**NAME**

**INSTALL** – Installation procedure for NetBSD/sparc64.

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## DESCRIPTION

### About this Document

This document describes the installation procedure for NetBSD 2.0 on the *sparc64* 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 2.0 on a machine of the sparc64 architecture.

- Fetch the CD image, `sparc64cd.iso` or the installation kernel and bootloader, `sparc64/binary/kernel/netbsd-INSTALL.gz` and `sparc64/installation/misc/ofwboot` which can be booted from a Solaris or NetBSD partition. Alternatively, you may netboot the installation kernel. This process is covered below, in detail.
- The actual binary distribution is in the `sparc64/binary/sets/` directory. When you boot the install CD-ROM or installation kernel, 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 the following sets: `kern-GENERIC.tgz`, `base.tgz` and `etc.tgz`. In a typical workstation installation you will probably want all the installation sets.

- Burn the CD or put the installation kernel and bootloader at the root level of a bootable Solaris or NetBSD partition.

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

- You will need to get to the OpenFirmware "**ok**" prompt. After your system first powers on, and displays some initial information, press the `STOP-A` keys, or send a BREAK if you're on a serial console. At the "**ok**" prompt, type the command to boot your system into NetBSD. The command to boot from CD is: "**boot cdrom**". The command to boot the NetBSD kernel from a Solaris or NetBSD partition depends on which disk and partition it is on. To boot from the first partition of the first (primary) disk: "**boot disk:a /ofwboot -a**". When it asks you for a kernel, specify "**netbsd-INSTALL.gz**"

- 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 5000 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 2.0 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 1.6 and 2.0 Releases**

The NetBSD 2.0 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 two years of development that went into the NetBSD 2.0 release. Some highlights include:

*Kernel*

- Ports to new platforms including: amd64, evbsh5, and xen.

- Native thread support has been added, based on Scheduler Activations. Applications which support native threads can now take full advantage of the high-performance NetBSD POSIX threads implementation.

- Kernel events notification framework - kqueue kqueue provides a stateful and efficient event notification framework. Currently supported events include socket, file, directory, fifo, pipe, tty and device changes, and monitoring of processes and signals. kqueue is supported by all writable filesystems in the NetBSD tree (with the exception of Coda) and all device drivers supporting poll(2).

- Improvements have been made to NetBSD's Linux emulation to support the latest Sun JDK/JRE for Linux. Testing has shown that it now runs as well as it does on Linux natively.
- NetBSD 2.0 enforces non-executable mappings on many platforms. This means that parts of the stack and heap are made non-executable when they are marked writable. This makes exploiting potential buffer overflows harder.
- For the i386 port it now supports SMP and has a new ACPI and power management framework which takes advantage of Intel's ACPI implementation.
- The macppc port also now supports SMP as well as hardware support for newer G4 models has been added.
- SMP support has been added to the sparc port as well.
- New generic i2c framework, supporting bit-bang and "intelligent" controllers.
- `sysctl`(9) was switched from a static binding to a dynamic implementation.
- Add a new driver `satalink`(4) and move SATA support from other controllers into this along with adding support for new controllers.

*Networking*

- `ipf`(8) has been upgraded to version 4.1.3.
- `tcp`(4) now implements path MTU discovery blackhole detection (i.e. it will turn off path MTU discovery if the connection is losing).
- Socket buffer insertion is now O(C). This can provide a substantial performance boost to some applications which use large socket buffers.
- `wi`(4) has support for Host-AP mode, allowing Intersil Prism2/2.5/3-based boards to be used to make an 802.11 Access Point.
- Support for `ipf`(8) has been added to `bridge`(4) and `brconfig`(8)
- Change port allocation from linked list to a hash table for better performance.

*File system*

- FreeBSD's UFS2 has been ported to NetBSD. UFS2 is an extension to FFS, adding 64 bit block pointers and support for extended file storage. Among other enhancements, UFS2 allows for file systems larger than 1Terabyte.
- The cryptographic disk driver (cgd) can be used to encrypt disks or partitions, using some strong encryption algorithms, like AES (Rijndael) and Blowfish. cgd can also be configured to encrypt swap.

*Security*

- The systrace utility has been added to the system. systrace monitors and controls an application access to the system by enforcing access policies for system calls. The systrace utility might be used to trace an untrusted application's access to the system. In addition, it can be used to protect the system from software bugs (such as buffer overflows) by constraining a daemon's access to the system. The privilege elevation feature of systrace can be used to obviate the need to run large, untrusted programs as root when only one or two system calls require the elevated privilege.
- Verified Exec support has been added in this release. Verified Exec verifies a cryptographic hash before allowing execution of binaries and scripts. This can be used to prevent a system from running binaries or scripts which have been illegally modified or installed. In addition, Verified Exec can also be used to limit the use of script interpreters to authorized scripts only and disallow interactive use.

*System administration and user tools*

- Switched from the GPL version to a non-GPL version of various tools including gzip and awk.

*Miscellaneous*

- NetBSD 2.0 supports a new toolchain based on gcc 3.3.3 and binutils 2.14. gcc 3.3.1 adds support for a number of CPU targets and greatly improved support for i386 and other targets. The support for new platforms in gcc 3.3.3 has enabled the porting of NetBSD to even more architectures.
- Updates of most third party packages that are shipped in the base system to the following latest stable releases:
  - bind 8.3.7
  - binutils 2.14
  - cvs 1.11.17
  - diffutils 2.8.1
  - file 4.08
  - gcc 3.3.3
  - gdb 5.3
  - grep 2.5.1
  - groff 1.19
  - less 381
  - openssl 0.9.7d
  - postfix 2.0.19
  - sendmail 8.12.11
  - tcpump 3.7.1
  - texinfo 4.6
- Many new packages in the *pkgsrc* system, including the latest open source desktop KDE3, OpenOffice, perl, Apache and many more. A number of new platforms are supported, including Darwin, FreeBSD, IRIX, Linux, OpenBSD and Solaris. Support for various other platforms (among them AIX, BSD/OS and HP-UX) is currently being worked on thanks to our new, portable bootstrap kit which makes it much simpler to port pkgsrc support to new operating systems. At the time of writing, there are over 4500 third party packages available in pkgsrc.

