

Installing FreeBSD

Presented by developerWorks, your source for great tutorials

ibm.com/developerWorks

Table of Contents

If you're viewing this document online, you can click any of the topics below to link directly to that section.

1. About this tutorial and FreeBSD	2
2. Installation methods	4
3. Performing the installation	7
4. Post-installation steps	11
5. Resources	13

Section 1. About this tutorial and FreeBSD

Is this tutorial right for me?

This tutorial is for users getting started with FreeBSD for the first time. The tutorial may serve as a refresher for FreeBSD users who want to install the most recent versions. A general knowledge of Unix-like systems is helpful, but not mandatory. You do not need to be a programmer or a network administrator to follow this tutorial, but some of the greatest advantages of FreeBSD itself target programmers and network administrators.

Which FreeBSD version is covered?

This tutorial examines the installation of FreeBSD 4.2 on the i386 platform. While earlier and later versions of FreeBSD are largely similar -- especially from an installation perspective -- some differences may exist between them and the coverage in the tutorial. Likewise, the Alpha platform has a similar installation procedure, but I do not specifically cover it in this tutorial. For the most part, any mentioned URL resources that contain platform- and version-specific information are modifiable in an obvious way to refer to other versions and platforms.

Why FreeBSD?

While this tutorial cannot cover all the strengths, weaknesses, and distinctive qualities of FreeBSD in comparison to other operating systems, a few are worth mentioning here.

- * FreeBSD is **free software**. You can see the source, and you can modify and distribute the source as you see fit.
 - * Many of the highest volume Internet sites use FreeBSD, such as Yahoo, Hotmail, and Apache.org. Large sites choose FreeBSD because of rock-solid stability, scalability, and ultra-efficient TCP/IP stack.
 - * FreeBSD provides layers for compatibility with binary applications for Linux, SCO, NetBSD, and BSDI. In many cases, FreeBSD runs Linux binaries faster than Linux itself! Of course, most applications, especially open source ones, are already available as native FreeBSD binaries.
 - * FreeBSD has a more centralized development model and a more liberal license than Linux. Whether this is good or bad is a matter of taste, but many users prefer this (and some businesses require it).
 - * Largely because of its centralized distribution, FreeBSD has one of the best and most consistent packaging and distribution systems for software of any operating system you can choose.
 - * FreeBSD has a strong focus on security of its code.
 - * FreeBSD supports symmetric multi-processing for intensive tasks.
-

Will FreeBSD run on my machine?

The short answer is "probably yes." FreeBSD has a very broad range of hardware support, and will run fine on older machines that cannot run resource eaters like Windows 2000. The

long answer is that you should take a look at the detailed [Supported Hardware](#) list.

More information on FreeBSD

The best place to get started for additional information about FreeBSD is at the [FreeBSD Web site](#).

Within the FreeBSD Web site, the [Frequently Asked Questions for FreeBSD](#) is a great resource. For a more directed guide to working with FreeBSD, the [FreeBSD Handbook](#) is a valuable read.

If you would like to purchase a book to help you work with (and install) FreeBSD, here is a [list of useful titles](#).

About the author

David Mertz is a writer, a programmer, and a teacher, who always endeavors to improve his communication to readers (and tutorial takers). He welcomes any comments; please direct them to mertz@gnosis.cx.

Section 2. Installation methods

Introduction to installation methods

There are so many different ways to get FreeBSD installed that we will only gloss over some of the less common ones. A good document for additional details on installation methods is [A Step-by-Step Guide to Installing FreeBSD](#).

Installation of FreeBSD is possible from many different installation media, including CD-ROM, floppies, QIC/SCSI tape, and an existing DOS partition. Furthermore, you can install FreeBSD over the Internet, or over a local network, without requiring (much) local media at all, via FTP or NFS. It is also possible to install FreeBSD over a serial or parallel cable to an existing FreeBSD or Linux machine. Of all these methods, however, the most important are FTP over the Internet, and local CD-ROM installation. Those are the focus of this tutorial, and I expect these to be the most suitable for the majority of tutorial takers.

Making the boot floppies

If you have **both** a bootable CD-ROM **and** a CD-ROM version of FreeBSD, you can skip this step. In all other cases, the first thing to do in installing FreeBSD is to create boot floppies for the installation (they will give you installation options later). Obtain boot floppies at <ftp://ftp.freebsd.org/pub/FreeBSD/releases/i386/4.2-RELEASE/floppies/>. Find detailed instructions on how to create the boot floppies from downloaded floppy images at <ftp://ftp.freebsd.org/pub/FreeBSD/releases/i386/4.2-RELEASE/floppies/README.TXT>.

