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Informative article: installation of OpenBSD 3.3.

Goal of the article: this article tries to guide the new user through a successful network installation of OpenBSD 3.3 for the Intel platform (i386).
You don't have to be a UNIX "Wiz" to get started, but it is advised to read through the entire paper before starting…
Good luck!

If you want to go further after the installation, you can get more information on the website of OpenBSD at http://www.openbsd.org.

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1.1 Installation of OpenBSD 3.3.

In this paragraph we are going to install OpenBSD 3.3 (current version since May 1, 2003). Installation procedures will stay (more or less) the same for other (future) versions of OpenBSD. The installation of OpenBSD is completely text-based and it is advised before the installation to read through the platform-specific INSTALL documents in the platform directory (on FTP, CDROM,…) of one of the OpenBSD mirror sites.

We are going to make an installation by downloading the installation packages in real-time over the network.

1.1.1 Supported architectures.

OpenBSD runs on a variety of architectures. Always check the information of the platform to find out what is supported and what is not supported.

- Alpha: DEC Alpha- based machines.
- Hp300: Hewlett-Packard HP300/HP400 machines.
- Hppa: HP PA-RISK based systems (new since 3.3 series).
- I386: the platform that we are going to use during the course, Intel i386 compatibles.
- Mac68k: most MC680x0-based Apple Macintosh models.
- Mvme68k: Motorola MVME147/16x/17x 68K VME cards.
- Macppc: support for Apple based PowerPC systems.
- Sparc: support for Sun Microsystems hardware.
- Sparc64: UltraSPARC systems from SUN.
- Vax: VAX computers (DEC).

1.1.2 Supported installation media.

OpenBSD can be installed from CD-ROM, FTP or a local file system. CD-ROMs are only to purchase from the official OpenBSD website. You will not be able to download any ISO images of a OpenBSD release (in contrast with most Linux distributions that offer you an ISO image from their latest release). If you don't have a screen available on your host, you can also use a serial cable to perform the installation.

1.1.3 Preparing your OpenBSD installation media.

When installing OpenBSD over the network in real-time, you need to prepare your installation media first. You will need to find one floppy disk and a floppy image from one of the OpenBSD mirror sites for this.

Most architectures have multiple floppy images to choose from. There are different floppy images to deal with different hardware variations of a host.

Example: i386 platform floppy images:

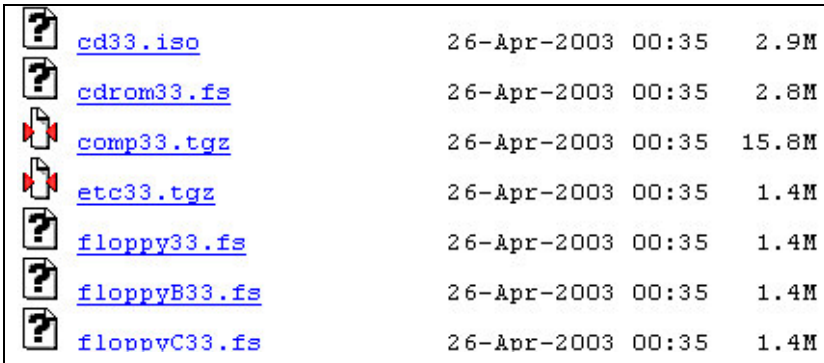


Figure 1 Overview of the required floppy images

- Floppy33.fs:
  - Desktop PC.
  - Support for many PCI and ISA NICs, IDE and SCSI adaptors, limited PCMCIA support.
- FloppyB33.fs:
  - Servers.
  - Support for RAID controllers, some less common SCSI adaptors.
- FloppyC33.fs:
  - Laptops.
  - Support for many PCMCIA and Cardbus devices.
- Cdrom33.fs:
  - Combination of all three boot disks.
  - Can be used to create a 2.88M floppy or to create a boot image for a CD-R.
- Cd33.iso:
  - ISO9660 image.
  - Can be used to create a bootable CD with most popular CDR creation software.

Most Intel compatible users will need the floppy33.fs installation floppy image.

1.1.4 Creating installation floppies on UNIX.

1.1.5 Creating installation floppies on Windows/DOS.

Most common utilities that people are using on the Microsoft platform are: rawrite, fdimage and ntrw. You can find all these tools in the tools directory on any of the ftp mirrors.