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.

*sparc64 specific*

NetBSD 2.0 is the third major release for the sparc64!

Some (but not all!) notable sparc64-specific improvements include:

- Support for a number of new models
- Support for a native serial driver on non-SBUS machines (*sab*)
- Support for the SBUS PCMCIA adapter (*nell*) has been completed.
- Support for SBUS based audio (*audiocs*)
- New generic cycle counter based microtime implementation greatly improves microtime(9) for sparc64
- Get rid of all sparc64-specific hacks, since the new GNU C/C++ compiler now included with NetBSD no longer has these problems
- The `ofwboot.net`(8) and `ofwboot` programs have been merged

**Important notes about NetBSD 2.0**

- As noted above, the sendmail third-party program has been upgraded since the last release. The new version of sendmail runs without requiring being set-user-ID to ''root''.

  In order to retain the functionality that a newly installed system can send mail ''out of the box'', the default has changed so that sendmail will now start by default, and listen for host-local connections.

  If this behaviour is not desired, you can either
  1. explicitly set the sendmail variable to ''NO'' in `/etc/rc.conf`,
  2. modify `/etc/mail/submit.cf` to point to another host,
  3. modify `/etc/mailer.conf` to point to something else than sendmail, or
  4. make sendmail set-user-ID to ''root'', remove `/etc/mail/submit.cf`, and set the sendmail_suid variable to ''YES'' in `/etc/rc.conf`.

  The latter method is strongly discouraged.

**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 2.0 Release Contents**

The root directory of the NetBSD 2.0 release is organized as follows:

`.../NetBSD-2.0/`

| | |
|---|---|
| `CHANGES` | Changes since earlier NetBSD releases. |
| `LAST_MINUTE` | Last minute changes. |
| `MIRRORS` | A list of sites that mirror the NetBSD 2.0 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 2.0 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 2.0 sources which are not in **gnusrc**, **sharesrc**, or **syssrc**.
*37 MB gzipped, 176 MB uncompressed*

**syssrc** This set contains the sources to the NetBSD 2.0 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/sparc64 subdirectory structure*

The sparc64-specific portion of the NetBSD 2.0 release is found in the `sparc64` subdirectory of the distribution: `.../NetBSD-2.0/sparc64/`. 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-INSTALL.gz`
The install kernel.
`sets/` sparc64 binary distribution sets; see below.

`installation/`
`miniroot/`
sparc64 miniroot file system image; see below.
`misc/`
`netboot/`
Netboot bootloader; see below.

*Binary distribution sets*

The NetBSD sparc64 binary distribution sets contain the binaries which comprise the NetBSD 2.0 release for the sparc64. The binary distribution sets can be found in the `sparc64/binary/sets` subdirectory of the NetBSD 2.0 distribution tree.

*Note:* If you want to install 32-bit only binaries, you will still need to boot using the sparc64 installation tools. When it asks you for the distribution set to install, provide the NetBSD /sparc `binary/sets`. Be sure to use the 32 bit sparc `kern-GENERIC_SUN4U.tgz` kernel distribution. Otherwise, continue to follow the sparc64 installation procedure, not the sparc instructions.

Most people will want the 64-bit sparc64 distribution tree:

**base** The NetBSD 2.0 sparc64 **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.
*18 MB gzipped, 56 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.
*22 MB gzipped, 88 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.
*4 MB gzipped, 8 MB uncompressed*

**kern-GENERIC**
This set contains a NetBSD/sparc64 2.0 `GENERIC` kernel, named `/netbsd`. You *must* install this distribution set.
*3 MB gzipped, 6 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, 8 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.
*7 MB gzipped, 20 MB uncompressed*

**xcomp** The extra libraries and include files needed to compile X source code.
*12 MB gzipped, 50 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 Xsun, Xsun24, XsunMono and Xvfb servers with man pages.
*6 MB gzipped, 14 MB uncompressed*

The sparc64 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 sparc64 binary distribution also has its own checksum files, just as the source distribution does.

**NetBSD/sparc64 System Requirements and Supported Devices**

*Supported machines*

The minimal configuration requires 32 MB of RAM and ~60 MB of disk space. To install the entire system requires much more disk space, and to run X or compile the system, more RAM is recommended, as NetBSD with 32 MB of RAM feels like Solaris with 32 MB of RAM - slow. Note that until you have at least 64 MB of RAM, getting more RAM is more important than getting a faster CPU.

Not all of the machines listed here have been tested. Often Sun will use the same motherboard design in multiple models. For example, they'll release a Blade ("workstation") model, Enterprise or Fire ("server") model, and Netra or ft ("telco") model with essentially the same devices, as far as NetBSD is concerned. If one model in this scheme works, it is highly likely another will work.

Sun has also released a few models with names that might imply the systems are UltraSPARC-based but actually have an i386 class CPU. These systems might be supported by the i386 port of NetBSD. See the following site for more info on what system boards are in which models.