Most users will need to download the floppy images `kern.flp` and `mfsroot.flp` (matching the version and platform you are installing). From a DOS machine (or one capable of running DOS programs, such as Windows 95, WinNT, OS/2, or Linux with dosemu), the first thing to do is obtain the utility <http://ftp.iteso.mx/FreeBSD/tools/fdimage.exe>. Once you have `fdimage.exe`, creating the boot floppies will consist of the following steps:

```
C:\freebsd> fdimage kern.flp a:  
C:\freebsd> fdimage mfsroot.flp a:
```

Make sure to change floppies between these two commands, and have freshly formatted blank floppies available. From Linux, you can probably use the commands:

```
% dd if=./kern.flp of=/dev/floppy  
% dd if=./mfsroot.flp of=/dev/floppy
```

In practice, any of the numerous utilities available for loading floppy images will probably work also.

Booting from the boot floppies

After creating the boot floppies in the last panel, label them "FreeBSD Kernel" and "FreeBSD MFS Boot Disk" (or if you like, "Disk One" and "Disk Two" are fine names). The main thing to remember is to boot the kernel disk first, then insert the MFS disk when requested (if you happen to have a 2.88 MB bootable floppy, you can choose the single installation disk; most

people do not have this). The kernel disk will display a few messages about memory and system detected, then prompt you for the MFS disk. The MFS disk will load the interactive installation system (more in the next section).

Modern PC BIOSs usually have a variety of options about boot sequence. Various selections of boot orders among the floppy, IDE hard-disk, CD-ROM, and SCSI devices are usually configurable in BIOS. The details of how you choose this, and what options exist, differ between machines. The common AWARD and PHOENIX BIOSs usually get at the BIOS configuration by pressing DEL during the boot sequence; other systems might use a different key or special utility. In any case, you want to make sure to configure your system to boot from floppies at the top of the boot order, if you do not already have this configuration.

Installing over the Internet

If you have an Ethernet card on your computer, and access to the Internet, this form of installation is probably the easiest. (In fact, I was so impressed the first time I did it, that I ran around boasting about it to anyone who would listen.)

Basically, all there is to it is booting from the boot floppies you created in an earlier panel, then selecting "FTP" as the installation media within the interactive installation. Before you get around to selecting your installation media, however, you will make several other selections that I will lead you through. Just keep this in mind as you install.

You will need to have a local LAN, a DSL or Cable connection that provides an Ethernet interface, or as a fallback, a modem that can connect to a PPP server.

Installing from CD-ROM

A CD-ROM-based installation requires a FreeBSD CD. There are two basic ways to obtain one: buy one, or make your own. If you purchase one, you can help support the FreeBSD development effort and get an attractive packaging of factory-made CDs. If you want to do that, contact:

BSDi
4041 Pike Lane, Suite F
Concord, CA 94520 USA
Phone: +1 925 691-2800
Fax: +1 925 674-0821
Email <info@osd.bsdi.com>
WWW: <http://www.osd.bsdi.com/>

The CD costs \$40 for a single copy, but only \$25 if you subscribe for updates upon their release (you can cancel your subscription whenever you want).

It is not hard to make your own CD if you have a CD-R device. Obtain ISO images of the FreeBSD CDs from <ftp://ftp.freebsd.org/pub/FreeBSD/releases/i386/ISO-IMAGES/>. Consult your software documentation for burning CD-Rs from ISO images in your environment. It is simple in most software.

Installing from a DOS partition

To install from a DOS partition, you will need to copy distribution files to your DOS drive. This needs to be an actual FAT drive, not FAT32. You might want to do this if you are unable to install over a network and you also do not have a distribution media like a CD-ROM that you can read from the FreeBSD installer (and you do not want to create a **huge** stack of floppies).

First, create a directory such as `C:\FreeBSD`. Underneath this, create distribution directories to hold the files from which to install. Absolutely essential is the `.\bin` directory; obtain the contents from <ftp://ftp.freebsd.org/pub/FreeBSD/releases/i386/4.2-RELEASE/bin/> . You may also want to create directories for `dict`, `des`, `doc`, `games`, `info`, `manpages`, `proflibs`, and `src`, depending on how much room you have on your DOS partition. Obtain the contents of these directories at the ftp location named by changing the last bit of the path given above, or by navigating under <ftp://ftp.freebsd.org/pub/FreeBSD/releases/i386/4.2-RELEASE/> .

