NAME

INSTALL — Installation procedure for NetBSD/amd64.

CONTENTS

About this Document....1
Quick install notes for the impatient....2
What is NetBSD?....3
Changes Between The NetBSD 5.0 and 6.0 Releases....3
Features to be removed in a later release....3
The NetBSD Foundation....3
Sources of NetBSD....3
NetBSD 5.99.64 Release Contents....3
  NetBSD/amd64 subdirectory structure....4
  Binary distribution sets....5
NetBSD/amd64 System Requirements and Supported Devices....6
Getting the NetBSD System on to Useful Media....6
Preparing your System for NetBSD installation....7
Installing the NetBSD System....7
  Running the sysinst installation program....7
    Introduction....7
    Possible hardware problems....7
    General....8
    Quick install....8
    Booting NetBSD....9
    Network configuration....9
    Installation drive selection and parameters....9
    Selecting which sets to install....9
    Partitioning the disk....9
    Preparing your hard disk....10
    Getting the distribution sets....10
    Installation from CD-ROM....10
    Installation using ftp....10
    Installation using NFS....11
    Installation from an unmounted file system....11
    Installation from a local directory....11
    Extracting the distribution sets....11
    Finalizing your installation....11
Post installation steps....11
Upgrading a previously-installed NetBSD System....14
Compatibility Issues With Previous NetBSD Releases....14
  Issues affecting an upgrade from NetBSD 5.x releases....14
  Issues affecting an upgrade from NetBSD 4.x releases....15
Using online NetBSD documentation....15
Administrivia....16
Thanks go to....16
We are....17
Legal Mumbo-Jumbo....25
The End....28

DESCRIPTION

About this Document

This document describes the installation procedure for NetBSD 5.99.64 on the *amd64* 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 5.99.64 on a machine of the amd64 architecture.

- Fetch files needed to install NetBSD.

  Option 1: bootable CD-ROM images containing the full distribution.

  These can be found on an FTP site near you, usually located in the `/pub/NetBSD/iso/` directory. Check the NetBSD website for details.

  Option 2: bootable CD-ROM images from `amd64/installation/cdrom/`.

  These images are bootable, but do not contain binary sets. They are intended for network installs or system repair. `boot.iso` is for VGA console installation, and `boot-com.iso` is for installation over serial console (com0, 9600 baud).

  Option 3: boot floppy images from `amd64/installation/floppy/`.

  `boot1.fs` and `boot2.fs` are floppy images for VGA console installation. `boot-com1.fs` and `boot-com2.fs` are for installation via serial console (com0, 9600 baud).

- The default kernel on CD-ROMs has ACPI enabled. This is known to cause issues on a few machines which have buggy ACPI implementations.

  To boot with ACPI disabled, choose the "no ACPI" option from the boot menu, or interrupt the menu and enter the NetBSD boot prompt. Type **`boot -2`** to boot with ACPI disabled.

- The actual binary distribution is in the `amd64/binary/sets/` directory. When you boot the install 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 CD-ROM images or floppy images out.

  Many commercial and freeware programs are available to burn CD-ROMs.

  If you have problems writing a raw image to a floppy, the **`rawrite.exe`** MS-DOS program or the **`Rawrite32`** Windows32 program (installed by `rawr32.exe`) 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 many thousands of third party software applications.

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 57 different system architectures (ports) across 15 distinct CPU families, and is being ported to more. The NetBSD 5.99.64 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. Please see the NetBSD web site at **http://www.NetBSD.org/** for information on them.)

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 5.0 and 6.0 Releases

The NetBSD 5.99.64 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 userland 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 the massive development that went into the NetBSD 5.99.64 release. The complete list of changes can be found in the CHANGES:

http://ftp.NetBSD.org/pub/NetBSD/NetBSD-6.0/CHANGES

and CHANGES-6.0:

http://ftp.NetBSD.org/pub/NetBSD/NetBSD-6.0/CHANGES-6.0

files in the top level directory of the NetBSD 6.0 release tree.

Features to be removed in a later release

The following features are to be removed from NetBSD in the future:

-

The NetBSD Foundation

The NetBSD Foundation is a tax exempt, not-for-profit 501(c)(3) corporation that devotes itself to the traditional goals and Spirit of the NetBSD Project and owns the trademark of the word "NetBSD". It supports the design, development, and adoption of NetBSD worldwide. More information on the NetBSD Foundation, its composition, aims, and work can be found at: **http://www.NetBSD.org/foundation/**

Sources of NetBSD

Refer to **http://www.NetBSD.org/mirrors/**

NetBSD 5.99.64 Release Contents

The root directory of the NetBSD 5.99.64 release is organized as follows:

`.../NetBSD-5.99.64/`

`CHANGES` Changes between the 5.0 and 6.0 releases.

`CHANGES-6.0` Changes between the initial 6.0 branch and final release of 6.0.

`CHANGES.prev` Changes in previous NetBSD releases.

`LAST_MINUTE` Last minute changes and notes about the release.

`README.files` README describing the distribution's contents.

`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 5.99.64 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.

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.

src This set contains all of the base NetBSD 5.99.64 sources which are not in **gnusrc**, **sharesrc**, or **syssrc**.

syssrc This set contains the sources to the NetBSD 5.99.64 kernel for all architectures as well as the `config`(1) utility.

xsrc This set contains the sources to the X Window System.

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:

`MD5` MD5 digests in the format produced by the command:
cksum -a MD5 *file*.

`SHA512` SHA512 digests in the format produced by the command:
cksum -a SHA512 *file*.

The SHA512 digest is safer, but MD5 checksums are provided so that a wider range of operating systems can check the integrity of the release files.

NetBSD/amd64 subdirectory structure

The amd64-specific portion of the NetBSD 5.99.64 release is found in the `amd64` subdirectory of the distribution: `.../NetBSD-5.99.64/amd64/`. 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 installation kernel.
`netbsd-INSTALL_XEN3_DOMU.gz`
`netbsd-XEN3_DOM0.gz`
`netbsd-XEN3_DOMU.gz`
`sets/` amd64 binary distribution sets; see below.

`installation/`
`cdrom/` amd64 bootable cdrom images; see below.
`floppy/` amd64 boot and installation floppies; see below.
`misc/` Miscellaneous amd64 installation utilities; see installation section below.

Binary distribution sets

The NetBSD amd64 binary distribution sets contain the binaries which comprise the NetBSD 5.99.64 release for amd64. The binary distribution sets can be found in the `amd64/binary/sets` subdirectory of the NetBSD 5.99.64 distribution tree, and are as follows:

base The NetBSD 5.99.64 amd64 **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.