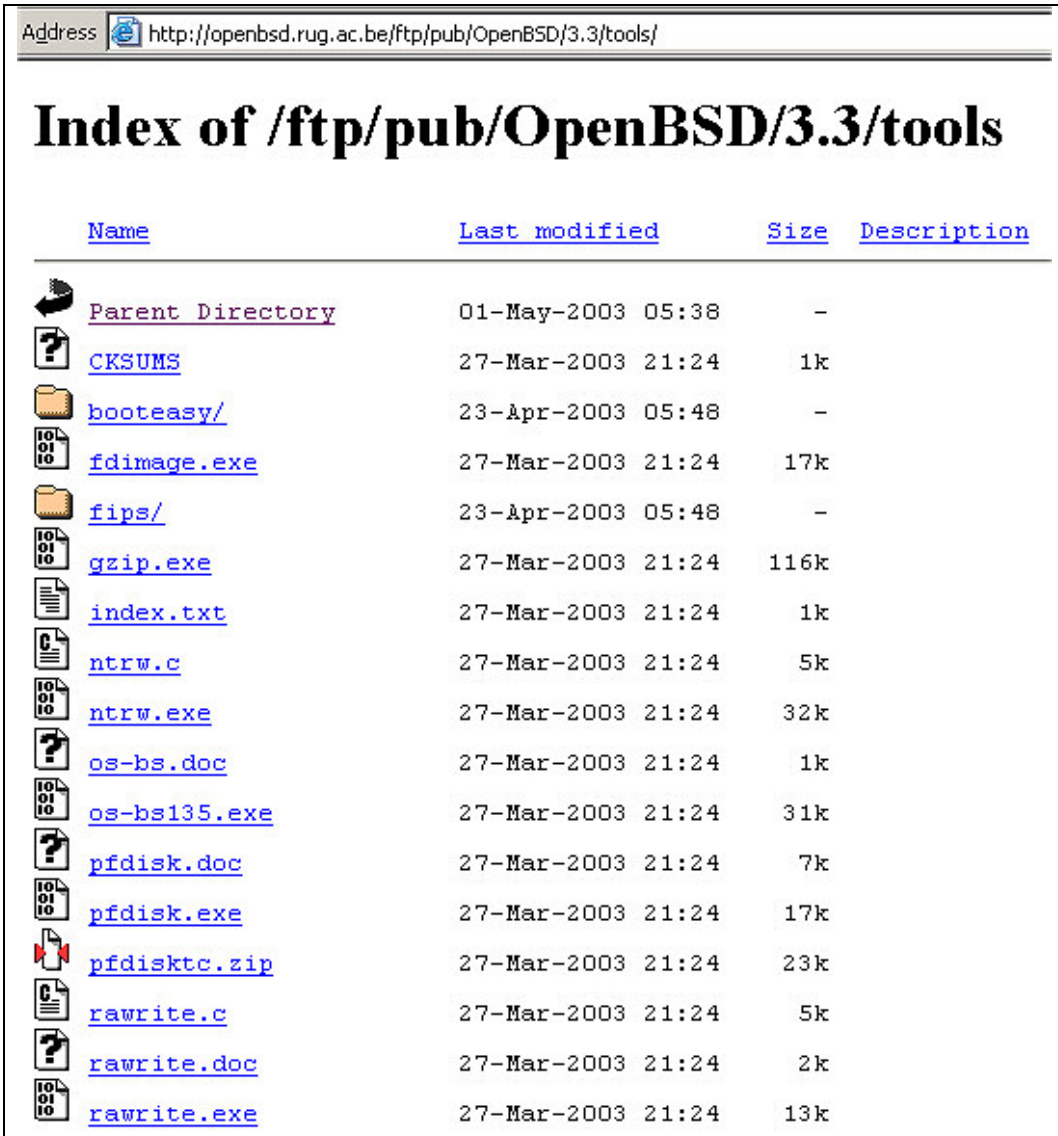


Figure 2: Tools directory on the OpenBSD mirrors

Download ntrw and the required floppy image (floppy33.fs) from the OpenBSD mirror. An example usage of ntrw would be:

```
C:\temp>ntrw floppy33.fs a:
3.5", 1.44MB, 512 bytes/sector
bufsize is 9216
1474560 bytes written
```

Figure 3 writing floppy images with ntrw

1.1.6 Before you start...

Before you start:

- Make sure that your machine is configured to boot from floppy.
- Make sure that you have a Internet access.
- Make sure that you have working backups of your information.

- Make sure that you have networking information for your host close at hand:
  - Machine name.
  - Hardware of the machine:
    - Is it compatible with OpenBSD? Check on the hardware compatibility pages.
    - Hardware compatibility pages: http://www.openbsd.org/i386.html.
  - Partitioning lay-out.
  - Network settings:
    - DHCP?
    - Domain Name.
    - DNS servers.
    - IP addresses and subnet masks for each NIC.
    - Gateway address.
  - Are you going to run X services on the system.
    - Not recommended on bastion hosts.

1.1.7 Starting the installation.

Note: you can always abort the installation at any time and restart the installation process by typing “restart” that the prompt. If you have a lousy disk, you will notice it right away.

When booting your system, you should see something like this:

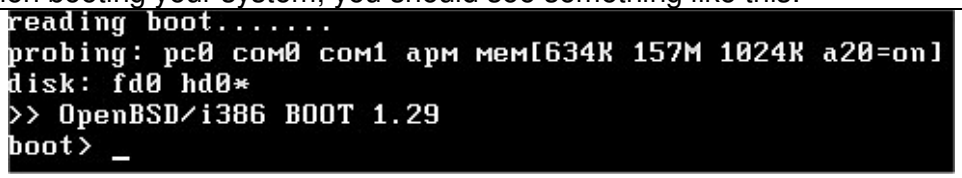


Figure 4 OpenBSD boot prompt.

