices.

Required configurations

To be detected by the distributed kernels, the devices must be configured as follows:

```
Device          Name    Port    IRQ     DRQ     Misc
------          ----    ----    ---     ---     ----
Serial ports    com0    0x3f8   4               [8250/16450/16550/clones]
                com1    0x2f8   3               [8250/16450/16550/clones]
                com2    0x3e8   5               [8250/16450/16550/clones]

Parallel ports  lpt0    0x378   7               [interrupt-driven or polling]
                lpt1    0x278                   [polling only]
                lpt2    0x3bc                   [polling only]

Floppy controller
                fdc0    0x3f0   6       2       [supports two disks]

AHA-154x, AHA-174x (in compatibility mode), or BT-54x SCSI host adapters
                aha0    0x330   any     any
                aha1    0x334   any     any

AHA-174x SCSI host adapters (in enhanced mode)
                ahb0    any     any     any

AHA-152x, AIC-6260- or AIC-6360-based SCSI host adapters
                aic0    0x340   11      6

AHA-2X4X or AIC-7xxx-based SCSI host adapters   [precise list: see NetBSD
                ahc0    any     any     any      System Requirements and
                                                 Supported Devices]

AdvanSys ABP-9x0[U][A] SCSI host adapters
                adv0    any     any     any

AdvanSys ABP-940UW[68], ABP-970UW[68], ASB3940UW-00 SCSI host adapters
                adw0    any     any     any

AMD PCscsi-PCI based SCSI host adapters
                pcscp0  any     any     any

BusLogic BT445, BT74x, or BT9xx SCSI host adapters
                bha0    0x330   any     any
                bha1    0x334   any     any

Seagate/Future Domain SCSI
                sea0    any     5       any     iomem 0xd8000

Symbios Logic/NCR 53C8xx, 53c1010 and 53c1510D based PCI SCSI host adapters
                siop0   any     any     any
                esiop0  any     any     any

Ultrastor 14f, 24f (if it works), or 34f SCSI host adapters
                uha0    0x330   any     any
```

```
                uha1    0x340   any     any

Western Digital WD7000 based ISA SCSI host adapters
                wds0    0x350   15      6
                wds1    0x358   11      5

PCI IDE hard disk controllers
                pciide0 any     any     any     [supports four devices]

MFM/ESDI/IDE/RLL hard disk controllers
                wdc0    0x1f0   14              [supports two devices]
                wdc1    0x170   15              [supports two devices]

ATA disks       wd0, wd1, ...
SCSI and ATAPI disks sd0, sd1, ...
SCSI tapes      st0, st1, ...
SCSI and ATAPI CD-ROMs cd0, cd1, ...
        For each SCSI and IDE controller found, the SCSI or ATA(PI) devices
        present on the bus are probed in increasing ID order for SCSI and
        master/slave order for ATA(PI).  So the first SCSI drive found will
       be called sd0, the second sd1, and so on ...

StarLAN cards
                ai0     0x360   7       any     iomem 0xd0000

FMV-180 series cards
                fmv0    0x2a0   any

AT1700 cards
                ate0    0x2a0   any

Intel EtherExpress/16 cards
                ix0     0x300   10

Intel EtherExpress PRO 10 ISA cards
                iy0     0x360   any

CS8900 Ethernet cards
                cs0     0x300   any     any

3Com 3c501 Ethernet cards
                el0     0x300   9

3Com 3c503 Ethernet cards
                ec0     0x250   9               iomem 0xd8000

3Com 3c505 Ethernet cards
                eg0     0x280   9

3Com 3c507 Ethernet cards
                ef0     0x360   7               iomem 0xd0000
```

```
Novell NE1000, or NE2000 Ethernet boards
                ne0     0x280   9
                ne1     0x300   10

Novell NE2100 Ethernet boards
                ne2     0x320   9       7

BICC IsoLan cards
                ne3     0x320   10      7

SMC/WD 8003, 8013, Elite16, and Elite16 Ultra Ethernet boards
                we0     0x280   9               iomem 0xd0000
                we1     0x300   10              iomem 0xcc000

3COM 3c509 or 3COM 3c579 Ethernet boards
                ep0     any     any

3COM 3x59X PCI Ethernet boards
                ep0     any     any     [you must assign an interrupt in your
                                         PCI BIOS, or let it do so for you]

3COM 3x90X PCI Ethernet boards
                ex0     any     any     [you must assign an interrupt in your
                                         PCI BIOS, or let it do so for you]

Intel EtherExpress PRO 10 ISA
                iy0             0x360   any

Intel EtherExpress 100 Fast Ethernet adapters
                fxp0    any     any     [you must assign an interrupt in your
                                         PCI BIOS, or let it do so for you]

SMC91C9x based Ethernet cards
                sm0     0x300   10

PCnet-PCI based Ethernet boards; see above for partial list
                le0     any     any     [you must assign an interrupt in your
                                         PCI BIOS, or let it do so for you]

DC21x4x based Ethernet boards; see above for partial list
                de0     any     any     [you must assign an interrupt in your
                                         PCI BIOS, or let it do so for you]

Digital EtherWORKS III (DE203/DE204/DE205) LEMAC
                lc0     0x320   any

Qlogic ISP [12]0x0 SCSI/FibreChannel boards
                isp0    any     any

Efficient Networks EN-155 and Adaptec AIC-590x ATM interfaces
                en0     any     any
```

```
SMC EPIC/100 Fast Ethernet boards
                epic0   any     any

Texas Instruments ThunderLAN based ethernet boards
                tl0     any     any

VIA VT3043(Rhine) and VT86C100A(Rhine-II) based ethernet boards
                vr0     any     any

IBM TROPIC based Token-Ring cards
                tr0     0xa20   any             iomem 0xd8000
                tr1     0xa24   any             iomem 0xd0000
                tr2     any     any
```