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.

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.

games This set includes the games and their manual pages.

kern-GENERIC
This set contains a NetBSD/amd64 5.99.64 `GENERIC` kernel, named `/netbsd`. You *must* install this distribution set.

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.

misc This set includes the system dictionaries, the typesettable document set, and other files from `/usr/share`.

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

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 X.Org. 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.

xcomp The extra libraries and include files needed to compile X source code.

xfont Fonts needed by the X server and by X clients.

xetc Configuration files for X which could be locally modified.

xserver The X server. This includes the modular Xorg server.

The amd64 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 -xzpf`** command from the root directory (`/`) of your system.

Note: Each directory in the amd64 binary distribution also has its own checksum files, just as the source distribution does.

NetBSD/amd64 System Requirements and Supported Devices

NetBSD/amd64 supports CPUs that implement the 64bit AMD64 architecture. These currently include AMD Opteron, AMD Athlon64, and Intel CPUs that implement the EM64T extension.

Getting the NetBSD System on to Useful Media

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.

CD-ROM / DVD Find out where the distribution set files are on the CD-ROM or DVD. Likely locations are `binary/sets` and `amd64/binary/sets`.

Proceed to the instructions 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.

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.

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 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.

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 **kern-GENERIC, 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-5.99.64
# cd amd64/binary
# tar -cf tape_device kern-GENERIC base etc
```

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

It is strongly recommended that as part of the installation procedure, you upgrade your system's BIOS to the latest version available from your system vendor. Later BIOSes often contain workarounds for CPU and chipset bugs, workarounds that cannot be provided by the operating system.

In the past, bugs fixed this way have been known to cause unpredictable behaviour and frequent system crashes with NetBSD and other UNIX-like operating systems on x86 hardware.

Installing the NetBSD System

Running the sysinst installation program

1. *Introduction*

   Using **sysinst**, installing NetBSD is a relatively easy process. Still, you should read this document and have it in hand when doing the installation process. This document tries to be a good guide to 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 hardware problems*

   Should you encounter hardware problems during installation, try rebooting after unplugging removable devices you don't need for installation. Non-removable devices can be disabled with **userconf** (use **boot -c** to enter it).

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).
     - A CD-ROM drive (SCSI or ATAPI), and a hard disk.
     - 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 215 MB more.
   - The Quick Installation
     - Insert the CD into the drive and boot the computer.

```
.*****************************************.
* NetBSD-5.99.64 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.**
- 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 `/etc/rc.conf` to match your needs.
- Your installation is now complete.

5. *Booting NetBSD*

   Boot your machine. The boot loader will start, and will print a countdown and begin booting. The most important thing to know is that `wd0` is NetBSD's name for your first IDE disk, `wd1` the second, etc. `sd0` is your first SCSI disk, `sd1` the second, etc.

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

6. *Network configuration*

   If you do not intend to use networking 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 when asked to provide a server.

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. You should see disk names like `sd0` or `sd1`.

8. *Selecting which sets to install*

   The next step is to choose which distribution sets you wish to install. Options are provided for full, minimal, and custom installations. If you choose sets on your own, **base**, **etc**, and a kernel must be selected.

9. *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, **sysinst** will check for the presence of other operating systems and you will be asked to confirm that you want to overwrite these.

10. *Editing the NetBSD disklabel*

    The partition table of the NetBSD part of a disk is called a *disklabel*. If your disk already has a disklabel written to it, you can choose **Use existing partition sizes**. Otherwise, select **Set sizes of NetBSD partitions**.

    After you have chosen your partitions and their sizes (or if you opted to use the existing partitions), you will be presented with the layout of the NetBSD disklabel and given one more 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 update 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, select **yes**.

    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*

    The NetBSD distribution consists of a number of *sets* that come in the form of gzipped tarfiles. At this point, 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 from CD-ROM*

    When installing from a CD-ROM, you will be asked to specify the device name for your CD-ROM drive (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 using ftp*

To be able to install using ftp, you first need to configure your network setup if you haven't already done so. **sysinst** will do this for you, asking you if you want to use DHCP. If you do not use DHCP, you can enter network configuration details yourself. If you do not have DNS set up for the machine that you are installing on, you can just press RETURN in answer to this question, 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, 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.

15. *Installation using NFS*

    To be able to install using NFS, you first need to configure your network setup if you haven't already done so. **sysinst** will do this for you, asking you if you want to use DHCP. If you do not use DHCP, you can enter network configuration details yourself. If you do not have DNS set up for the machine that you are installing on, you can just press RETURN in answer to this question, 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, you will need to specify an IP address instead of a hostname for the NFS server.

16. *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.

17. *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.

18. *Extracting the distribution sets*

    A progress bar will be displayed while the distribution sets are being extracted.

    After all the files have been extracted, the 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 then set a password for the "root" account, to prevent the machine from coming up without access restrictions.

19. *Finalizing your installation*

    Congratulations, you have successfully installed NetBSD 5.99.64. 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. The most important steps are 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).

   When you have finished editing `/etc/rc.conf`, type **exit** at the prompt to leave the single-user shell and continue with the multi-user boot.

   Other values that may need to be set in `/etc/rc.conf` for a networked environment are *hostname* and possibly *defaultroute*. You may also need to add an *ifconfig_int* for your ⟨int⟩ network interface, along the lines of