**http://sunsolve.sun.com/handbook_pub/Devices/System_Board/SYSBD_TOC.html**

- Sbus-based UltraSPARC I or II systems
  - Ultra 1 family (Ultra 1, Ultra 1 Creator, Ultra 1 Creator 3D, Netra i 150, Netra nfs 150, Enterprise 1, Enterprise 150)
  - Ultra 2 family (Ultra 2, Ultra 2 Creator, Ultra 2 Creator 3D, Enterprise 2)
  - Enterprise (3000, 3500, 4000, 4500, 500x, 5500, 600x, 6500, 10000)
- PCI-based UltraSPARC II, IIi, or IIe systems
  - Ultra 5/10 family (Ultra 5, Ultra 10, Enterprise 5, Enterprise 10)
  - Ultra 30 family (Ultra 30, Netra T 1100)
  - Ultra 60 family (Ultra 60, E220R, Netra T 1120 and T 1125)
  - Ultra 80 family (Ultra 80, E420R, Netra T 1400 and T 1405)
  - Ultra 250 family (Enterprise 250 and E250R)
  - Ultra 450 family (Ultra 450, Enterprise 450, Netra ft 1800)
  - Blade 100 and 150
  - SPARCengine CP1400 or SPARCengine CP1500 system boards (Netra T1 (models 100 and 105), CT400, CT800, CT1600)
  - SPARCengine Ultra AXi family (Netra X1, Fire v100, Fire v120, Netra 120, Netra AC 200, Netra DC 200)
  - SPARCengine Ultra AXe system board

*Unsupported machines*

- Systems with an UltraSPARC III CPU
- Systems with an UltraSPARC IIIi CPU
- Systems with an UltraSPARC IV CPU

*Supported devices*

- Ethernet devices
  - Sbus LANCE ethernet (*le*)
  - Sbus BigMac ethernet (*be*)
  - On-board, PCI, and Sbus HME ethernet (*hme*)
  - PCI ERI (*gem*)
  - Many other PCI and PCMCIA Ethernet interfaces, such as Tulip-compatible (*tlp*), Intel (*fxp*), Intel gigabit (*wm*), NE2000-compatible (*ne*), and Realtek (*rtk*).
  - Several USB Ethernet interfaces, such as (*aue*, *cue*, and *kue*)
- Video devices
  - All on-board frame buffers
    Unless otherwise specified, only text console is supported
  - On-board and SBUS card (GX, GX+, TGX, TGX+) (*cgsix*)
    8 bpp accelerated framebuffer.
- SCSI host controllers
  - ncr53c9x based controllers (*esp*)
  - ncr53c8xx based controllers (*siop* or *esiop*)
  - ISP10x0 based controllers (*isp*)
  - 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.

    *Note:* Some Adaptec cards that support booting on MacOS may be bootable on sparc64 systems.
  - Many other PCI SCSI controllers should work, but no one has tried them
  - Most SCSI disk/tape/CD-ROM devices should work
- PCI IDE host controllers
  - Generic IDE controllers (*pciide*)
  - Acard ATP-850/860 based IDE controllers (*pciide*)
    (including the Acard AEC-6210/6260 and the Sonnet Tempo ATA/66 cards)
  - CMD Tech PCI064[3689] and Silicon Image 0680 IDE Controllers (*cmdide*)
  - Silicon Image 3112 SATA Controller (*satalink*)

    *Note:* Some IDE cards that support booting on MacOS may be bootable on sparc64 systems.
  - Many other PCI IDE controllers should work, but no one has tried them
  - Most IDE and ATAPI disk/tape/CD-ROM devices should work
- Serial devices
  - On-board Sbus z8530 serial (*zs*)
  - On-board PCI 16550-based su and su-pnp serial (*com*)
  - On-board PCI SAB82532 dual UART serial (*sab*)
- Parallel devices
  - On-board and Sbus parallel ports (*bpp*)
  - On-board PCI/Ebus parallel ports (*lpt*)
- Audio devices
  - On-board, PCI, and SBUS based CS4231-based 44 KHz, 16 bit, stereo, PCM audio (*audiocs*)

There are a large number of untested PCI drivers that have never been tested on UltraSPARC PCI systems that may 'just work'.

*Unsupported devices*

- SMP (NetBSD/sparc64 currently only uses one CPU if more than one is present)
- Floppy drives
- smart card reader
- X Server on ffb framebuffers, including on-board ATI mach64 and Creator series
  - Creator3D framebuffers (*ffb*)
  - General PCI VGA support (currently experimental *machfb*)

**Getting the NetBSD System on to Useful Media**

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
- 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.

*Note:* If you are installing the 32-bit sparc distribution sets, you will need to rename `sparc/binary/sets/kern-GENERIC_SUN4U.tgz` to `kern-GENERIC.tgz` since the sparc64 installation tools would otherwise attempt to install the kernel for 32-bit sparc computers which does not boot on sparc64 systems.

*CD-ROM / DVD* Find out where the distribution set files are on the CD-ROM or DVD. Likely locations are `binary/sets` and `sparc64/binary/sets`.

Proceed to the instruction on installation.

*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.

*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-2.0
# cd sparc64/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.

**Preparing your System for NetBSD installation**

*Deciding on partition sizes*

If you're installing NetBSD/sparc64 for the first time it's a good idea to look at the partition sizes of the disk you plan to install NetBSD on. Will you be installing NetBSD onto the same disk as Solaris, on its own disk, or will you be netbooting? While NetBSD can work just fine on a disk shared with Solaris, the NetBSD installer does not currently support this. The limitation is that the NetBSD `disklabel`(8) writes partition info that Solaris is not familiar with. Therefore, if you are sharing a disk with Solaris, any time you change a partition table, you must do it from Solaris.

Assuming a classic partition scheme with / (root) and /usr file systems, a comfortable size for the NetBSD / partition is about 100 MB. A full binary installation including X11R6 takes nearly 350 MB in /usr. Since the pkgsrc binaries are typically installed in /usr/pkg you may want a significantly larger /usr partition. A good initial size for the swap partition is the amount of physical memory in your machine, if you've got more than 128 MB RAM. If you've got less RAM, you may want swap to be at least 128 MB.

*Setting up Open Firmware*

First, you need to stop your system from automatically booting when powered on. Pressing the STOP key (sometimes called the L1 key, found on the left side of your keyboard) and the a key will halt your system and give you the "ok" prompt. If you are using a serial console, send a "BREAK" signal from your terminal (the method of sending "BREAK" varies from terminal to terminal).