Getting the NetBSD System on to Useful Media

If you are not booting off a CD-ROM, you will need to have some floppy disks to boot off; either two 1.44 MB floppies or one 1.2 MB floppy.

For laptops that have cardbus slots, you should use the `bootlap1.fs` and `bootlap2.fs` floppy images.

For older machines with little RAM, use `boot-tiny.fs`. This image is tailored towards old, small-memory systems, and thus does not contain any PCI or SCSI support. It should work on systems with 4M of RAM. Note that this means 4M available to NetBSD; systems that are said to have 4M may have 640k of base memory and 3072k of extended memory, which currently will not work, as this is a total of 3712k.

For old machines that may have EISA, SCSI and more RAM, but only have a 1.2M floppy drive, use `boot-small1.fs` and `boot-small2.fs`.

For old IBM PS/2 machines with MCA, use `boot-ps2-1.fs` and `boot-ps2-2.fs` floppy images.

For all other systems, use `boot1.fs` and `boot2.fs`

For the 2-floppy sets (and the CD boot image), utilities to repair a badly crashed systems are included. The `boot-tiny.fs` image has a separate `rescue-tiny.fs` rescue floppy image because of lack of space.

If you are using a UNIX -like system to write the floppy images to disks, you should use the `dd` command to copy the file system image(s) (.fs file) directly to the raw floppy disk. It is suggested that you read the `dd`(1) manual page or ask your system administrator to determine the correct set of arguments to use; it will be slightly different from system to system, and a comprehensive list of the possibilities is beyond the scope of this document.

If you are using MS-DOS to write the floppy image(s) to floppy disk, you should use the **`rawrite`** utility, provided in the `i386/installation/misc` directory of the NetBSD distribution. It will write a file system image (.fs file) to a floppy disk. A **`rawrite32`** is also available that runs under MS Windows.

Note that if you are installing or upgrading from a writable media, the media can be write-protected if you wish. These systems mount a root image from inside the kernel, and will not need to write to the media. If you booted from a floppy, the floppy disk may be removed from the drive after the system has booted.

Installation is supported from several media types, including:

- CD-ROM / DVD
- MS-DOS floppy
- FTP

- Remote NFS partition
- 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 / DVD Find out where the distribution set files are on the CD-ROM or DVD. Likely locations are `binary/sets` and `i386/binary/sets`.

Proceed to the instruction on installation.