   ```
   ifconfig_wm0="inet 192.0.2.123 netmask 255.255.255.0"
   ```

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

   ```
   ifconfig_wm0="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. 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.

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 installed the X Window System, you may want to read the chapter about X in the NetBSD Guide:
   http://netbsd.org/docs/guide/en/chap-x.html

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, pkgsrc. pkgsrc automatically handles any changes necessary to make the software run on NetBSD. This includes the retrieval and installation of any other packages on which the software may depend.

   - More information on the package system is available at
     http://www.NetBSD.org/docs/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/pkgsrc/packages/NetBSD/
     usually in the `amd64/5.99.64/All` subdir. You can install them with the following commands under `sh`(1):

     ```
     # PKG_PATH=ftp://ftp.NetBSD.org/pub/pkgsrc/packages/NetBSD/amd64/5.99.64/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 firefox
     ...
     ```

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

     ```
     # setenv PKG_PATH ftp://ftp.NetBSD.org/pub/pkgsrc/packages/NetBSD/amd64/5.99.64
     ```

     Note: Some mirror sites don't mirror the `/pub/pkgsrc` directory. If you would like to use such mirrors, you could also try the `/pub/NetBSD/packages/current-packages/NetBSD/amd64/5.99.64/All` directory, which may have the same contents.

     The above commands will install the Tenex-csh and Bourne Again shells, the Perl programming language, Apache web server, KDE desktop environment and the Firefox web browser as well as all the packages they depend on.

     Note: In some cases the `pkg_add`(1) command will complain about a version mismatch of packages with a message like the following:

     ```
     Warning: package 'foo' was built for a different version
     of the OS:
     NetBSD/i386 M.N (pkg) vs. NetBSD/i386 5.99.64 (this
     host),
     ```

     This warning is harmless if the formal major release numbers are the same between the pkg and your host. Please refer to the NetBSD release glossary and graphs at
     http://www.NetBSD.org/releases/release-map.html
     for more information about NetBSD's release numbering scheme.

- The framework for compiling packages can be obtained by retrieving the file
  ftp://ftp.NetBSD.org/pub/NetBSD/packages/pkgsrc.tar.gz
  It is typically extracted into `/usr/pkgsrc` (though other locations work fine) with the commands:

  ```
  # cd /usr
  # tar -zxpf pkgsrc.tar.gz
  ```

  After extracting, see the `doc/pkgsrc.txt` file in the extraction directory (e.g., `/usr/pkgsrc/doc/pkgsrc.txt`) 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/postfix/main.cf` file will almost definitely need to be adjusted. If you prefer a different MTA, then install it using pkgsrc or by hand and 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 easiest way to upgrade to NetBSD 5.99.64 is with binaries, and that is the method documented here.

To do the upgrade, you must have one form of boot media available. You must also have at least the **base** and **kern** binary distribution sets available. 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, boot blocks, 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 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. Also, file systems are checked before unpacking the sets. Fetching the binary sets is done in the same manner as the installation procedure; refer to the installation part of the document for help.

After a new kernel has been copied to your hard disk, your machine is a complete NetBSD 5.99.64 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 5.99.64.

Note that **sysinst** will automatically invoke

```
postinstall fix
```

and thus all issues that are fixed by **postinstall** by default (see below) will be handled.

Issues affecting an upgrade from NetBSD 5.x releases

The pthread libraries from previous versions of NetBSD require that the sysctl(3) node kern.no_sa_support be set to 0. This affects the following environments:

- Running a 5.0 kernel with an older userland.
- Running an older userland inside a chroot'ed environment on a 5.0 system.
- Running older statically linked pthread applications.

The 5.0 kernel defaults to 0 for kern.no_sa_support, which covers the first case. However, please note that a full installation of 5.0 (either from scratch or through an upgrade) will set kern.no_sa_support to 1 during the boot process. This means that for the last two cases, you will have to manually set kern.no_sa_support to 0, using either the sysctl(8) command or through sysctl.conf(5).

Issues affecting an upgrade from NetBSD 4.x releases

The following issues can generally be resolved by running *postinstall* with the **etc** set:

```
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/daily
  - /etc/weekly
  - /etc/monthly
  - /etc/security
  - /etc/rc.subr
  - /etc/rc
  - /etc/rc.shutdown
  - /etc/rc.d/*
  - /etc/envsys.conf

The following issues need to be resolved manually:

- The users '_httpd' and '_timedc' and the groups '_httpd' and '_timedc' need to be created.
- Unprivileged use of the mount(8) command now requires the *nosuid* and *nodev* options to be explicitly specified. Previously, these options were automatically enforced even if they were not explicitly specified.
- A number of things have been removed from the NetBSD 5.99.64 release. See the "Components removed from NetBSD" section near the beginning of this document for a list.

Using online NetBSD documentation

Documentation is available if you installed 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. See **http://www.NetBSD.org/mailinglists/** for a web interface.

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.

Bugs also can be submitted and queried with the web interface at
http://www.NetBSD.org/support/send-pr.html

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-users@NetBSD.org.

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

Thanks go to

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

  Keith Bostic
  Ralph Campbell
  Mike Karels
  Marshall Kirk McKusick

  for their work on BSD systems, support, and encouragement.
- The Internet Systems Consortium, Inc. for hosting the NetBSD FTP, CVS, AnonCVS, mail, mail archive, GNATS, SUP, Rsync and WWW servers.
- The Internet Research Institute in Japan for hosting the server which runs the CVSweb interface to the NetBSD source tree.
- The Luleå Academic Computer Society for providing the backup services server.
- The Columbia University Computer Science Department for hosting the NYC build cluster.
- The Western Washington University Computer Science Department for running the WWU build cluster.
- The many organizations that provide NetBSD mirror sites.
- Without CVS, this project would be impossible to manage, so our hats go off to Brian Berliner, Jeff Polk, and the various other people who've had a hand in making CVS a useful tool.
- We list the individuals and organizations that have made donations or loans of hardware and/or money, to support NetBSD development, and deserve credit for it at **http://www.NetBSD.org/donations/** (If you're not on that list and should be, tell us! We probably were not able to get in touch with you, to verify that you wanted to be listed.)
- Finally, we thank all of the people who've put sweat and tears into developing NetBSD since its inception in January, 1993. (Obviously, there are a lot more people who deserve thanks here. If you're one of them, and would like to be mentioned, tell us!)

We are...

(in alphabetical order)

The NetBSD core group:

Alistair Crooks	`agc@NetBSD.org`
Matthew Green	`mrg@NetBSD.org`
Matt Thomas	`matt@NetBSD.org`
YAMAMOTO Takashi	`yamt@NetBSD.org`
Christos Zoulas	`christos@NetBSD.org`

The portmasters (and their ports):