If the ethernet address of your sparc64 system is ff:ff:ff:ff:ff:ff (check with the Open Firmware "banner" command), then your NVRAM battery is dead and you will have trouble using ethernet (among other problems). Read the Sun NVRAM/Hostid FAQ.

**http://www.squirrel.com/squirrel/sun-nvram-hostid.faq.html**

If you have a valid ethernet address and you plan to netboot, write down your system's ethernet address.

You cannot use the security modes of the SPARC OpenFirmware.

ok **setenv security-mode none**

If you are using a serial console, the NetBSD/sparc64 installer defaults to using 9600 bps, 8N1 settings. You may want to configure your system and serial terminal like this prior to booting the installer. Additionally, a new installation of NetBSD/sparc64 will default to these settings as well.

SCSI devices are specified by an Open Firmware **devalias** which provides simple mnemonics for the full path to the device. Type **devalias** to get a list of all of the available aliases. At a minimum, the alias and partition are necessary when booting.

Therefore, to boot from the swap partition on the internal hard drive one would use:

ok **boot disk:b**

To boot from a CD-ROM (Open Firmware assumes SCSI CD-ROMs are at target 6), one would use:

ok **boot cdrom**

And, to boot from a kernel named netbsd-GENERIC on the fourth partition ( 'd', often the /usr partition) on an external SCSI hard drive (target 2, partition 3), one would use:

ok **boot disk2:d netbsd-GENERIC**

If you get ".... Fast Data MMU Miss" when booting after the NetBSD installation, your OpenBoot PROM may need updating. It has been reported that version 3.31 lead to a successful boot on an Ultra Enterprise 420R, while version 3.23 did not. Exact values may vary, depending on your hardware, current OpenBoot PROM version and moon phase.

*Determining how to boot from an SBUS or PCI card*

Some SBUS and PCI cards have firmware that lets you use them as a boot device. These cards do not automatically create a **devalias** entry, so you must traverse the device tree to figure out what Open Firmware calls your card. You will be using Open Firmware commands at the 'ok' prompt. First 'cd' to the top of the device tree and list the nodes there. The following is the procedure to boot from an IDE card in an UltraSPARC 30.

ok **cd /**
ok **ls**
f006cf08 SUNW,ffb@1e,0

```
f006c32c SUNW,UltraSPARC-II@0,0
f006002c counter-timer@1f,1c00
f005f410 pci@1f,2000
f005eb54 pci@1f,4000
f004cf84 virtual-memory
f004c9a4 memory@0,0
f002ce38 aliases
f002cdc8 options
f002cc90 openprom
f002cc24 chosen
f002cbb4 packages
```

Usually, you can simply type in the name before the at (@) sign and OpenFirmware will fill in the rest.

```
ok cd pci@1f,4000
ok ls
f0081524 ide@2
f007be50 scsi@3
f0074688 network@1,1
f0060324 ebus@1
ok cd ide@2
ok ls
0081fe4 cdrom
f0081938 disk
ok cd disk
ok ls
ok pwd
/pci@1f,4000/ide@2/disk
```

OK, now we know the path to the IDE device in this example. Now, we need to determine if it's capable of booting. If it is, it will have the **word** 'open'.

```
ok words
close          load           write          read           seek
open           write-blocks   read-blocks    max-transfer
block-size     dma-free       dma-alloc      spin-down      spin-up
```

Great! Also, in case you're interested in further details about your hardware, you can use the '.properties' command.

So, when it's time to type in a boot command, use the shortened version of the **pwd** command. You need to be more specific if there are two devices with the same name (in this case, two /pci entries). In this example, you'd type:

```
ok boot /pci@1f,4000/ide/disk@0,0
```

You can also store this device path across reboots using the **nvalias** command.

```
ok nvalias wd0 /pci@1f,4000/ide/disk@0,0:a
```

And when the kernel is done booting, it may not automatically use your card as the root device -- you may need to type in the NetBSD/sparc64 name for that device:

```
root on sd0a dumps on sd0b
no file system for sd0 (dev 0x700)
cannot mount root, error = 79
root device (default sd0a): ?
use one of: hme0 sd0[a-h] wd0[a-h] halt
root device (default sd0a): wd0a
```

dump device: **wd0a**
file system (default generic): **ffs**
`root on wd0a`

*Configuration of network interfaces*

Some network devices (i.e. certain SBus cards) allow a choice between operating on a UTP or a AUI port. The `le` driver supports automatic detection of the port which is actually connected to the wire. If automatic detection is not available or not working properly in your environment, you may have to specify the type connection using the *media* parameter of `ifconfig`(8). During installation, you'll get the opportunity to specify the appropriate medium. Use `10base5/AUI` to select the AUI connector, or `10baseT/UTP` to select the UTP connector.

**Installing the NetBSD System**

Installing NetBSD is a relatively complex process, but if you have this document in hand it shouldn't be too much trouble.

There are several ways to install NetBSD onto a disk. The easiest way in terms of preliminary setup is to install from CDROM. If you don't have access to a CDROM or CDROM burner, you can use a miniroot image that can be booted off your local disk's swap partition. Alternatively, if your UltraSPARC is hooked up in a network you can find a server and arrange for a diskless setup which is a convenient way to install on a machine whose disk does not currently hold a usable operating system (see the section **Installing NetBSD by using a diskless setup** below).

If you have problems with these or you are installing NetBSD onto the same disk as Solaris, see the section below on **Manual Installation of NetBSD using Solaris**

*Installing NetBSD from CDROM*

Installing from CDROM, whether it has the full distribution or just a kernel and **sysinst** is the least painful way to install NetBSD. Simply insert the CD-ROM in the drive, power up the computer, and type:

ok **boot cdrom**

This Open Firmware boot command will cause the NetBSD kernel contained in the CD-ROM to be booted. After the initial probe messages you'll be asked to start the install or upgrade procedure. Proceed to the section **Running the sysinst installation program** below.