MS-DOS floppy NetBSD doesn't include split sets to keep the distribution size down. They can be created on a seperate machine using the `split`(1) command, running e.g. **`split -b 235k base.tgz base.`** to split the `base.tgz` file from `i386/binary/sets` into files named `base.aa`, `base.ab`, and so on. Repeat this for all `set_name.tgz` files, splitting them into `set_name.`*`xx`* files. Count the number of `set_name.`*`xx`* files that make up the distribution sets you want to install or upgrade. You will need one fifth that number of 1.2 MB floppies, or one sixth that number of 1.44 MB floppies. You should only use one size of floppy for the install or upgrade procedure; you can't use some 1.2 MB floppies and some 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. If you don't have DHCP available on your network, you will 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 IPv4 address of **ftp.NetBSD.org** is `204.152.184.75` and the IPv6 address is `2001:4f8:4:7:2e0:81ff:fe21:6563` (as of June, 2004).

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 for those 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 you don't have DHCP available on your network and 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 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.

Preparing your System for NetBSD installation

First and foremost, before beginning the installation process, *make sure you have a reliable backup* of any data on your hard disk that you wish to keep. Mistakes in partitioning your hard disk may lead to data loss.

Before you begin, you should be aware of the geometry issues that may arise in relation to your hard disk. First of all, you should know about sector size. You can count on this to be 512 bytes; other sizes are rare (and currently not supported). Of particular interest are the number of sectors per track, the number of tracks per cylinder (also known as the number of heads), and the number of cylinders. Together they describe the disk geometry.

The BIOS has a limit of 1024 cylinders and 63 sectors per track for doing BIOS I/O. This is because of the old programming interface to the BIOS that restricts these values. Most of the big disks currently being used have more than 1024 real cylinders. Some have more than 63 sectors per track. Therefore, the BIOS can be instructed to use a fake geometry that accesses most of the disk and the fake geometry has less than or equal to 1024 cylinders and less than or equal to 63 sectors. This is possible because the disks can be addressed in a way that is not restricted to these values, and the BIOS can internally perform a translation. This can be activated in most modern BIOSes by using *Large* or *LBA* mode for the disk.

NetBSD does not have the mentioned limitations with regard to the geometry. However, since the BIOS has to be used during startup, it is important to know about the geometry the BIOS uses. The NetBSD kernel should be on a part of the disk where it can be loaded using the BIOS, within the limitations of the BIOS geometry. The install program will check this for you, and will give you a chance to correct this if this is not the case.

If you have not yet installed any other systems on the hard disk that you plan to install NetBSD on, or if you plan to use the disk entirely for NetBSD, you may wish to check your BIOS settings for the 'Large' or 'LBA' modes, and activate them for the hard disk in question. While they are not needed by NetBSD as such, doing so will remove the limitations mentioned above, and will avoid hassle should you wish to share the disk with other systems. Do *not* change these settings if you already have data on the disk that you want to preserve!

In any case, it is wise to check your the BIOS settings for the hard disk geometry before beginning the installation, and write them down. While this should usually not be needed, it enables you to verify that the install program determines these values correctly.

The geometry that the BIOS uses will be referred to as the *BIOS geometry*, the geometry that NetBSD uses is the *real geometry*.

sysinst, the NetBSD installation program, will try to discover both the real geometry and BIOS geometry.

It is *important* that **sysinst** know the proper BIOS geometry to be able to get NetBSD to boot, regardless of where on your disk you put it. It is less of a concern if the disk is going to be used entirely for NetBSD. If you intend to have several OSes on your disk, this becomes a much larger issue.

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. 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.

   The kernel attempts to probe for available interrupts that are usable by the PCIC (PCMCIA interrupt controller), which 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.

   It can be difficult to distinguish an interrupt conflict from an I/O space conflict. There are no hard-and-fast rules, but interrupt conflicts are more likely to lock up the machine, and I/O space conflicts are more likely to result in misbehavior (e.g. a network card that cannot send or receive packets).