Erik Berls	cyber@NetBSD.org	**cobalt**
Manuel Bouyer	bouyer@NetBSD.org	**xen**
Simon Burge	simonb@NetBSD.org	**evbmips**
Simon Burge	simonb@NetBSD.org	**pmax**
Simon Burge	simonb@NetBSD.org	**sbmips**
Julian Coleman	jdc@NetBSD.org	**atari**
Andrew Doran	ad@NetBSD.org	**amd64**
Andrew Doran	ad@NetBSD.org	**i386**
Matthias Drochner	drochner@NetBSD.org	**cesfic**
Gavan Fantom	gavan@NetBSD.org	**iyonix**
Jaime A Fournier	ober@NetBSD.org	**zaurus**
Ben Harris	bjh21@NetBSD.org	**acorn26**
Nick Hudson	skrll@NetBSD.org	**hp700**
Martin Husemann	martin@NetBSD.org	**sparc64**
Søren Jørvang	soren@NetBSD.org	**sgimips**
Takayoshi Kochi	kochi@NetBSD.org	**ia64**
Michael Lorenz	macallan@NetBSD.org	**macppc**
Anders Magnusson	ragge@NetBSD.org	**vax**
Tohru Nishimura	nisimura@NetBSD.org	**luna68k**
Tohru Nishimura	nisimura@NetBSD.org	**sandpoint**
Scott Reynolds	scottr@NetBSD.org	**mac68k**
Tim Rightnour	garbled@NetBSD.org	**ofppc**
Tim Rightnour	garbled@NetBSD.org	**prep**
Tim Rightnour	garbled@NetBSD.org	**rs6000**
Noriyuki Soda	soda@NetBSD.org	**arc**
Ignatios Souvatzis	is@NetBSD.org	**amiga**
Ignatios Souvatzis	is@NetBSD.org	**amigappc**
NISHIMURA Takeshi	nsmrtks@NetBSD.org	**x68k**
Matt Thomas	matt@NetBSD.org	**alpha**
Matt Thomas	matt@NetBSD.org	**ibmnws**
Matt Thomas	matt@NetBSD.org	**netwinder**
Jason Thorpe	thorpej@NetBSD.org	**algor**
Jason Thorpe	thorpej@NetBSD.org	**evbarm**
Jason Thorpe	thorpej@NetBSD.org	**shark**
IWAMOTO Toshihiro	toshii@NetBSD.org	**hpcarm**
Izumi Tsutsui	tsutsui@NetBSD.org	**ews4800mips**
Izumi Tsutsui	tsutsui@NetBSD.org	**hp300**
Izumi Tsutsui	tsutsui@NetBSD.org	**news68k**
Valeriy E. Ushakov	uwe@NetBSD.org	**hpcsh**
Valeriy E. Ushakov	uwe@NetBSD.org	**landisk**
Steve Woodford	scw@NetBSD.org	**evbppc**
Steve Woodford	scw@NetBSD.org	**mvme68k**
Steve Woodford	scw@NetBSD.org	**mvmeppc**
Reinoud Zandijk	reinoud@NetBSD.org	**acorn32**

The NetBSD 5.99.64 Release Engineering team:

Stephen Borrill	sborrill@NetBSD.org
Manuel Bouyer	bouyer@NetBSD.org
David Brownlee	abs@NetBSD.org
James Chacon	jmc@NetBSD.org
Julian Coleman	jdc@NetBSD.org
Alistair G. Crooks	agc@NetBSD.org
Håvard Eidnes	he@NetBSD.org
Jaime A Fournier	ober@NetBSD.org
Liam J. Foy	liamjfoy@NetBSD.org
John Heasley	heas@NetBSD.org
Martin Husemann	martin@NetBSD.org
Soren Jacobsen	snj@NetBSD.org
Phil Nelson	phil@NetBSD.org
Jeff Rizzo	riz@NetBSD.org
SAITOH Masanobu	msaitoh@NetBSD.org

NetBSD Developers:

Nathan Ahlstrom	nra@NetBSD.org
Steve Allen	wormey@NetBSD.org
Jukka Andberg	jandberg@NetBSD.org
Julian Assange	proff@NetBSD.org
Lennart Augustsson	augustss@NetBSD.org
Zafer Aydogan	zafer@NetBSD.org
Christoph Badura	bad@NetBSD.org
Marc Balmer	mbalmer@NetBSD.org
Bang Jun-Young	junyoung@NetBSD.org
Dieter Baron	dillo@NetBSD.org
Robert V. Baron	rvb@NetBSD.org
Alan Barrett	apb@NetBSD.org
Grant Beattie	grant@NetBSD.org
Erik Berls	cyber@NetBSD.org
Hiroyuki Bessho	bsh@NetBSD.org
John Birrell	jb@NetBSD.org
Rafal Boni	rafal@NetBSD.org
Stephen Borrill	sborrill@NetBSD.org
Sean Boudreau	seanb@NetBSD.org
Manuel Bouyer	bouyer@NetBSD.org
Allen Briggs	briggs@NetBSD.org
Mark Brinicombe	mark@NetBSD.org
Aaron Brown	abrown@NetBSD.org
Andrew Brown	atatat@NetBSD.org
David Brownlee	abs@NetBSD.org
Jon Buller	jonb@NetBSD.org
Simon Burge	simonb@NetBSD.org
Robert Byrnes	byrnes@NetBSD.org
Pavel Cahyna	pavel@NetBSD.org

D'Arcy J.M. Cain	darcy@NetBSD.org
Taylor R. Campbell	riastradh@NetBSD.org
Daniel Carosone	dan@NetBSD.org
Dave Carrel	carrel@NetBSD.org
James Chacon	jmc@NetBSD.org
Mihai Chelaru	kefren@NetBSD.org
Aleksey Cheusov	cheusov@NetBSD.org
Bill Coldwell	billc@NetBSD.org
Julian Coleman	jdc@NetBSD.org
Marcus Comstedt	marcus@NetBSD.org
Jeremy Cooper	jeremy@NetBSD.org
Thomas Cort	tcort@NetBSD.org
Chuck Cranor	chuck@NetBSD.org
Alistair Crooks	agc@NetBSD.org
Johan Danielsson	joda@NetBSD.org
John Darrow	jdarrow@NetBSD.org
Jed Davis	jld@NetBSD.org
Matt DeBergalis	deberg@NetBSD.org
Arnaud Degroote	degroote@NetBSD.org
Rob Deker	deker@NetBSD.org
Chris G. Demetriou	cgd@NetBSD.org
Tracy Di Marco White	gendalia@NetBSD.org
Jaromír Dolecek	jdolecek@NetBSD.org
Andy Doran	ad@NetBSD.org
Roland Dowdeswell	elric@NetBSD.org
Steven Drake	sbd@NetBSD.org
Emmanuel Dreyfus	manu@NetBSD.org
Matthias Drochner	drochner@NetBSD.org
Jun Ebihara	jun@NetBSD.org
Håvard Eidnes	he@NetBSD.org
Jaime A Fournier	ober@NetBSD.org
Stoned Elipot	seb@NetBSD.org
Michael van Elst	mlelstv@NetBSD.org
Enami Tsugutomo	enami@NetBSD.org
Bernd Ernesti	veego@NetBSD.org
Erik Fair	fair@NetBSD.org
Gavan Fantom	gavan@NetBSD.org
Hauke Fath	hauke@NetBSD.org
Hubert Feyrer	hubertf@NetBSD.org
Jason R. Fink	jrf@NetBSD.org
Matt J. Fleming	mjf@NetBSD.org
Marty Fouts	marty@NetBSD.org
Liam J. Foy	liamjfoy@NetBSD.org
Matt Fredette	fredette@NetBSD.org
Thorsten Frueauf	frueauf@NetBSD.org
Castor Fu	castor@NetBSD.org
Makoto Fujiwara	mef@NetBSD.org
Ichiro Fukuhara	ichiro@NetBSD.org
Quentin Garnier	cube@NetBSD.org