Section 3. Performing the installation

Introduction to the installer

The FreeBSD installer is a friendly, interactive tool. In fact, the installer does quite a bit on top of installing FreeBSD: it lets you update packages after installation, allows you to configure parts of FreeBSD, performs system upgrades, and provides interactive help on a variety of FreeBSD. If you should need to run the installer after this install, just type the following in a root shell:

```
% /stand/sysinstall
```

This tutorial presents installation options in the order you encounter them for a standard install. If you have two computers available, or if you print this tutorial, this tutorial will walk you through the installation.

Kernel configuration

The first option during installation is the configuration of the FreeBSD kernel (that will run underneath the installer). Beginners almost surely want to select: "Skip Kernel Configuration." The defaults are good and will recognize almost all hardware. If everything else fails, however, you can attempt customizing the kernel at this point.

Select the standard installation

Once you jump into the installer proper (right after kernel configuration), you have a number of options. Selection of options is performed with a familiar keyboard-only "bouncing highlight" menu (options are listed, with one highlighted; arrow keys move between options, and many show a hotkey). The program calls most of these either automatically later in the installation, or reserves them for post-installation. The "Usage" and "Doc" menu options might be worth looking at, however. In general, though, just select the "Standard" installation option at this point: The "Express" option does not provide enough control of installation, most of the time; the "Custom" option is really best left for experts.

Setting up partitions: general

One thing you need to decide when installing FreeBSD is how to partition your hard disk. Many users will have other operating systems on their FreeBSD machine, and will want to select between them at boot time. FreeBSD can live nicely with other operating systems, but there are a few things to be aware of.

FreeBSD has a somewhat different concept of partitioning than do most operating systems on PCs. From the point-of-view of most other operating systems (Win95/98/ME, WinNT/2000, Linux, OS/2), FreeBSD occupies just a single partition. Furthermore, it must be a **primary** partition, not a logical drive in an extended partition (as many operating systems are happy with). This single primary partition will host multiple **slices**, usually one for swap space, and several others for different mounted paths (root, /tmp, /proc, and /usr

usually). The FreeBSD scheme is somewhat of a limitation for multi-boot systems insofar as it demands a primary partition, but it is nicely behaved insofar as it can divide up this single partition as it needs for its own purposes.

Setting up partitions: FDISK (partitions)

As described in the last panel, you will need to have a primary partition available for FreeBSD. If you have a modern hard disk, it is a good idea to allocate at least a GB for FreeBSD, to leave room for packages and ports you might want to install. On a legacy system, however, FreeBSD can get by with much less (about 80 MB seems like a minimal system requirement).

Once you have chosen the "Standard" installation option, you come into FreeBSD's fullscreen FDISK program. This program provides you with a key for options (each selected by a letter), and a highlight bar for selecting existing partitions. If you wish, you can choose "A" to use the entire disk. In many cases, you will want to locate some free space or an existing primary partition, and then choose "C" to create a slice (partition). If you are using an existing partition, I find it safest to delete the existing partition before creating the FreeBSD one, even if they will occupy the same space (although you do have an option of simply changing the "T"ype of an existing partition). FreeBSD partitions have type 165, which is the presented default when you create a new partition/slice.

Press "Q" when you have created a primary partition for FreeBSD (we'll get to slices soon).

Setting up partitions: boot manager

Once you have created a FreeBSD partition, you have three choices for booting FreeBSD:

1. BootMgr
2. Standard
3. None

`BootMgr` is FreeBSD's standard boot manager. It allows you to boot among multiple operating systems by pressing a function key during boot time. The interface is rather simple, and configuration is limited, but the functionality is good. You can use this to boot to most any operating system.

The only time you will want to choose `Standard` is if you are using your entire disk for FreeBSD. If you have other operating systems, or think you might add them in the future, do not choose this option. If you are using FreeBSD as the only operating system, this option jumps straight into booting FreeBSD upon starting the machine or rebooting.