   The kernel selects a free interrupt according to a mask of allowable interrupts, stored in the kernel global variable *pcic_isa_intr_alloc_mask*. This mask is a logical-or of power-of-2s of allowable interrupts:

IRQ	Val	IRQ	Val	IRQ	Val	IRQ	Val
0	0x0001	4	0x0010	8	0x0100	12	0x1000
1	0x0002	5	0x0020	9	0x0200	13	0x2000
2	0x0004	6	0x0040	10	0x0400	14	0x4000

```
3  0x0008    7  0x0080   11  0x0800    15  0x8000
```

For example, 0x0a00 allows both IRQ 9 and IRQ 11. By default, the INSTALL kernel permits all IRQs other than IRQs 5 and 7, so the corresponding mask is 0xff5f. The GENERIC kernel, however, allows all IRQs. (The presumption here is that IRQ 10 may be assigned to a device that the GENERIC kernel supports, but that the INSTALL does not.) Because of support for interrupt probing, it is no longer necessary to exclude IRQs 3 and 5 explicitly; if they are in use, they should not be assigned to PCMCIA.

The kernel selects IO space by assigning cards IO space within a predefined range. The range is specified as a base and size, specified by the kernel global variables *pcic_isa_alloc_iobase* and *pcic_isa_alloc_iosize*. For systems with 12-bit addressing (most systems), the kernel defaults to a base of 0x400 and a size of 0xbff (a range of 0x400-0xfff). For systems with 10-bit addressing, the kernel defaults to a base of 0x300 and a size of 0xff (range of 0x300-0x3ff).

Unfortunately, these ranges may conflict with some devices. In the event of a conflict, try a base of 0x330 with a size of 0x0bf (range of 0x330-0x3ff).

In order to work around this at installation time, you may interrupt the 5 second countdown when booting the INSTALL kernel, and use **boot -d**, in order to enter ddb(4) (the in-kernel debugger), and then use the **write** command to alter the variable values:

```
db write pcic_isa_intr_alloc_mask 0x0a00
pcic_isa_intr_alloc_mask            0xff5f = 0xa00
db write pcic_isa_alloc_iobase 0x330
pcic_isa_alloc_iobase               0x400 = 0x330
db write pcic_isa_alloc_iosize 0x0bf
pcic_isa_alloc_iosize               0xbff = 0xbf
db continue
```

Note that, since some floppy images may not have symbol information in the kernel, you may have to consult the matching .symbols file in the binary/kernel directory in the installation tree. Find the pcic_ symbols used above, look at the hexadecimal value in the first column, and write, for example (if *pcic_isa_intr_alloc_mask* is equal to c0513e3c):

```
db write 0xc0513e3c 0x0a00
```

After installation, this value can be permanently written to the kernel image directly with:

```
# cp /netbsd /netbsd.bak
# gdb --write /netbsd
(gdb) set pcic_isa_intr_alloc_mask=0x0a00
(gdb) set pcic_isa_alloc_iobase=0x330
(gdb) set pcic_isa_alloc_iosize=0x0bf
(gdb) quit
#
```

or you could specify these value when configuring your kernel, e.g.:

```
options PCIC_ISA_INTR_ALLOC_MASK=0x0a00
options PCIC_ISA_ALLOC_IOBASE=0x330
options PCIC_ISA_ALLOC_IOSIZE=0x0bf
```

If you can get your PCMCIA card to work using this hack, you may also ignore the [PCMCIA] notes later in this document.

We hope to provide a more elegant solution to this problem in a future NetBSD release.

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).
     - Two 1.44 MB 3.5" floppy disks if the CD is not bootable or if you cannot boot from CD.
     - A PC with a 386 or newer processor.
     - A CD-ROM drive (SCSI or ATAPI), a hard disk and a minimum of 4 MB of memory installed.
     - The hard disk 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 120 MB more.
   - Creating the boot floppies. You can create the floppies needed for installation under MS-DOS or Windows. Supposing your 1.44 MB floppy drive is drive A:, and your CD is drive E: do the following from an MS-DOS command prompt:

     ```
     e:
     cd \NetBSD-3.1_STABLE\i386\installation\misc
     rawrite
     ```

     When asked for a source filename, answer
     ```
     ..\floppy\boot1.fs
     ```
     for the first diskette and
     ```
     ..\floppy\boot2.fs
     ```
     for the second diskette.