Thomas Gerner	thomas@NetBSD.org
Simon J. Gerraty	sjg@NetBSD.org
Justin Gibbs	gibbs@NetBSD.org
Chris Gilbert	chris@NetBSD.org
Eric Gillespie	epg@NetBSD.org
Brian Ginsbach	ginsbach@NetBSD.org
Oliver V. Gould	ver@NetBSD.org
Paul Goyette	pgoyette@NetBSD.org
Michael Graff	explorer@NetBSD.org
Matthew Green	mrg@NetBSD.org
Andreas Gustafsson	gson@NetBSD.org
Ulrich Habel	rhaen@NetBSD.org
Jun-ichiro itojun Hagino	itojun@NetBSD.org
HAMAJIMA Katsuomi	hamajima@NetBSD.org
Adam Hamsik	haad@NetBSD.org
Juergen Hannken-Illjes	hannken@NetBSD.org
Charles M. Hannum	mycroft@NetBSD.org
Yorick Hardy	yhardy@NetBSD.org
Ben Harris	bjh21@NetBSD.org
Eric Haszlakiewicz	erh@NetBSD.org
John Hawkinson	jhawk@NetBSD.org
Emile Heitor	imil@NetBSD.org
John Heasley	heas@NetBSD.org
Lars Heidieker	para@NetBSD.org
Geert Hendrickx	ghen@NetBSD.org
René Hexel	rh@NetBSD.org
Iain Hibbert	plunky@NetBSD.org
Kouichirou Hiratsuka	hira@NetBSD.org
Michael L. Hitch	mhitch@NetBSD.org
Ádám Hóka	ahoka@NetBSD.org
Jachym Holecek	freza@NetBSD.org
David A. Holland	dholland@NetBSD.org
Christian E. Hopps	chopps@NetBSD.org
Daniel Horecki	morr@NetBSD.org
Ken Hornstein	kenh@NetBSD.org
Marc Horowitz	marc@NetBSD.org
Eduardo Horvath	eeh@NetBSD.org
Nick Hudson	skrll@NetBSD.org
Shell Hung	shell@NetBSD.org
Darran Hunt	darran@NetBSD.org
Martin Husemann	martin@NetBSD.org
Dean Huxley	dean@NetBSD.org
Love Hörnquist Åstrand	lha@NetBSD.org
Roland Illig	rillig@NetBSD.org
Bernardo Innocenti	bernie@NetBSD.org
Tetsuya Isaki	isaki@NetBSD.org
ITOH Yasufumi	itohy@NetBSD.org
IWAMOTO Toshihiro	toshii@NetBSD.org
Matthew Jacob	mjacob@NetBSD.org

Soren Jacobsen	snj@NetBSD.org
Lonhyn T. Jasinskyj	lonhyn@NetBSD.org
Darrin Jewell	dbj@NetBSD.org
Nicolas Joly	njoly@NetBSD.org
Søren Jørvang	soren@NetBSD.org
Takahiro Kambe	taca@NetBSD.org
Antti Kantee	pooka@NetBSD.org
Frank Kardel	kardel@NetBSD.org
KAWAMOTO Yosihisa	kawamoto@NetBSD.org
Min Sik Kim	minskim@NetBSD.org
KIYOHARA Takashi	kiyohara@NetBSD.org
Thomas Klausner	wiz@NetBSD.org
Klaus Klein	kleink@NetBSD.org
John Klos	jklos@NetBSD.org
Wayne Knowles	wdk@NetBSD.org
Takayoshi Kochi	kochi@NetBSD.org
Jonathan A. Kollasch	jakllsch@NetBSD.org
Radoslaw Kujawa	rkujawa@NetBSD.org
Jochen Kunz	jkunz@NetBSD.org
Martti Kuparinen	martti@NetBSD.org
Arnaud Lacombe	alc@NetBSD.org
Kevin Lahey	kml@NetBSD.org
David Laight	dsl@NetBSD.org
Johnny C. Lam	jlam@NetBSD.org
Guillaume Lasmayous	gls@NetBSD.org
Martin J. Laubach	mjl@NetBSD.org
Greg Lehey	grog@NetBSD.org
Ted Lemon	mellon@NetBSD.org
Christian Limpach	cl@NetBSD.org
Frank van der Linden	fvdl@NetBSD.org
Joel Lindholm	joel@NetBSD.org
Tonnerre Lombard	tonnerre@NetBSD.org
Mike Long	mikel@NetBSD.org
Michael Lorenz	macallan@NetBSD.org
Warner Losh	imp@NetBSD.org
Tomasz Luchowski	zuntum@NetBSD.org
Federico Lupi	federico@NetBSD.org
Brett Lymn	blymn@NetBSD.org
MAEKAWA Masahide	gehenna@NetBSD.org
Anders Magnusson	ragge@NetBSD.org
John Marino	marino@NetBSD.org
Roy Marples	roy@NetBSD.org
Cherry G. Mathew	cherry@NetBSD.org
David Maxwell	david@NetBSD.org
Gregory McGarry	gmcgarry@NetBSD.org
Dan McMahill	dmcmahill@NetBSD.org
Jared D. McNeill	jmcneill@NetBSD.org
Neil J. McRae	neil@NetBSD.org
Julio M. Merino Vidal	jmmv@NetBSD.org