After this, you will see a lot of messages fly by on the screen (in blue color). This text is the “dmesg”: the kernel tells you what devices have been found and their location. A copy of this text is available in “/var/run/dmesg.boot”. On most architectures you can scroll through it using SHIFT-PGUP/SHIFT-PGDOWN.

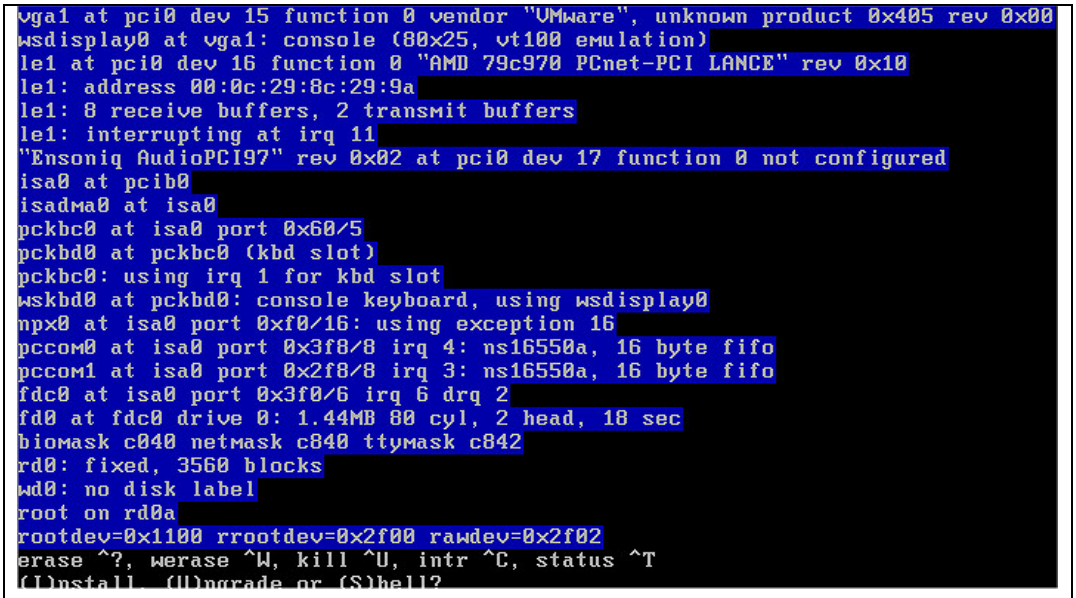


Figure 5 Dmesg on boot.

After the dmesg, you encounter the first message: install, upgrade or shell.

- Install:
  - Install OpenBSD on the system.
- Upgrade:
  - Install a new set of install files on the host but do not overwrite any configuration, user data or additional programs.
  - No disk formatting.
  - Not overwriting /etc or /var.
  - Important note if you want to upgrade: you cannot skip releases; you can only upgrade from 3.2 to 3.3. If you should like to upgrade from an older version, a reinstall would be recommended.
- Shell:
  - Option allows you to do maintenance (repair/recovery) on the system.

To install, we choose the “(I)nstall” option. You will be asked for a terminal type which is by default “vt220” and a keyboard type. If you do not choose another keyboard type, a US keyboard layout (qwerty) will be loaded.

Choose “y” at the keyboard encoding question and choose your type of keyboard: (P)C-AT/XT. After this, you can choose your desired keyboard encoding table. For Belgium, your encoding table would be “be”.

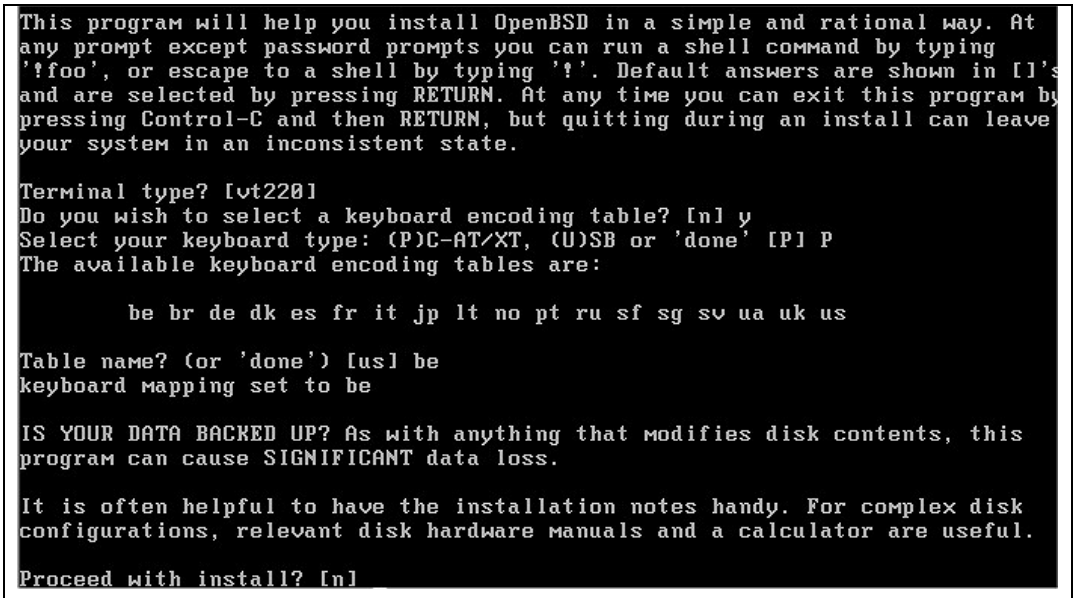


Figure 6 Terminal type and keyboard encoding table.