Users of other operating systems will probably select `None`. In order to boot to FreeBSD in this case, you will need to configure your other boot manager to give an option for the FreeBSD partition, but this is usually easy enough. Many boot managers present attractive interfaces and a range of configuration options. I have used FreeBSD with GRUB, BeOS BootMan, IBM OS/2 Boot Manager, System Commander, and LILO, all with good results. Other boot managers will probably work also; it is just a matter of pointing to the right primary partition for FreeBSD.

Setting up partitions: Disklabel Editor (slices)

You will recall that FreeBSD uses its partition for several "slices." The next step in the FreeBSD installation is to set up these slices using the "Disklabel Editor." This tool looks very similar to FreeBSD FDISK, but it does its work solely within the FreeBSD partition (you can select which one if several exist).

I recommend a slightly counterintuitive procedure for allocating slices, but I have had the best luck with this, and some bad luck with the most obvious approach. First thing, press "A" for "Auto Defaults for all!" This option seems to allocate about 50 MB to root ("/"), twice memory for swap, 20 MB for /var, and the rest for /usr. I am not certain of the exact algorithm in use, but this is about right.

Most of the defaults are fine, but I have found it very easy to fill up /tmp, which under the default lives in the small 50 MB root slice. It just seems a lot safer to leave more generous space for /tmp (unless you are installing to a system where disk space is extremely tight). Therefore, the next thing to do is the following:

1. "D"elete the /usr slice.
2. "C"reate a new filesystem (slice) in the available space (aim for the greater of 50 MB and 10% of the size of /usr, if possible). Mount this new slice as /tmp.
3. "C"reate a new filesystem (slice) in the remaining available space. Mount this new slice as /usr.

Press "Q" when you have completed these steps to move on to the next part of the installation.

Select a distribution

You can fine-tune exactly which FreeBSD component you wish to install, if you want; however, to make things easier, FreeBSD provides a list of "canned" distributions that consist of likely collections of software. I find the "X-Window User" is a nice starting point (you can always install more later), but the descriptions provided in the installation screen give you further information on your options. The "Custom" distribution lets you select exactly what you want, but at the cost of a little more work during installation time.

After choosing a distribution, you are presented with a few extra questions. One is whether to install the ports collection. This costs about 70 MB (as the installation screen tells you). I recommend installing this unless you are very tight on disk space. Having this makes upgrading and enhancing your system much easier.

Assuming you are installing the X-Window system, you will have a few more options. Unless you are very worried about space, I recommend selecting all the "Basic" components and all the "Fonts," but only the "Server" that you need (the selection by default is probably correct, but if you see your graphics chipset unchecked, go ahead and select it).

Select your installation method

Now that you have set up your FreeBSD filesystems, you can get to the system installation itself. At this point, you are given nine options for the installation media. Pick whichever one you decided upon in the "Installation methods" section of this tutorial. Most users will use CD-ROM or FTP media.

If you have chosen the FTP option, you are presented with a list of FTP sites. Usually the FreeBSD default site is a good choice. Then you are asked for network interface information. It is possible here to use a modem, and configure a dialed PPP connection. It is also possible to use a direct serial (SLIP) or parallel (PLIP) connection to another machine. But the best option -- if you can use it -- is to select an Ethernet card. FreeBSD does a good job of auto-detecting most cards. Assuming you select an Ethernet card, you can use IPv6 or DHCP to configure most of your settings (otherwise, find out your DNS, netmask, IP address, domain, and gateway from your local LAN administrator).

If you choose to install from an existing DOS partition, you will need to specify the exact path to it, including the name of the partition (watch the names when you use FDISK; FreeBSD names partitions a bit differently than Linux).

Once you select an installation media, the installation begins. Just sit back and let it do its thing (it might take a while over a slower connection, perhaps several hours; local media are much faster, of course).

Wrapping up

Near the end, you have a few more choices. You can configure the console a bit: keyboard settings, screen font, screen saver, and a few other things. Change the defaults if you wish, but they should be fine for most people. You are also asked a few questions about time zone, security level, NFS client and/or server. These are all generally yes/no questions, and you should just use your best judgment (you can change things later if needed). I **do** recommend installing the Linux compatibility layer at this point. You might never use it since most programs have native packages, but if you have a little room, it cannot hurt to have it installed.

Upon complete installation of the basic system, you have a choice of installing applications from the ports collection. I would recommend skipping this for now (you can spend a long time going through all of the thousands of applications available, and checking/unchecking every one). You can always go back to it; now is a good time to make sure you have a working system.

Just reboot, select a boot option if you use a boot manager, and start having fun with FreeBSD.