*Installing NetBSD by using the NetBSD miniroot*

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

Loading the miniroot onto your raw partition is simple using the `dd`(1) command. Just remember to first uncompress the miniroot image and boot your OS with the `-s` flag so that it runs "single-user" and does not attempt to start swapping.

ok **boot -s**

On Solaris you use a command like:

# **gunzip miniroot.fs.gz**
# **dd if=miniroot.fs of=/dev/rdsk/c0t0d0s1 bs=4k conv=sync**

On NetBSD the command is:

```
# gunzip miniroot.fs.gz
# dd if=miniroot.fs of=/dev/rsd0b bs=4k conv=sync
```

Replace `/dev/rdsk/c0t0d0s1` or `/dev/rsd0b` with your swap partition.

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

```
# halt
```

Then boot the miniroot by typing the appropriate command at the OpenFirmware prompt:

```
ok boot disk:b netbsd
```

If you've loaded the miniroot onto some other disk than `sd0` use the correct `devalias`, such as

```
ok boot disk1:b netbsd
```

This Open Firmware boot command will cause the NetBSD kernel contained in the miniroot image to be booted. After the initial probe messages you'll be asked to start the install or upgrade procedure. Proceed to the section **Running the sysinst installation program** below.

*Installing NetBSD by using a NetBSD kernel on a Solaris partition*

This procedure is very straightforward. You will be putting the NetBSD installation kernel (kernel with a RAM disk installer) on your Solaris partition and telling Open Firmware to boot the NetBSD kernel.

First, copy the `netbsd-INSTALL.gz` kernel and bootloader to the root level of your hard drive and halt your system

```
# cp binary/kernel/netbsd-INSTALL.gz /
# cp installation/misc/ofwboot /
# halt
```

At the Open Firmware prompt, boot NetBSD.

```
ok boot disk:a /ofwboot -a
```

The `-a` flag is needed so that the bootloader will ask you to find your installation kernel.

```
Rebooting with command: boot disk:a /ofwboot -a
Boot device: /pci@1f,4000/scsi@3/disk@0,0:a  File and args: /ofwboot -a
Enter filename [/ofwboot]: return
 NetBSD/sparc64 OpenFirmware Boot, Revision 1.7
 (autobuild@tgm.netbsd.org, Thu May 20 16:29:20 UTC 2004)
Boot: netbsd-INSTALL.gz
```

After the initial probe messages you'll be asked to start the install or upgrade procedure. Proceed to the section **Running the sysinst installation program** below.

*Installing NetBSD by using a netboot setup*

1. Introduction

   To netboot a sparc64, you must configure one or more servers to provide information and files to your sparc64 (the 'client ).' If you are using NetBSD (any architecture) on your netboot server(s), the information provided here should be sufficient to configure everything. Additionally, you may wish to look at the `diskless`(8) manual page and the manual pages for each daemon you'll be configuring. If the server(s) are another operating system, you should consult the NetBSD Diskless HOW-TO, which will walk you through the steps necessary to configure the netboot services on a variety of platforms.

   **http://www.NetBSD.org/Documentation/network/netboot/**

   You may either netboot the installer so you can install onto a locally attached disk, or you may run your system entirely over the network.

   Briefly, the netboot process involves discovery, bootstrap, kernel and file system stages. In the first stage, the client discovers information about where to find the bootstrap program. Next, it downloads

and executes the bootstrap program. The bootstrap program goes through another discovery phase to determine where the kernel is located. The bootstrap program tries to mount the NFS share containing the kernel. Once the kernel is loaded, it starts executing. For RAM disk kernels, it mounts the RAM disk file system and begins executing the installer from the RAM disk. For normal (non-RAM disk) kernels, the kernel tries to mount the NFS share that had the kernel and starts executing the installation tools or `init`(8). All sparc64 systems use a combination of RARP and DHCP for the discovery stage. TFTP is used in the bootstrap phase to download the bootstrap program, `ofwboot.net`, which has been linked to a file name appropriate to the client's IP address as described in the TFTP section below. NFS is used in both the kernel and file system stages to download the kernel, and to access files on the file server.

We will use '`CC:CC:CC:CC:CC:CC`' as the MAC address (ethernet hardware address) of your netboot client machine. You should have determined this address in an earlier stage. In this example, we will use '`192.168.1.10`' as the IP address of your client and '`client.test.net`' as its name. We will assume you're providing all of your netboot services on one machine called '`server.test.net`' with the client's files exported from the directory `/export/client/root`. You should, of course, replace all of these with the names, addresses, and paths appropriate to your environment.

You should set up each netboot stage in order (i.e. discovery, bootstrap, kernel, and then file system) so that you can test them as you proceed.

2. `dhcpd`(8) in `bootpd`(8) compatible mode

   Put the following lines in your `/etc/dhcpd.conf` (see `dhcpd.conf`(5) and `dhcp-options`(5) for more information):

```
ddns-update-style none;
                # Do not use any dynamic DNS features
                #
allow bootp;    # Allow bootp requests, thus the dhcp server
                # will act as a bootp server.
                #
authoritative;  # master DHCP server for this subnet
                #
subnet 192.168.1.0 netmask 255.255.255.0 {
                # Which network interface to listen on.
                # The zeros indicate the range of addresses
                # that are allowed to connect.
}
group {
                # Set of parameters common to all clients
                # in this "group".
                #
        option broadcast-address        192.168.1.255;
        option domain-name              "test.net";
        option domain-name-servers      dns.test.net;
        option routers                  router.test.net;
        option subnet-mask              255.255.255.0;
                #
                # An individual client.
                #
        host client.test.net {
                hardware ethernet       CC:CC:CC:CC:CC:CC;
```

```
                        fixed-address           192.168.1.10;
                        #
                        # Name of the host (if the fixed address
                        # doesn't resolve to a simple name).
                        #
                        option host-name        "client";
                        #
                        # Name of the bootloader or kernel
                        # to download via tftp.

                        #
                        # The path on the NFS server.
                        #
                        option root-path "/export/client/root";

                        #
                        # If your DHCP server is not your NFS server, supply the
                        # address of the NFS server. Since we assume you run everythi
                        # on one server, this is not needed.
                        #
                        # next-server server.test.net;
                }
        #you may paste another "host" entry here for additional
        #clients on this network
}
```