After the keyboard configuration, the installation program asks you “IS YOUR DATA BACKED UP”, an important question because after this, you will start the installation, overwriting existing files on your system.

1.1.8 Good to know about disks in OpenBSD.

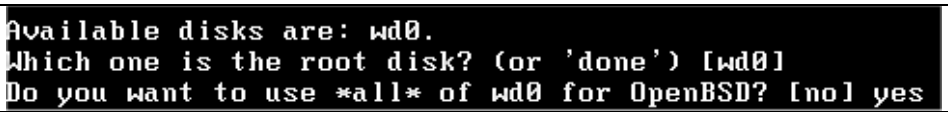
- IDE disks show up wd0, wd1, wd2, …
- SCSI and RAID devices show up as sd0, sd1, sd2, …

1.1.9 Configuring your disk for OpenBSD (i386/macppc).

OpenBSD disk setup is done in two stages:

- Define first a OpenBSD slice of the hard disk, using fdisk(8).
  - This is the operating system partitioning, how multiple operating systems mark their own space on the disk.
  - Visible result to DOS, Windows, another OS.
- Subdivide that OpenBSD slice into OpenBSD partitions using disklabel(8).
  - How is the OpenBSD partition sub-partitioned into individual file systems.
  - Only visible to operating systems that can directly read an OpenBSD filesystem.

In our setup, we are not going to use the entire disk for OpenBSD.
The installation program asks you what to use as the “root disk”. The root disk is the disk that the system will use to boot from and where the swap space resides.



If you choose “yes” on the question if you want to use *all* of wd0 for OpenBSD, than you will have one partition (the size of the entire hard disk) with the OpenBSD partition type.

Note: if you have a Compaq, Dell or equal system that maintains a “maintenance partition”, never choose yes on this question!

1.1.9.1 Using fdisk to create an OpenBSD partition.

Fdisk is the partition maintenance program. When fdisk is started without special flags, it simply prints the MBR partition table of the specified device (wd0).

You can get more information during the installation by issuing “help” at the fdisk prompt. You can get more information by using the “manual” command to see the entire fdisk man page.

```
Offset: 0       Signature: 0xAA55
         Starting       Ending       LBA Info:
 #: id    C   H  S -    C   H  S [       start:      size   ]
------------------------------------------------------------------------
 0: 00    0   0  0 -    0   0  0 [           0:           0 ] unused
 1: 00    0   0  0 -    0   0  0 [           0:           0 ] unused
 2: 00    0   0  0 -    0   0  0 [           0:           0 ] unused
*3: A6    0   1  1 -  519 127 63 [          63:     4193217 ] OpenBSD
Enter 'help' for information
fdisk: 1> help
        help            Command help list
        manual          Show entire OpenBSD man page for fdisk
        reinit          Re-initialize loaded MBR (to defaults)
        setpid          Set the identifier of a given table entry
        disk            Edit current drive stats
        edit            Edit given table entry
        flag            Flag given table entry as bootable
        update          Update machine code in loaded MBR
        select          Select extended partition table entry MBR
        print           Print loaded MBR partition table
        write           Write loaded MBR to disk
        exit            Exit edit of current MBR, without saving changes
        quit            Quit edit of current MBR, saving current changes
        abort           Abort program without saving current changes
fdisk: 1> _
```

Figure 7 Fdisk program.

- Reinit:
  - Clears the existing partition table and creates one big OpenBSD partition and flags it active.
  - Equals saying “yes” to the use all question.
- Print:
  - Show the current partition table in sectors.
    - “Print m” shows the partition in megabytes.
    - “Print g” shows the partition table in gigabytes.
- Edit:
  - Edit the table entries.
- Flag:

    - Marks the active partition (the partition that will be used to boot from).
- Exit/Quit:
    - Be careful with these commands, they do not have the same meaning!
    - Exit: stop editing the MBR and do not save changes.
    - Quit: stop editing the MBR and save current changes.

```
fdisk: 1> print m
Disk: wd0       geometry: 520/128/63 [2048 Megabytes]
Offset: 0       Signature: 0xAA55
         Starting       Ending       LBA Info:
 #: id    C   H  S -    C   H  S [       start:      size   ]
-------------------------------------------------------------------------
 0: 00    0   0  0 -    0   0  0 [           0:           0M] unused
 1: 00    0   0  0 -    0   0  0 [           0:           0M] unused
 2: 00    0   0  0 -    0   0  0 [           0:           0M] unused
*3: A6    0   1  1 -  519 127 63 [          63:        2047M] OpenBSD
```

Figure 8 Print partition layout in megabytes.

Interpreting the results:

- #:
    - Number of the partition table entry.
    - “*” indicates a bootable partition.
- Id:
    - System identifier number.
    - OpenBSD reserves the number 166 (0xA6) for its partition identification.
- Cyl/hd/sec:
    - Provide the starting and the ending address of the partition in BIOS geometry.
- Start/size:
    - Provide the starting sector and size in sectors of the partition.