Perry Metzger	perry@NetBSD.org
Luke Mewburn	lukem@NetBSD.org
Jean-Yves Migeon	jym@NetBSD.org
Brook Milligan	brook@NetBSD.org
Minoura Makoto	minoura@NetBSD.org
Simas Mockevicius	symka@NetBSD.org
der Mouse	mouse@NetBSD.org
Constantine A. Murenin	cnst@NetBSD.org
Joseph Myers	jsm@NetBSD.org
Tuomo Mäkinen	tjam@NetBSD.org
Zoltán Arnold NAGY	zoltan@NetBSD.org
Ken Nakata	kenn@NetBSD.org
Takeshi Nakayama	nakayama@NetBSD.org
Alexander Nasonov	alnsn@NetBSD.org
Phil Nelson	phil@NetBSD.org
John Nemeth	jnemeth@NetBSD.org
NISHIMURA Takeshi	nsmrtks@NetBSD.org
Tohru Nishimura	nisimura@NetBSD.org
NONAKA Kimihiro	nonaka@NetBSD.org
Takehiko NOZAKI	tnozaki@NetBSD.org
Tobias Nygren	tnn@NetBSD.org
OBATA Akio	obache@NetBSD.org
Jesse Off	joff@NetBSD.org
Tatoku Ogaito	tacha@NetBSD.org
OKANO Takayoshi	kano@NetBSD.org
Masaru Oki	oki@NetBSD.org
Ryo ONODERA	ryoon@NetBSD.org
Atsushi Onoe	onoe@NetBSD.org
Greg Oster	oster@NetBSD.org
Jonathan Perkin	sketch@NetBSD.org
Fredrik Pettai	pettai@NetBSD.org
Herb Peyerl	hpeyerl@NetBSD.org
Matthias Pfaller	matthias@NetBSD.org
Chris Pinnock	cjep@NetBSD.org
Adrian Portelli	adrianp@NetBSD.org
Chris Provenzano	proven@NetBSD.org
Mindaugas Rasiukevicius	rmind@NetBSD.org
Michael Rauch	mrauch@NetBSD.org
Marc Recht	recht@NetBSD.org
Darren Reed	darrenr@NetBSD.org
Jeremy C. Reed	reed@NetBSD.org
Jens Rehsack	sno@NetBSD.org
Antoine Reilles	tonio@NetBSD.org
Tyler R. Retzlaff	rtr@NetBSD.org
Scott Reynolds	scottr@NetBSD.org
Tim Rightnour	garbled@NetBSD.org
Jeff Rizzo	riz@NetBSD.org
Hans Rosenfeld	hans@NetBSD.org
Steve Rumble	rumble@NetBSD.org

Rumko	rumko@NetBSD.org
Jukka Ruohonen	jruoho@NetBSD.org
Blair J. Sadewitz	bjs@NetBSD.org
David Sainty	dsainty@NetBSD.org
SAITOH Masanobu	msaitoh@NetBSD.org
Kazuki Sakamoto	sakamoto@NetBSD.org
Curt Sampson	cjs@NetBSD.org
Wilfredo Sanchez	wsanchez@NetBSD.org
Ty Sarna	tsarna@NetBSD.org
SATO Kazumi	sato@NetBSD.org
Jan Schaumann	jschauma@NetBSD.org
Matthias Scheler	tron@NetBSD.org
Silke Scheler	silke@NetBSD.org
Karl Schilke (rAT)	rat@NetBSD.org
Amitai Schlair	schmonz@NetBSD.org
Konrad Schroder	perseant@NetBSD.org
Georg Schwarz	schwarz@NetBSD.org
Lubomir Sedlacik	salo@NetBSD.org
Christopher SEKIYA	sekiya@NetBSD.org
Reed Shadgett	dent@NetBSD.org
John Shannon	shannonjr@NetBSD.org
Tim Shepard	shep@NetBSD.org
Naoto Shimazaki	igy@NetBSD.org
Ryo Shimizu	ryo@NetBSD.org
Takao Shinohara	shin@NetBSD.org
Takuya SHIOZAKI	tshiozak@NetBSD.org
Daniel Sieger	dsieger@NetBSD.org
Chuck Silvers	chs@NetBSD.org
Thor Lancelot Simon	tls@NetBSD.org
Jeff Smith	jeffs@NetBSD.org
Noriyuki Soda	soda@NetBSD.org
Wolfgang Solfrank	ws@NetBSD.org
Jörg Sonnenberger	joerg@NetBSD.org
Ignatios Souvatzis	is@NetBSD.org
T K Spindler	dogcow@NetBSD.org
Matthew Sporleder	mspo@NetBSD.org
Bill Squier	groo@NetBSD.org
Adrian Steinmann	ast@NetBSD.org
Bill Studenmund	wrstuden@NetBSD.org
Kevin Sullivan	sullivan@NetBSD.org
Kimmo Suominen	kim@NetBSD.org
Grégoire Sutre	gsutre@NetBSD.org
Sergey Svishchev	shattered@NetBSD.org
Robert Swindells	rjs@NetBSD.org
Shin Takemura	takemura@NetBSD.org
TAMURA Kent	kent@NetBSD.org
Shin'ichiro TAYA	taya@NetBSD.org
Hasso Tepper	hasso@NetBSD.org
Matt Thomas	matt@NetBSD.org

Jason Thorpe	thorpej@NetBSD.org
Christoph Toshok	toshok@NetBSD.org
Greg Troxel	gdt@NetBSD.org
Tsubai Masanari	tsubai@NetBSD.org
Izumi Tsutsui	tsutsui@NetBSD.org
UCHIYAMA Yasushi	uch@NetBSD.org
Masao Uebayashi	uebayasi@NetBSD.org
Shuichiro URATA	ur@NetBSD.org
Valeriy E. Ushakov	uwe@NetBSD.org
Todd Vierling	tv@NetBSD.org
Aymeric Vincent	aymeric@NetBSD.org
Paul Vixie	vixie@NetBSD.org
Mike M. Volokhov	mishka@NetBSD.org
Krister Walfridsson	kristerw@NetBSD.org
Mark Weinem	weinem@NetBSD.org
Lex Wennmacher	wennmach@NetBSD.org
Leo Weppelman	leo@NetBSD.org
Assar Westerlund	assar@NetBSD.org
Frank Wille	phx@NetBSD.org
Nathan Williams	nathanw@NetBSD.org
Rob Windsor	windsor@NetBSD.org
Jim Wise	jwise@NetBSD.org
Colin Wood	ender@NetBSD.org
Steve Woodford	scw@NetBSD.org
YAMAMOTO Takashi	yamt@NetBSD.org
Yuji Yamano	yyamano@NetBSD.org
David Young	dyoung@NetBSD.org
Arnaud Ysmal	stacktic@NetBSD.org
Reinoud Zandijk	reinoud@NetBSD.org
S.P.Zeidler	spz@NetBSD.org
Tim Zingelman	tez@NetBSD.org
Christos Zoulas	christos@NetBSD.org