You will need to make sure that the `dhcpd.leases` file exists.

```
# touch /var/db/dhcpd.leases
```

You will need to start the **dhcpd**. If it's already running, you will need to restart it to force it to re-read its configuration file. If the server is running NetBSD, you can achieve this with:

```
# /etc/rc.d/dhcpd restart
```

3. `rarpd`(8)

   Create an `/etc/ethers` file with the following line:

   ```
   CC:CC:CC:CC:CC:CC     client
   ```

   Add your client to the server's `/etc/hosts` file:

   ```
   192.168.1.10 client
   ```

   You will need to start the **rarpd**. If it's already running, you will need to restart it to force it to re-read its configuration file. If the server is running NetBSD, you can achieve this with:

   ```
   # /etc/rc.d/rarpd restart
   ```

4. `tftpd`(8)

   The default configuration of the TFTP server is to run in a `chroot`(8) environment in the `/tftpboot` directory. Thus, the first order of business is to create this directory:

   ```
   # mkdir -p /tftpboot
   ```

   Next, edit `/etc/inetd.conf` and uncomment the line with the TFTP daemon:

```
tftp  dgram  udp  wait  root  /usr/libexec/tftpd tftpd -l -s /tftpboot
```

Now, restart `inetd`(8). If the server is running NetBSD, you can achieve this with:

```
# /etc/rc.d/inetd restart
```

Now, you need to copy the bootloader for your sparc64 machine to `/tftpboot`. Get `ofwboot.net` from the `installation/netboot` directory of the distribution.

```
# cp ofwboot.net /tftpboot
```

Now, you need to link `ofwboot.net` to the filename that your sparc64 will look for. It will look for a filename composed of the machine's IP address (in hexadecimal). For example, a machine which has been assigned IP address 192.168.1.10, will make a TFTP request for `C0A8010A`.

You can use `bc`(1) to help calculate the filename:

```
# bc
obase=16
192
C0
168
A8
1
1
10
A
quit
# cd /tftpboot
# ln -s ofwboot.net C0A8010A
```

Just to be sure, let's make everything readable.

```
# chmod -R a+rX /tftpboot
```

Sometimes, the `arp`(8) table gets messed up, and the TFTP server can't communicate with the client. In this case, it will write a log message (via `syslogd`(8)) to `/var/log/messages` saying: '`tftpd: write: Host is down`'. If this is the case, you may need to force the server to map your client's ethernet address to its IP address:

```
# arp -s client CC:CC:CC:CC:CC:CC
```

5. `nfsd`(8), `mountd`(8), and `rpcbind`(8)

   Now your system should be able to load the bootstrap program and start looking for the kernel. Let's set up the NFS server. Create the directory you are exporting for the netboot client:

   ```
   # mkdir -p /export/client/root
   ```

   Put the following line in `/etc/exports` to enable NFS sharing:

   ```
   /export/client/root -maproot=root client.test.net
   ```

   If your server is currently running an NFS server, you only need to restart `mountd`(8). Otherwise, you need to start `rpcbind`(8) and `nfsd`(8). If the server is running NetBSD, you can achieve this with:

   ```
   # /etc/rc.d/rpcbind start
   # /etc/rc.d/nfsd start
   # /etc/rc.d/mountd restart
   ```

6. NetBSD kernel and installation tools

   Now, if you place a kernel named `netbsd` in `/export/client/root` your client should boot the kernel. Use `binary/kernel/netbsd-GENERIC.gz`).

   ```
   # gunzip netbsd-GENERIC.gz
   # mv netbsd-GENERIC /export/client/root/netbsd
   ```

   If you are netbooting the installer, copy the distribution files to the client's root directory and extract the tools from `installation/misc/instfs.tgz`.

   ```
   # cp *tgz /export/client/root
   # cd /export/client/root
   # tar -xpzf instfs.tgz
   ```

7. Client file system

   You can skip this step if you do not plan to run your client diskless after installation. Otherwise, you need to extract and set up the client's installation of NetBSD. The Diskless HOW-TO describes how to provide better security and save space on the NFS server over the procedure listed here.

   **http://www.NetBSD.org/Documentation/network/netboot/nfs.html**

   - Extracting distribution sets

     ```
     # cd /export/client/root
     # tar -xpzf /path/to/files/base.tgz
     # tar -xpzf /path/to/files/etc.tgz
     ```

     Continue with the other non-essential distribution sets if desired.

   - Set up swap

     ```
     # mkdir /export/client/root/swap
     # dd if=/dev/zero of=/export/client/swap bs=4k count=4k
     # echo '/export/client/swap -maproot=root:wheel client.test.net' | cat  /et
     # /etc/rc.d/mountd restart
     ```

     This creates a 16 MB swap file and exports it to the client.

   - Create device nodes

     ```
     # cd /export/client/root/dev
     # ./MAKEDEV all
     ```

     This procedure only works on NetBSD hosts.

   - Set up the client's `fstab`(5)

     Create a file in `/export/client/root/etc/fstab` with the following lines:

     ```
     server:/export/client/swap   none  swap  sw,nfsmntpt=/swap
     server:/export/client/root   /     nfs   rw 0 0
     ```

   - Set up the client's `rc.conf`(5)

     Edit `/export/client/root/etc/rc.conf`

     ```
     rc_configured=YES
     hostname="client"
     defaultroute="192.168.1.1"
     nfs_client=YES
     auto_ifconfig=NO
     net_interfaces=""
     ```

Make sure rc does not reconfigure the network device since it will lose its connection to the NFS server with your root file system.