The following will delete the (default) reserved OpenBSD partition from an empty disk: edit 4 (edit the fourth partition), 0 (to disable it). All partitions become unused.

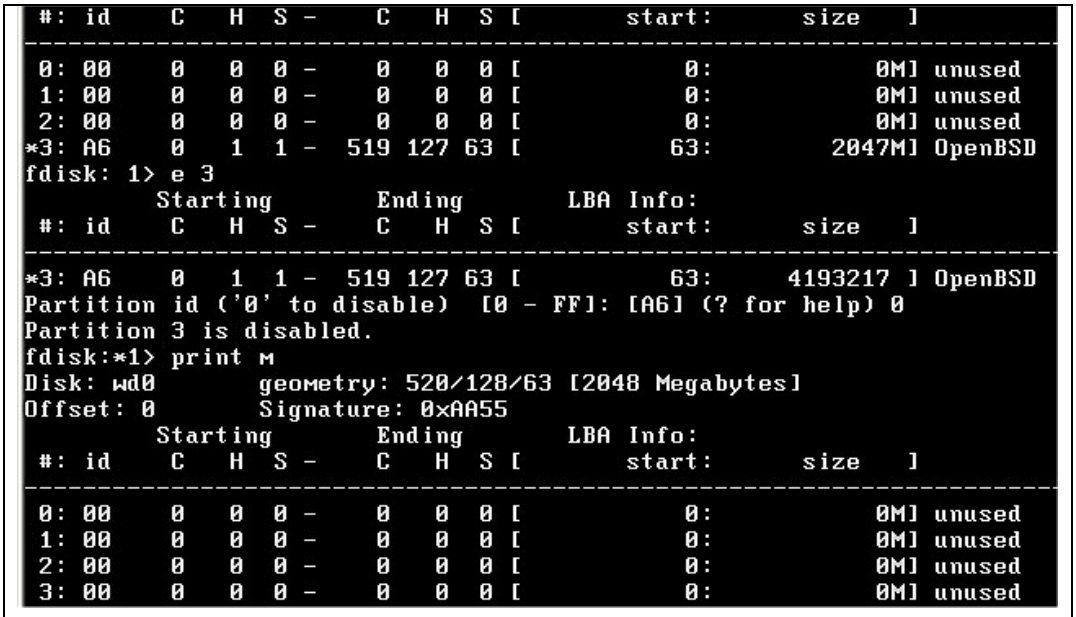


Figure 9 Removing a partition.

Create a new OpenBSD partition to make the installation on. For instance, use the second partition to make an OpenBSD partition out of it using “edit 1” or “e 1”.

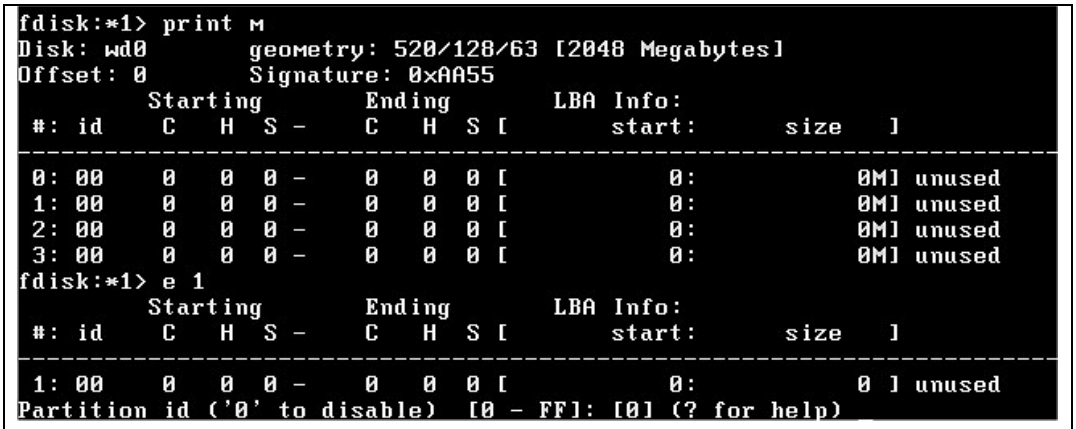


Figure 10 Editing the first partition.