Legal Mumbo-Jumbo

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

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

NetBSD is a registered trademark of The NetBSD Foundation, Inc.
This product includes software developed by the University of California, Berkeley and its contributors.
This product includes software developed by the NetBSD Foundation.
This product includes software developed by The NetBSD Foundation, Inc. and its contributors.
This product includes software developed for the NetBSD Project. See http://www.netbsd.org/ for information about NetBSD.
This product includes software developed by Intel Corporation and its contributors.
This product includes cryptographic software written by Eric Young (eay@cryptsoft.com)
This product includes cryptographic software written by Eric Young (eay@mincom.oz.au)
This product includes software designed by William Allen Simpson.
This product includes software developed at Ludd, University of Lulea, Sweden and its contributors.
This product includes software developed at Ludd, University of Lulea.
This product includes software developed at the Information Technology Division, US Naval Research Laboratory.
This product includes software developed by David Jones and Gordon Ross
This product includes software developed by Hellmuth Michaelis and Joerg Wunsch

This product includes software developed by Internet Research Institute, Inc.
This product includes software developed by Leo Weppelman and Waldi Ravens.
This product includes software developed by Mika Kortelainen
This product includes software developed by Aaron Brown and Harvard University.
This product includes software developed by Adam Ciarcinski for the NetBSD project.
This product includes software developed by Adam Glass and Charles M. Hannum.
This product includes software developed by Adam Glass.
This product includes software developed by Advanced Risc Machines Ltd.
This product includes software developed by Alex Zepeda, and Colin Wood for the NetBSD Projet.
This product includes software developed by Alex Zepeda.
This product includes software developed by Amancio Hasty and Roger Hardiman
This product includes software developed by Berkeley Software Design, Inc.
This product includes software developed by Bill Paul.
This product includes software developed by Bodo Moeller. (If available, substitute umlauted o for oe)
This product includes software developed by Boris Popov.
This product includes software developed by Brini.
This product includes software developed by Bruce M. Simpson.
This product includes software developed by Causality Limited.
This product includes software developed by Charles Hannum.
This product includes software developed by Charles M. Hannum, by the University of Vermont and State Agricultural College and Garrett A. Wollman, by William F. Jolitz, and by the University of California, Berkeley, Lawrence Berkeley Laboratory, and its contributors.
This product includes software developed by Charles M. Hannum.
This product includes software developed by Christian E. Hopps, Ezra Story, Kari Mettinen, Markus Wild, Lutz Vieweg and Michael Teske.
This product includes software developed by Christian E. Hopps.
This product includes software developed by Christopher G. Demetriou for the NetBSD Project.
This product includes software developed by Christopher G. Demetriou.
This product includes software developed by Christos Zoulas.
This product includes software developed by Chuck Silvers.
This product includes software developed by Colin Wood for the NetBSD Project.
This product includes software developed by Colin Wood.
This product includes software developed by Daan Vreeken.
This product includes software developed by Daishi Kato
This product includes software developed by Daniel Widenfalk and Michael L. Hitch.
This product includes software developed by Daniel Widenfalk for the NetBSD Project.
This product includes software developed by Dean Huxley.
This product includes software developed by Eric S. Hvozda.
This product includes software developed by Eric S. Raymond
This product includes software developed by Eric Young (eay@@mincom.oz.au)
This product includes software developed by Eric Young (eay@cryptsoft.com)
This product includes software developed by Eric Young (eay@mincom.oz.au)
This product includes software developed by K. Kobayashi.
This product includes software developed by K. Kobayashi and H. Shimokawa.
This product includes software developed by Ezra Story and by Kari Mettinen.
This product includes software developed by Ezra Story, by Kari Mettinen and by Bernd Ernesti.
This product includes software developed by Ezra Story, by Kari Mettinen, Michael Teske and by Bernd Ernesti.
This product includes software developed by Ezra Story, by Kari Mettinen, and Michael Teske.
This product includes software developed by Ezra Story.
This product includes software developed by Florian Stoehr.
This product includes software developed by Frank van der Linden for the NetBSD Project.
This product includes software developed by Gardner Buchanan.
This product includes software developed by Garrett D'Amore.
This product includes software developed by Gary Thomas.
This product includes software developed by Gordon Ross
This product includes software developed by Harvard University and its contributors.
This product includes software developed by Harvard University.
This product includes software developed by Henrik Vestergaard Draboel.
This product includes software developed by Herb Peyerl.
This product includes software developed by Hidetoshi Shimokawa.
This product includes software developed by Ian W. Dall.
This product includes software developed by Ignatios Souvatzis for the NetBSD Project.
This product includes software developed by Internet Initiative Japan Inc.
This product includes software developed by James R. Maynard III.
This product includes software developed by Jason L. Wright
This product includes software developed by Jason R. Thorpe for And Communications, http://www.and.com/