Section 4. Post-installation steps

Adding packages

Our friend, the system installer, provides the easiest way of adding additional packages after initial installation. The `pkg_add` command-line utility serves a similar purpose, but, at least initially, it is easier to work with the installer. To launch it, simply run:

```
mybox# /stand/sysinstall
```

First select "Configure," then select "Packages." At this point, you are prompted for installation media. In most cases, you will continue to use the same media type you did for the initial installation. If you are using FTP media, it might take a few minutes to retrieve the most current package lists.

The package lists are organized logically in several hierarchical levels. This allows you to browse for applications of a particular type, even if you do not know the name of a specific tool. If you choose the "All" category, you will get an alphabetical list of all the available packages (and you can jump to a first letter by pressing it).

The great thing about FreeBSD packages is that they resolve all of their dependencies without you having to do additional work. Just choose what you want and the FreeBSD package system will figure out exactly what else you might need to get it working. Navigate your way to the "Install" button once you have selected one or more packages, and you are all set.

Building ports

While packages are probably the quickest way to install software, using ports is not much harder. Ports are source code versions of available software. The directory `/usr/ports/` contains the ports collection (if you installed it). But cleverly, this directory, by default, does not contain all of the source; only a few stub files that allow the retrieval and construction of necessary source code.

Underneath the `/usr/ports/` directory are several levels of subdirectories containing various types of applications. The first thing to do in building an application is to change directories into that of the application you want to build. After that, all you need to do is a `make` / `make install` combo. Everything that you need to build the application will download for you, as if by magic. Let's look at an example (we'll build the text editor 'joe'):

```
mybox# cd /usr/ports/editors/joe
mybox# make > make.results
mybox# make install
```

That's it -- we are ready to run the application.

Miscellaneous configuration

The `/stand/sysinstall` utility is a source of many additional riches. Using the same

"Configure" menu option we used to get at package installation, you can also modify many elements of your system configuration: networking, mouse, console, XFree86, and various other components. It is worthwhile to play around with these menus just to become familiar with what's there.

One configuration option you may want to use at some point is the "Upgrade" menu. Using this, you can upgrade your entire FreeBSD system to the most current release. Use this option with caution, and read the warnings it presents to you. In general, though, this option will reliably and easily upgrade a system.

Section 5. Resources

Downloads mentioned in the tutorial

Downloading distribution files:

<ftp://ftp.freebsd.org/pub/FreeBSD/releases/i386/4.2-RELEASE/>

Downloading ISO images: <ftp://ftp.freebsd.org/pub/FreeBSD/releases/i386/ISO-IMAGES/>

Downloading boot floppies:

<ftp://ftp.freebsd.org/pub/FreeBSD/releases/i386/4.2-RELEASE/floppies/>

Further installation information

Find [FreeBSD installation details](#) for "newbies" by Randy Pratt.

Check out [Installing and Using FreeBSD With Other Operating Systems](#) by Jay Richmond.

Find [Supported Hardware](#) from the FreeBSD Handbook, Chapter 2: Installing FreeBSD.

A helpful resource is [A Step-by-Step Guide to Installing FreeBSD](#).

General FreeBSD information

The FreeBSD Web site is at FreeBSD.org.

Check out the [FreeBSD Handbook](#) that covers the installation and day-to-day use of FreeBSD Release 4.2.

Find many answers and solutions at FreeBSD's [Frequently Asked Questions](#).

[FreeBSD Tutorials](#) offer a list of documents on various aspects of FreeBSD, FreeBSD software, and hardware.

For books, magazines, and articles about FreeBSD, check out the [Free BSD Handbook](#).

For people new to both FreeBSD and Unix, check out the [Introduction](#) by Annelise Anderson.

Find basic instructions on using the [Ports Collection](#) to install or remove programs from your system.

Find the [FreeBSD Booting Process](#) in Chapter 5 of the FreeBSD Handbook.

Your feedback

We look forward to getting your feedback on this tutorial. Additionally, you are welcome to contact the author, David Mertz, at mertz@gnosis.cx.

Colophon

This tutorial was written entirely in XML, using the developerWorks Toot-O-Matic tutorial generator. The Toot-O-Matic tool is a short Java program that uses XSLT stylesheets to convert the XML source into a number of HTML pages, a zip file, JPEG heading graphics, and PDF files. Our ability to generate multiple text and binary formats from a single source file illustrates the power and flexibility of XML.