After this, the fdisk program asks you the partition id (or 0 to disable the partition). You can get a listing of known partition id’s by issuing “?” at the fdisk prompt. As you already know, for OpenBSD, you will need the “A6” (OpenBSD) type.

```
Choose from the following Partition id values:
00 unused          1C Thinkpad Rec    65 Netware 3.xx    A8 MacOS X
01 DOS FAT-12      20 Willowsoft      66 Netware 386     A9 NetBSD
02 XENIX /         24 NEC DOS         67 Novell          AB MacOS X boot
03 XENIX /usr      38 Theos           68 Novell          B7 BSDI filesy*
04 DOS FAT-16      39 Plan 9          69 Novell          B8 BSDI swap
05 Extended DOS    40 VENIX 286       70 DiskSecure      C0 CTOS
06 DOS > 32MB      41 Lin/Minux DR    75 PCIX            C1 DRDOSs FAT12
07 HPFS/QNX/AUX    42 LinuxSwap DR    80 Minix (old)     C4 DRDOSs < 32M
08 AIX fs          43 Linux DR        81 Minix (new)     C6 DRDOSs >=32M
09 AIX/Coherent    4D QNX 4.2 Pri     82 Linux swap      C7 HPFS Disbled
0A OS/2 Bootmgr    4E QNX 4.2 Sec     83 Linux files*    DB CPM/C.DOS/C*
0B Win95 FAT-32    4F QNX 4.2 Ter     84 OS/2 hidden     DE Dell Maint
0C Win95 FAT32L    50 DM              85 Linux ext.      E1 SpeedStor
0E DOS FAT-16      51 DM              86 NT FAT VS       E3 SpeedStor
0F Extended LBA    52 CP/M or SysV    87 NTFS VS         E4 SpeedStor
10 OPUS            53 DM              93 Amoeba FS       EB BeOS/i386
11 OS/2 hidden     54 Ontrack         94 Amoeba BBT      F1 SpeedStor
12 Compaq Diag.    55 EZ-Drive        99 Mylex           F2 DOS 3.3+ Sec
14 OS/2 hidden     56 Golden Bow      9F BSDI            F4 SpeedStor
16 OS/2 hidden     5C Priam           A0 NotebookSave    FF Xenix BBT
17 OS/2 hidden     61 SpeedStor       A5 FreeBSD
18 AST swap        63 ISC, HURD, *    A6 OpenBSD
19 Willowtech      64 Netware 2.xx    A7 NEXTSTEP
Partition id ('0' to disable)  [0 - FF]: [0] (? for help) _
```

Figure 11 Partition IDs.

After having chosen the partition id, they ask you if you want to edit in “CHS mode”. The default answer is no; specify otherwise if you want to play around with these values. If you do not choose to use the “CHS mode”, you can enter the size of the desired partitions in megabytes or gigabytes…
Also mark this partition as bootable by using the “flag” option (“flag 1”). The partition is marked to be bootable, indicated by a “*”.

```
Partition id ('0' to disable)  [0 - FF]: [0] (? for help) A6
Do you wish to edit in CHS mode? [n]
offset: [0]
size: [0] 2g
fdisk:*1> print m
Disk: wd0       geometry: 520/128/63 [2048 Megabytes]
Offset: 0       Signature: 0xAA55
         Starting        Ending        LBA Info:
 #: id    C   H  S -    C   H  S [       start:      size   ]
------------------------------------------------------------------------
 0: 00    0   0  0 -    0   0  0 [           0:         0M] unused
 1: A6    0   0  1 -  520  16 16 [           0:      2048M] OpenBSD
 2: 00    0   0  0 -    0   0  0 [           0:         0M] unused
 3: 00    0   0  0 -    0   0  0 [           0:         0M] unused
fdisk:*1>
```

Figure 12 Creating a second partition of two gig.

When you have your desired partition layout, save the changes by issuing “quit”.

```
fdisk:*1> flag 1
Partition 1 marked active.
```

Figure 13 Mark a partition to be active

1.1.9.2Using Disklabel to create OpenBSD sub-partitions.

The moment that you have chosen to save the changes using “quit”, disklabel will start and show on your screen. Here, you are going to specify how OpenBSD splits up the MBR partition into OpenBSD partitions in which the needed filesystems and swap space are created.

```
You will now create an OpenBSD disklabel inside the OpenBSD MBR
partition. The disklabel defines how OpenBSD splits up the MBR partition
into OpenBSD partitions in which filesystems and swap space are created.

The offsets used in the disklabel are ABSOLUTE, i.e. relative to the
start of the disk, NOT the start of the OpenBSD MBR partition.

disklabel: no disk label
WARNING: Disk wd0 has no label. You will be creating a new one.

# using MBR partition 1: type A6 off 0 (0x0) size 4194304 (0x400000)

Treating sectors 0-4194304 as the OpenBSD portion of the disk.
You can use the 'b' command to change this.

Initial label editor (enter '?' for help at any prompt)
>
```

Figure 14 Initial disk label.

First, discover the possible options you have with disklabel. For this, issue “?” at the disklabel prompt. You can also ask for the entire man page on disklabel, issue “M” for this at the disklabel prompt.
You can have an overview of your partitions by entering “print m” (show partitions in megabytes).