This product includes software developed by Joachim Koenig-Baltes.
This product includes software developed by Jochen Pohl for The NetBSD Project.
This product includes software developed by Joerg Wunsch
This product includes software developed by John Birrell.
This product includes software developed by John P. Wittkoski.
This product includes software developed by John Polstra.
This product includes software developed by Jonathan R. Stone for the NetBSD Project.
This product includes software developed by Jonathan Stone and Jason R. Thorpe for the NetBSD Project.
This product includes software developed by Jonathan Stone.
This product includes software developed by Julian Highfield.
This product includes software developed by Kazuhisa Shimizu.
This product includes software developed by Kazuki Sakamoto.
This product includes software developed by Kenneth Stailey.
This product includes software developed by Kiyoshi Ikehara.
This product includes software developed by Klaus Burkert,by Bernd Ernesti, by Michael van Elst, and by the University of California, Berkeley and its contributors.
This product includes software developed by LAN Media Corporation and its contributors.
This product includes software developed by Lloyd Parkes.
This product includes software developed by Lutz Vieweg.
This product includes software developed by MINOURA Makoto, Takuya Harakawa.
This product includes software developed by Marc Horowitz.
This product includes software developed by Marcus Comstedt.
This product includes software developed by Mark Brinicombe for the NetBSD project.
This product includes software developed by Mark Brinicombe.
This product includes software developed by Mark Tinguely and Jim Lowe
This product includes software developed by Markus Wild.
This product includes software developed by Masanobu Saitoh.
This product includes software developed by Masaru Oki.
This product includes software developed by Matthew Fredette.
This product includes software developed by Michael Smith.
This product includes software developed by Mike Pritchard.
This product includes software developed by Mike Pritchard and contributors.
This product includes software developed by Minoura Makoto.
This product includes software developed by Niels Provos.
This product includes software developed by Niklas Hallqvist, Brandon Creighton and Job de Haas.
This product includes software developed by Niklas Hallqvist.
This product includes software developed by Paul Kranenburg.
This product includes software developed by Paul Mackerras.
This product includes software developed by Per Fogelstrom
This product includes software developed by Peter Galbavy.
This product includes software developed by Phase One, Inc.
This product includes software developed by Philip A. Nelson.
This product includes software developed by RiscBSD.
This product includes software developed by Roar Thronæs.
This product includes software developed by Rodney W. Grimes.
This product includes software developed by Roger Hardiman
This product includes software developed by Rolf Grossmann.
This product includes software developed by Ross Harvey for the NetBSD Project.
This product includes software developed by Ross Harvey.
This product includes software developed by Scott Bartram.
This product includes software developed by Scott Stevens.
This product includes software developed by Shingo WATANABE.
This product includes software developed by Softweyr LLC, the University of California, Berkeley, and its contributors.
This product includes software developed by Stephan Thesing.
This product includes software developed by Steven M. Bellovin.
This product includes software developed by Takashi Hamada.
This product includes software developed by Takumi Nakamura.
This product includes software developed by Tatoku Ogaito for the NetBSD Project.
This product includes software developed by Terrence R. Lambert.
This product includes software developed by TooLs GmbH.
This product includes software developed by Trimble Navigation, Ltd.
This product includes software developed by WIDE Project and its contributors.
This product includes software developed by Waldi Ravens.
This product includes software developed by Wasabi Systems for Zembu Labs, Inc. http://www.zembu.com/
This product includes software developed by Winning Strategies, Inc.
This product includes software developed by Wolfgang Solfrank.

This product includes software developed by Yasushi Yamasaki.
This product includes software developed by Yen Yen Lim and North Dakota State University.
This product includes software developed by Zembu Labs, Inc.
This product includes software developed by the Alice Group.
This product includes software developed by the Center for Software Science at the University of Utah.
This product includes software developed by the Charles D. Cranor, Washington University, University of California, Berkeley and its contributors.
This product includes software developed by the Computer Systems Engineering Group at Lawrence Berkeley Laboratory.
This product includes software developed by the David Muir Sharnoff.
This product includes software developed by the Harvard University and its contributors.
This product includes software developed by the Network Research Group at Lawrence Berkeley Laboratory.
This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit. (http://www.OpenSSL.org/)
This product includes software developed by the PocketBSD project and its contributors.
This product includes software developed by the RiscBSD kernel team
This product includes software developed by the RiscBSD team.
This product includes software developed by the SMCC Technology Development Group at Sun Microsystems, Inc.
This product includes software developed by the University of California, Berkeley and its contributors, as well as the Trustees of Columbia University.
This product includes software developed by the University of California, Lawrence Berkeley Laboratory and its contributors.
This product includes software developed by the University of California, Lawrence Berkeley Laboratory.
This product includes software developed by the University of Illinois at Urbana and their contributors.
This product includes software developed by the Urbana-Champaign Independent Media Center.
This product includes software developed by the University of Vermont and State Agricultural College and Garrett A. Wollman.
This product includes software developed by the University of Vermont and State Agricultural College and Garrett A. Wollman, by William F. Jolitz, and by the University of California, Berkeley, Lawrence Berkeley Laboratory, and its contributors.
This product includes software developed for the FreeBSD project
This product includes software developed for the NetBSD Project by Bernd Ernesti.
This product includes software developed for the NetBSD Project by Christopher G. Demetriou.
This product includes software developed for the NetBSD Project by Emmanuel Dreyfus.
This product includes software developed for the NetBSD Project by Frank van der Linden
This product includes software developed for the NetBSD Project by Ignatios Souvatzis.
This product includes software developed for the NetBSD Project by Jason R. Thorpe.
This product includes software developed for the NetBSD Project by John M. Vinopal.
This product includes software developed by Kyma Systems.
This product includes software developed for the NetBSD Project by Kyma Systems LLC.
This product includes software developed for the NetBSD Project by Matthias Drochner.
This product includes software developed for the NetBSD Project by Perry E. Metzger.
This product includes software developed for the NetBSD Project by Scott Bartram and Frank van der Linden
This product includes software developed for the NetBSD Project by Allegro Networks, Inc., and Wasabi Systems, Inc.
This product includes software developed for the NetBSD Project by Genetec Corporation.
This product includes software developed for the NetBSD Project by Jonathan Stone.
This product includes software developed for the NetBSD Project by Piermont Information Systems Inc.
This product includes software developed for the NetBSD Project by SUNET, Swedish University Computer Network.
This product includes software developed for the NetBSD Project by Shigeyuki Fukushima.
This product includes software developed for the NetBSD Project by Wasabi Systems, Inc.
This product includes software developed under OpenBSD by Per Fogelstrom Opsycon AB for RTMX Inc, North Carolina, USA.
This product includes software developed under OpenBSD by Per Fogelstrom.
This software is a component of "386BSD" developed by William F. Jolitz, TeleMuse.
This software was developed by Holger Veit and Brian Moore for use with "386BSD" and similar operating systems. "Similar operating systems" includes mainly non-profit oriented systems for research and education, including but not restricted to "NetBSD", "FreeBSD", "Mach" (by CMU).
This software includes software developed by the Computer Systems Laboratory at the University of Utah.
This product includes software developed by Computing Services at Carnegie Mellon University (http://www.cmu.edu/computing/).
This product includes software developed by Marshall M. Midden.
This product includes software developed or owned by Caldera International, Inc.
The Institute of Electrical and Electronics Engineers and The Open Group, have given us permission to reprint portions of their documentation.

In the following statement, the phrase ‘‘this text’’ refers to portions of the system documentation.

Portions of this text are reprinted and reproduced in electronic form in NetBSD, from IEEE Std 1003.1, 2004 Edition, Standard for Information Technology -- Portable Operating System Interface (POSIX), The Open Group Base Specifications Issue 6, Copyright (C) 2001-2004 by the Institute of Electrical and Electronics Engineers, Inc and The Open Group. In the event of any discrepancy between these versions and the original IEEE and The Open Group Standard, the original IEEE and The Open Group Standard is the referee document.

The original Standard can be obtained online at http://www.opengroup.org/unix/online.html.

This notice shall appear on any product containing this material

The End