- Set up the client's `hosts`(5) file.

  Edit `/export/client/root/etc/hosts`

```
::1                     localhost
127.0.0.1               localhost
192.168.1.10 client.test.net client
192.168.1.5  server.test.net server
```

8. Setting up the server daemons

   If you want these services to start up every time you boot your server, make sure the following lines are present in your `/etc/rc.conf`:

```
dhcpd=YES         dhcpd_flags="-q"
rarpd=YES         rarpd_flags="-a"
nfs_server=YES          # enable server daemons
mountd=YES
rpcbind=YES       rpcbind_flags="-l"   # -l logs libwrap
```

   Also, you'll need to make sure the `tftpd` line in `/etc/inetd.conf` remains uncommented.

Now, netboot your system from the server by entering the appropriate **`boot`** command at the Open Firmware prompt.

```
ok boot net netbsd
```

After the initial probe messages you'll be asked to start the install or upgrade procedure. Proceed to the section **Running the sysinst installation program** below.

*Running the sysinst installation program*

1. *Introduction*

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

2. *General*

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

3. *Quick install*

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

   - What you need.
     - The distribution sets (in this example, they are on CD).

- A CD-ROM drive (SCSI or ATAPI), a hard disk and a minimum of 16 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.

• The Quick Installation

- Boot the system as described above. You should be at the **sysinst** main menu.

```
.*********************************************.
* NetBSD-2.0 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.

  WARNING: If you are installing onto a disk which you want to use with Solaris, stop here. You will need to perform a manual installation as **sysinst** overwrites the Solaris partition table. See the section on **Manual Installation of NetBSD using Solaris**
- 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.**
- Once the system reaches the Open Firmware prompt, you will need to type the correct command to boot from your hard drive. NetBSD will now boot. If you haven't already done so in **sysinst**, you should log in as `root`, and set a password for that account. You are also advised to edit the file `/etc/rc.conf` to match your system needs.
- Your installation is now complete.
- For configuring the X window system, if installed, see the files in `/usr/X11R6/lib/X11/doc`. Further information can be found on **http://www.xfree86.org/**.

4. *Booting NetBSD*

   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.

5. *Network configuration*

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

6. *Installation drive selection and parameters*

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

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

7. *Partitioning the disk*

   - Which portion of the disk to use.

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

8. *Editing the NetBSD disklabel*

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

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

   `a` Root partition ( `/` )

   `b` Swap partition.

   `c` The NetBSD portion of the disk.

   `d`–`h` Available for other use. Traditionally, `g` 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.

9. *Preparing your hard disk*

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

   The install program will now label your disk and make the file systems you specified. The file systems will be initialized to contain NetBSD bootstrapping binaries and configuration files. You will see mes-

sages on your screen from the various NetBSD disk preparation tools that are running. There should be no errors in this section of the installation. If there are, restart from the beginning of the installation process. Otherwise, you can continue the installation program after pressing the return key.

10. *Getting the distribution sets*

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

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

11. *Installation using ftp*

    To be able to install using ftp, you first need to configure your network setup, if you haven't already at the start of the install procedure. **sysinst** will do this for you, asking you 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.

12. *Installation using NFS*

    To be able to install using NFS, you first need to configure your network setup, if you haven't already at the start of the install procedure. **sysinst** will do this for you, asking you 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.

13. *Installation from CD-ROM*

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

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

14. *Installation from an unmounted file system*

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

15. *Installation from a local directory*

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

16. *Extracting the distribution sets*

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

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

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

17. *Ensure you have the correct kernel installed*

    If you are installing from the 32-bit sparc distribution set, make sure that you installed the correct kernel. The sparc64 installation tools do not by default copy the correct 32-bit kernel. Unless you prepared ahead of time by renaming the `kern-GENERIC_SUN4U.tgz` to `kern-GENERIC.tgz` then you will need to follow the next few instructions.

    Go to the main installation menu, and select **Utility menu** and then select the **Run /bin/sh** option, which will give you a shell prompt. 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 '^?'
    ```

    Type the following command (replacing `wd0a` with the partition name of your destination root partition):

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

    Now you ned to mount the location of your distribution sets:

    ```
    # mount /dev/cd0a /mnt2
    # tar xpzvf /mnt2/sparc/binary/kernel/kern-GENERIC_SUN4U.tgz
    # umount /mnt
    # umount /mnt2
    # exit
    ```

18. *Finalizing your installation*

    Congratulations, you have successfully installed NetBSD 2.0. You can now reboot the machine, and boot NetBSD from hard disk.

Skip down to the section on **Booting NetBSD for the first time**

*Manual Installation of NetBSD using Solaris*

(Adapted from Murray Stokely's murray@osd.bsdi.com instructions)

You can use Solaris to prepare the NetBSD user-friendly installer or to perform a full manual installation of NetBSD. If you want to use the user-friendly miniroot installer or RAM disk installation kernel, follow the sections **Installing NetBSD by using the NetBSD miniroot** or **Installing NetBSD by using a NetBSD kernel on a Solaris partition**.

- *Preparing the disk in Solaris*

  The first step is to format and label the disk that you would like to use with NetBSD. This can be accomplished with the `format`(1M) command in Solaris, which allows you to partition a disk and write a disklabel. It also is used to perform a low-level format on SCSI drives. You will want to create a root partition and a swap partition. Depending on your preferences, you may also wish to create separate `/usr` or `/var` partitions.