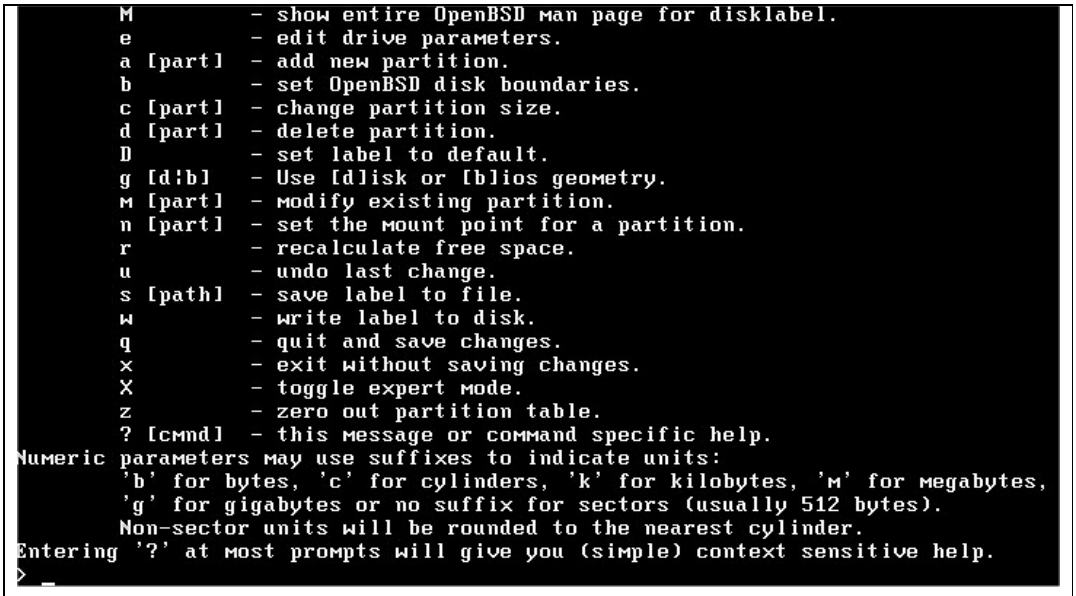


Figure 15 Several disklabel options.

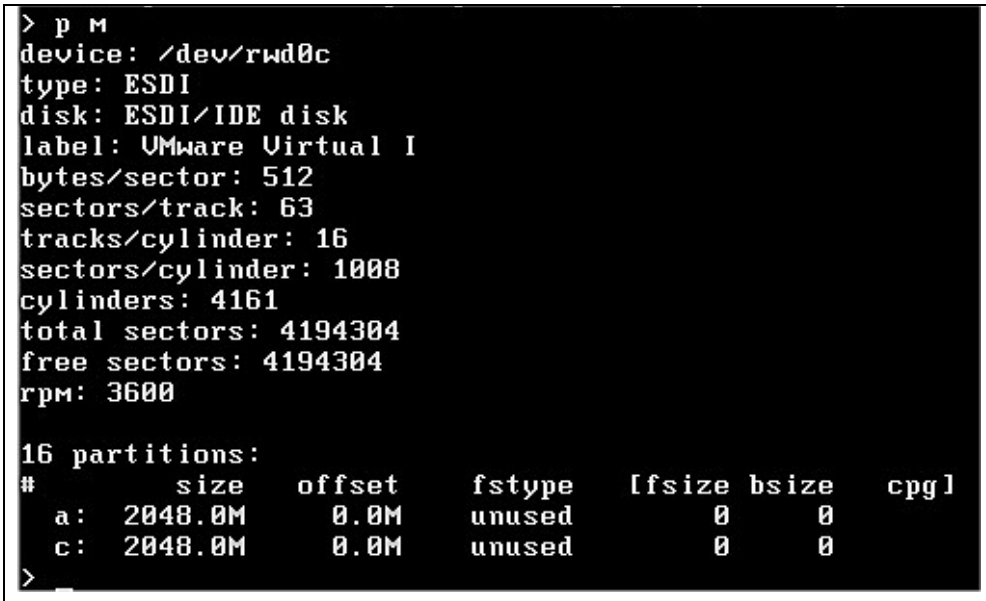


Figure 16 print m command results.

Important:

- On the root disk (wd0), there need to be two partitions “a” and “b”. Your installation process will not continue without them.
- “a” will be used for the root filesystem (“/”).
- “b” will be used as a swap space.

1.1.9.2.1 Recommended OpenBSD sub-partitions.

For good (more secure) installations of OpenBSD it is recommended to use several subpartitions. An example:

- Wd0a:

    - / (root).
    - 150M.
- Wd0b:
    - Needs to be the swap partition.
    - 300M.
- Wd0d:
    - /tmp (used for building software and other temporal things).
    - 120M.
- Wd0e:
    - /var partition.
    - 80M (if it is a web or a mail server, this will need to be larger. Also when you are building a web server, remember that your apache installation will be chrooted by default!).
- Wd0g:
    - /usr.
    - 2G. Normally this partition needs to be large to allow user applications and space to be able to update and rebuild the system. Also note that when using the "ports tree" you will need an additional 100M.
- Wd0h:
    - /home.
    - Depends on your need.

For our installation (for new users), we are going to make one root ("/") partition and one swap partition.

1.1.9.2.2 Creating the OpenBSD sub-partitions.

We need to create one partition "a" (root) and one partition "b" (swap partition).
Adding partitions is done using the "a" directive, deleting by the "d" directive.

```
16 partitions:
#        size   offset    fstype   [fsize bsize   cpg]
  a:  2048.0M     0.0M    unused        0     0
  c:  2048.0M     0.0M    unused        0     0
> d a
> a a
offset: [0]
size: [4194304] 1.5G
Rounding to nearest cylinder: 3145968
FS type: [4.2BSD]
Mount point: [none] /
> a b
offset: [3145968]
size: [1048336]
FS type: [swap]
> p_
```

Figure 17 Adding a root and a swap partition.