     When asked for a destination drive answer '**a**'.
   - To create a bootfloppy under NetBSD or other UNIX -like system, you would type something like:

     ```
     # dd if=.../boot1.fs bs=18k of=/dev/rfd0a
     ```
   - The Quick Installation
     - Insert the first boot floppy you just created. Restart the computer. When prompted, insert the second boot floppy. After language selection, the main menu will be displayed.

```
.*******************************************.
* NetBSD-3.1_STABLE 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*

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

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

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

   If that doesn't work, try booting after disabling your CPU's internal and external caches (if any). If it still doesn't work, NetBSD probably can't be run on your hardware. This can probably be considered a bug, so you might want to report it. If you do, please include as many details about your system configuration as you can.

   It will take a while to load the kernel from the floppy, probably around a minute or so, then, the kernel boot messages will be displayed. This may take a little while also, as NetBSD will be probing your system to discover which hardware devices are installed. You may want to read the boot messages, to notice your disk's name and geometry. 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.

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

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

6. *Network configuration*

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

   If you will not use network operation during the installation, but you do want your machine to be configured for networking once it is installed, you should first go to the **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`.

   `sysinst` next tries to figure out the real and BIOS geometry of your disk. It will present you with the values it found, if any, and will give you a chance to change them.

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

8. *Partitioning the disk*

   - Which portion of the disk to use.

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

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

9. *Editing the Master Boot Record*

   First, you will be prompted to specify the units of size that you want to express the sizes of the partitions in. You can either pick megabytes, cylinders or sectors.

   After this, you will be presented with the current values stored in the MBR, and will be given the opportunity to change, create or delete partitions. For each partition you can set the type, the start and the size. Setting the type to **`unused`** will delete a partition. You can also mark a partition as active, meaning that this is the one that the BIOS will start from at boot time.

   Be sure to mark the partition you want to boot from as active!

   After you are done editing the MBR, a sanity check will be done, checking for partitions that overlap. Depending on the BIOS capabilities of your machine and the parameters of the NetBSD partition you have specified, you may also be asked if you want to install newer bootcode in your MBR. If you have multiple operating systems on the disk that you are installing on, you will also be given the option to install a bootselector, that will allow you to pick the operating system to start up when your computer is

(re-)started.

If everything is ok, you can go on to the next step, editing the NetBSD disklabel.

10. *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**. You can also specify a partition as type **MSDOS**. This is useful if you share the disk with MS-DOS or Windows; NetBSD is able to access the files on these partitions. You can use the values from the MBR for the MS-DOS part of the disk to specify the partition of type **MSDOS** (you don't have to do this now, you can always re-edit the disklabel to add this once you have installed NetBSD, or use `mbrlabel`(8) to help you updating your disklabel with data from the MBR).

    Some partitions in the disklabel have a fixed purpose.

    `a` Root partition (`/`)

    `b` Swap partition.

    `c` The NetBSD portion of the disk.

    `d` The entire disk.

    `e`–`p` 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 will be ok for most purposes. 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.

11. *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.

12. *Getting the distribution sets*

    [PCMCIA] Load a kernel tar file (i.e. the `kern-GENERIC.tgz` set file) on to your hard disk, for example by mounting the hard disk first, copying the `kern-GENERIC.tgz` file from floppy and unpacking it. Example:

    ```
    # mount /dev/wd0a /mnt
    # cd /mnt
    ```

repeat the following 3 steps until all kern. files are there*