```
# /usr/sbin/format
Searching for disks...
Mode sense page(3) reports nsect value as 280, adjusting it to 218
done

c0t1d0: configured with capacity of 16.95GB

AVAILABLE DISK SELECTIONS:
       0. c0t0d0 SUN4.2G cyl 3880 alt 2 hd 16 sec 135
          /pci@1f,4000/scsi@3/sd@0,0
       1. c0t1d0 IBM-DXHS18Y-0430 cyl 8152 alt 2 hd 20 sec 218
          /pci@1f,4000/scsi@3/sd@1,0
Specify disk (enter its number): 1
selecting c0t1d0
[disk formatted]
Disk not labeled.  Label it now? y

format format
Ready to format.  Formatting cannot be interrupted
and takes 114 minutes (estimated). Continue? y
Beginning format. The current time is Sat May 29 22:15:13 2004

Formatting...
done
Verifying media...
        pass 0 - pattern = 0xc6dec6de
   8151/19/208
        pass 1 - pattern = 0x6db6db6d
   8151/19/208

Total of 0 defective blocks repaired.
format partition
partition print
Current partition table (original):
Total disk cylinders available: 8152 + 2 (reserved cylinders)

Part      Tag    Flag     Cylinders        Size            Blocks
```

```
0       root    wm       0 -   60      129.86MB    (61/0/0)     265960
1       swap    wu      61 -  121      129.86MB    (61/0/0)     265960
2     backup    wu       0 - 8151       16.95GB    (8152/0/0) 35542720
3 unassigned    wm       0               0         (0/0/0)           0
4 unassigned    wm       0               0         (0/0/0)           0
5 unassigned    wm       0               0         (0/0/0)           0
6        usr    wm     122 - 8151       16.69GB    (8030/0/0) 35010800
7 unassigned    wm       0               0         (0/0/0)           0
```

partition **label**
Ready to label disk, continue? **y**
partition **quit**
format **quit**

After your disk has been labeled you need to create file systems on your slices. The Solaris `newfs`(1M) command will create ffs file systems that can be used by NetBSD.

```
# /usr/sbin/newfs /dev/dsk/c0t1d0s0
# /usr/sbin/newfs /dev/dsk/c0t1d0s6
```

- *Installing NetBSD Software from Solaris*

  You should now mount your NetBSD root and `/usr` partitions under Solaris so that you can populate the file systems with NetBSD binaries.

  ```
  # /usr/sbin/mount /dev/dsk/c0t1d0s0 /mnt
  # mkdir /mnt/usr
  # /usr/sbin/mount /dev/dsk/c0t1d0s6 /mnt/usr
  ```

  Now extract the distribution file sets

  ```
  # cd ~/netbsd/binary/sets
  # gunzip *.tar.gz
  # echo ~/netbsd/binary/sets/*.tar | (cd /mnt; xargs -n1 pax -rpe -f )
  ```

  Now you should copy the NetBSD second stage bootloader into your new root partition and install the bootblocks using Solaris's `installboot`(1M) command.

  ```
  # cp ~/netbsd/installation/misc/ofwboot /mnt
  # /usr/sbin/installboot ~/netbsd/installation/misc/bootblk /dev/rdsk/c0t1d0s0
  ```

- *Creating NetBSD Device Nodes under Solaris*

  This is not a necessary step. If your `/dev` directory is empty, the kernel will create a RAM disk with all of the essential device nodes each time the system boots. If you want to create the device nodes on disk, you will need to use the Solaris `mknod`(1M) command. Look in `/dev/MAKEDEV` for the correct names, major and minor numbers, ownership, and permissions.

- *Configuring the NetBSD system from Solaris*

  To save effort, you may want to use your favorite Solaris editor to configure some of the files in `/etc` before booting into NetBSD the first time. In particular, you should look at `/etc/fstab`, `/etc/rc.conf`, `/etc/resolv.conf`, and `/etc/hosts`. See the section below on **Post installation steps** before **Booting NetBSD for the first time**.

**Booting NetBSD for the first time**

Now it is time to boot NetBSD for the first time. You will boot from your disk using similar syntax as described above in **Setting up Open Firmware** and **Determining how to boot from an SBUS or PCI card**

That is, boot from your first disk:

ok **boot 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 **sun** for a local console, or whatever is appropriate for your serial console (some systems display garbage with a **sun** terminal type, you may need to use **sun-ss5**) 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=sun
   ```

   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_hme0="inet 123.45.67.89 netmask 255.255.255.0"
   ```

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

   ```
   ifconfig_hme0="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. Select the proper terminal devices

   If you are using a serial console, you will have to edit the /etc/ttys file and change sun-ss5 to the appropriate terminal type, such as vt220.

3. 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? [...].

4. 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.

5. 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.

6. 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 2.0/sparc64/All subdir. You can install them with the following commands under sh(1):

     ```
     # PKG_PATH=ftp://ftp.NetBSD.org/pub/NetBSD/packages/2.0/sparc64/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/2.0/sparc64/All
...
```

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 Packages.txt files in the extraction directory (e.g. /usr/pkgsrc/README) for more information.

7. 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 2.0 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 boot from the installer kernel using one of the methods described above. 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 2.0 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 2.0.

*Issues affecting an upgrade from NetBSD 1.6*

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/fsck.sh` `/etc/rc.d/gated` `/etc/rc.d/kerberos` `/etc/rc.d/NETWORK` `/etc/rc.d/systemfs` `/etc/rc.d/xntpd` and `/etc/rc.d/ypset`.
- The users and groups 'smmsp', needs to be created, 'news' is no longer part of the system.

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
```

**Using online NetBSD documentation**

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

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

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

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

```
# man passwd
```

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

```
# man 5 passwd
```

instead.

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

**apropos** *subject-word*

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

**Administrivia**

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

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

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

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

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

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

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

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- The Internet Research Institute in Japan for hosting the server which runs the CVSweb interface to the NetBSD source tree.
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- SSH Communications Security in Finland for operating the backup server.
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