Verify the results using "print m". Use "quit" to stop and to save the changes.

```
16 partitions:
#        size    offset    fstype   [fsize bsize   cpg]
  a:   1536.1M      0.0M    4.2BSD     1024  8192    16  # /
  b:    511.9M   1536.1M      swap
  c:   2048.0M      0.0M    unused        0     0
```

Figure 18 Verifying the partitions with "print m".

Save the changes and confirm. Your hard drive will be partitioned with the desired layout.

```
> q
Write new label?: [y] y
The root filesystem will be mounted on wd0a.
wd0b will be used for swap space.
Done - no available disks found.

You have configured the following partitions and mount points:

wd0a /

The next step creates a filesystem on each partition, ERASING existing data.
Are you really sure that you're ready to proceed? [n] y
/dev/rwd0a:     3145968 sectors in 3121 cylinders of 16 tracks, 63 sectors
        1536.1MB in 196 cyl groups (16 c/g, 7.88MB/g, 1920 i/g)
```

Figure 19 Confirming the partitioning.

1.1.10 Host and network configuration.

During this part of the installation, you will need to give the installation program more information on your host and its network. You will also need to give a root password (and to confirm this) to the installation program. Remember: password is case sensitive. Also use a good password: uppercase, lowercase, numbers, special characters, …

```
System hostname? (short form, e.g. 'foo') woxbat
Configure the network? [y] y
Available interfaces are: le1.
Which one do you wish to initialize? (or 'done') [le1]
Symbolic (host) name for le1? [woxbat]
IP address for le1? (or 'dhcp') 10.0.18.44
Netmask? [255.255.255.0] 255.255.252.0
Done - no available interfaces found.
DNS domain name? (e.g. 'bar.com') [my.domain] thti.telindus.be
DNS nameserver? (IP address or 'none') [none] 10.0.16.33
Use the nameserver now? [y] y
Default route? (IP address, 'dhcp' or 'none') 10.0.16.1
add net default: gateway 10.0.16.1
Edit hosts with ed? [n]
```

Figure 20 Host and network configuration.

1.1.11 Configuring the installation media.

You will need to specify your installation media. The options you have are: ftp, nfs or http when installing over the network. In our case, we are going to use

ftp. Tell the installation program also if you are using a http or ftp proxy server (when needed).
If you have not yet chosen one of the ftp mirrors, you have a chance here to show all the potential ftp servers that are serving OpenBSD to the world.

You can use either the server list or specify your own mirror. Example: for an ftp installation, we could use openbsd.rug.ac.be (Belgian ftp mirror). The default server directory will be “pub/OpenBSD/3.3/i386” with an anonymous logon.

1.1.12 Installing the required filesets.

After you have configured your network and your installation media, you need to specify which packages that you need for your system.
By default, all non-X packages are selected (bsd, base33, etc33, misc33, comp33, man33, game33). The minimal package set to run OpenBSD would be base33, etc33 and bsd. If you want to install them all, you can use “all”, you an add or remove packages using “+” or “-“. At the moment when you confirm (“done”), your packages will be installed from the chosen ftp server.

Example: removing the games fileset: “-game33.tgz”.
Example: adding all x filesets: “+ x*”

- Bsd:
  - Contains the kernel.
  - Required.
- Bsd.rd:
  - RAM disk kernel (not required).
- Base33.tgz:
  - Contains the base OpenBSD system.
  - Required.
- Etc33.tgz:
  - Contains all /etc files.
  - Required.
- Comp33.tgz:
  - Contains compiler, tools, libraries.
  - Recommended.
- Man33.tgz:
  - Contains man pages.
  - Recommended.
- Misc33.tgz:
  - Contains miscellaneous information.
- Game33.tgz:
  - Contains the games for OpenBSD.
- Xbase33.tgz:
  - Contains the base install for X11.
- Xfont33.tgz:
  - Contains the X11’s font server and fonts.
- Xserv33.tgz:

    - Contains X11's servers.
- Xshare33.tgz:
    - Contains man pages, local settings, includes, … for X.

1.1.12.1 Why using separated file systems?

Why would you use separated file systems? There are some reasons why you would like to choose for multiple file systems and not only one main root system and one swap system

- Security:
    - You can mark file systems as readonly, nodev, nosuid, noexec,…
- Stability:
    - Users or misbehaving programs might fill up a filesystem with garbage if they have write permission to it. Your critical programs, running on different file systems, do not get interrupted.
- Speed:
    - File systems that are written to frequently may get somewhat fragmented.
    - The OpenBSD file system is not prone to heavy fragmentation.
- Integrity:
    - If one file system is corrupted for some reason, the other file systems might still be ok.
- Size:
    - Many platforms have limitations on the area of a disk where the boot ROM can load the kernel from (504M on 486's, 8G on i386). As the kernel can end up anywhere in this root partition, the entire root partition should be within this area.

1.1.13 Finishing the installation.

One of the final tasks you need to do is to set the time zone. For Belgium it will be Europe/Brussels. After that, you will need to issue the command "halt" and reboot the system.