```
# mount -t msdos /dev/fd0a /mnt2
# cp /mnt2/kern.* .
# umount /mnt2
# cat kern.* | tar zxpvf -
```

Then halt the machine using the **halt** command. Power the machine down, and re-insert all the PCMCIA devices. Remove any floppy from the floppy drive. Start the machine up. After booting NetBSD, you will be presented with the main **sysinst** menu. Choose the option to re-install sets. Wait for the file system checks that it will do to finish, and then proceed as described below.

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 the section labeled 'Extracting the distribution sets'.

13. *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 if you want to use DHCP, and if not to provide 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.

14. *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 if you want to use DHCP, and if not to provide 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.

15. *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.

16. *Installation from a floppy set*

    Because the installation sets are too big to fit on one floppy, the floppies are expected to be filled with the split set files. The floppies are expected to be in MS-DOS format. You will be asked for a directory where the sets should be reassembled. Then you will be prompted to insert the floppies containing the split sets. This process will continue until all the sets have been loaded from floppy.

17. *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.

18. *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.

19. *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.

20. *Finalizing your installation*

    Congratulations, you have successfully installed NetBSD 3.1_STABLE. You can now reboot the machine, and boot NetBSD from hard disk.

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. Instead of manually configuring network and naming service, DHCP can be used by setting `dhclient=YES` in `/etc/rc.conf`.

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

2. Logging in

   After reboot, you can log in as `root` at the login prompt. Unless you've set a password in **sysinst**, there is no initial password. If you're using the machine in a networked environment, you should create an account for yourself (see below) and protect it and the "root" account with good passwords. By default, root login from the network is disabled (even via `ssh`(1)). One way to become root over the network is to log in as a different user that belongs to group "wheel" (see `group`(5)) and use `su`(1) to become root.

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

3. Adding accounts

   Use the `useradd`(8) command to add accounts to your system. Do not edit `/etc/passwd` directly! See `vipw`(8) and `pwd_mkdb`(8) if you want to edit the password database.

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.

You will need to set up a configuration file, see `/usr/X11R6/lib/X11/XF86Config.eg` for an example. The `xf86cfg`(1) and `xf86config`(1) utilities can interactively create a first version of such a configuration file for you. See **http://www.xfree86.org/** and the XFree86 manual page for more 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 `3.1_STABLE/i386/All` subdir. You can install them with the following commands under `sh`(1):

     ```
     # PKG_PATH=ftp://ftp.NetBSD.org/pub/NetBSD/packages/3.1_STABLE/i386/All
     # export PKG_PATH
     # pkg_add -v tcsh
     # pkg_add -v bash
     # pkg_add -v perl
     # pkg_add -v apache
     # pkg_add -v kde
     # pkg_add -v mozilla
     ...
     ```

     If you are using `csh`(1) then replace the first two lines with the following:

     ```
     # setenv PKG_PATH ftp://ftp.NetBSD.org/pub/NetBSD/packages/3.1_STABLE/i386/Al
     ...
     ```

     The above commands will install the Tenex-csh and Bourne Again shell, the Perl programming language, Apache web server, KDE desktop environment and the Mozilla web browser 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, see the `README` and `doc/pkgsrc.txt` files 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. If you prefer postfix as MTA, adjust `/etc/mailer.conf`.
   - 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 3.1_STABLE 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 set 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 kernel, the boot blocks on your NetBSD partition, 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 the NetBSD partition or on another operating system's partition on your disk before beginning the upgrade process.

The upgrade procedure using the **sysinst** tool is similar to an installation, but without the hard disk partitioning. **sysinst** will attempt to merge the settings stored in your `/etc` directory with the new version of NetBSD. 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 3.1_STABLE 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.

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 3.1_STABLE.

Issues affecting an upgrade from NetBSD 3.1 and older releases.

It is **very important** that you populate the directory `/etc/pam.d` with appropriate configuration files for the Pluggable Authentication Modules (PAM) because you will not be able to login any more otherwise. Using *postinstall* as described below will take care of this. Please refer to

http://www.netbsd.org/guide/en/chap-pam.html

for documentation about PAM.

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

```
postinstall -s /path/to/etc.tgz check
postinstall -s /path/to/etc.tgz fix
```

Issues fixed by *postinstall*:

- Various files in `/etc` need upgrading. These include:
  - `/etc/defaults/*`
  - `/etc/mtree/*`
  - `/etc/pam.d/*`
  - `/etc/daily`
  - `/etc/weekly`
  - `/etc/monthly`
  - `/etc/security`
  - `/etc/rc.subr`
  - `/etc/rc`
  - `/etc/rc.shutdown`
  - `/etc/rc.d/*`

  The following issues need to be resolved manually:

  - The user '_pflogd' and '_proxy' and the groups '_pflogd', '_proxy' and 'authpf' need to be created.

Using online NetBSD documentation

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

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

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

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

```
# man passwd
```

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

```
# man 5 passwd
```

instead.

If you are unsure of what man page you are looking for, enter

apropos *subject-word*

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

Administrivia

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

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

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

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

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

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

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

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