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MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY,  
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PRACTICALS OF  
**Operating Systems Designing Concepts**

Prepared by:-

SUBMITTED TO: Dr Tariq Jamil Saifullah Khanzada

## Lab 1: Installing and Configuring Operating System MINIX Through Vmware and other methods

### ○ **References:**

The material in this lab is taken from [www.osnews.com](http://www.osnews.com) and Minix3's official website [www.minix3.org](http://www.minix3.org).

The names of respective authors for each section have been mentioned.

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### ○ **Documentation**

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### ○ **Introduction to MINIX 3**

How often have you rebooted your TV set in the past year? Probably a lot less than you have rebooted your computer. Of course there are many "reasons" for this, but increasingly, nontechnical users don't want to hear them. They just want their computer to work perfectly all the time and never crash. MINIX 3 is a project to develop an operating system as reliable as a TV set, for embedded systems and mission critical applications, but also for future \$50 single-chip laptops and general desktop use. The focus is being small, simple, and reliable.

### **History**

MINIX 3 has a bright future but somewhat checkered past. The first version, MINIX 1, was released in 1987 and was the first UNIX clone with all the source code available. It developed rapidly and soon had its own USENET newsgroup (comp.os.minix), with 40,000 subscribers within 3 months, a large number at a time when the Internet was only available to university researchers and students. One of the early MINIX adopters was a Finnish student named Linus Torvalds, who went out and bought a PC just to run MINIX, studied it very carefully, and then decided to write his own operating system, inspired by MINIX. Although Linus knew MINIX very well, he didn't steal any code from it, as some people have alleged. Linus system grew into the modern Linux system. MINIX' author, Andrew Tanenbaum and Torvalds have had some fairly public discussions on operating system design, originally in 1992 and most recently in 2006.



### **Rebirth**

Although MINIX was (and still is) widely used for teaching operating systems courses at universities, it got a new impetus in 2005 when Tanenbaum assembled a new

team of people to completely redo it as a highly reliable system. MINIX 3 has some history with MINIX 1 and MINIX 2 (released in 1997 as a POSIX-conformant OS), but it is really a new system (analogous to the relationship between Windows XP and Windows 3.1).

Various studies have shown that software broadly contains something like 6-16 bugs per 1000 lines of code and that device drivers have 3-7 times as many bugs as the rest of the operating system. When combined with the fact that 70% of a typical operating system consists of device drivers, it is clear that device drivers are a big source of trouble. For Windows XP, 85% of the crashes are do to bugs in device drivers. Obviously, to make OSes reliable, something has to be done to deal with buggy device drivers. Building a reliable system despite the inevitable bugs in device drivers was the original driving force behind MINIX 3.

## Design

The approach that MINIX 3 uses to achieve high reliability is fault isolation. In particular, unlike traditional OSes, where all the code is linked into a single huge binary running in kernel mode, in MINIX 3, only a tiny bit of code runs in kernel mode--about 4000 lines in all. This code handles interrupts, process scheduling, and interprocess communication. The rest of the operating system runs as a collection of user-mode processes, each one encapsulated by the MMU hardware and none of them running as superuser. One of these processes, dubbed the *reincarnation server*, keeps tabs on all the others and when one of them begins acting sick or crashes, it automatically replaces it by a fresh version. Since many bugs are transient, triggered by unusual timing, in most cases, restarting the faulty component solves the problem and allows the system to repair itself without a reboot and without the user even noticing it. This property is called self healing, and traditional systems do not have it.

The structure of MINIX 3 is shown in Fig. 1. It is constructed as a series of layers. At the bottom, running in kernel mode, is a microkernel, consisting of about 3000 lines of C and 800 lines of assembler. Above that comes a layer of device drivers, with each driver in a separate user-mode process to ease in replacing it should it fail. Then come the servers, which form the core of the operating system. These include the reincarnation server mentioned above, the file server, the process manager, and others, including the X server, the data store, and various others. Finally, on top of that come the user processes. Although internally, MINIX 3 is completely different from other UNIX systems, it supports the standard POSIX interface to applications, so normal UNIX software can be ported fairly easily.

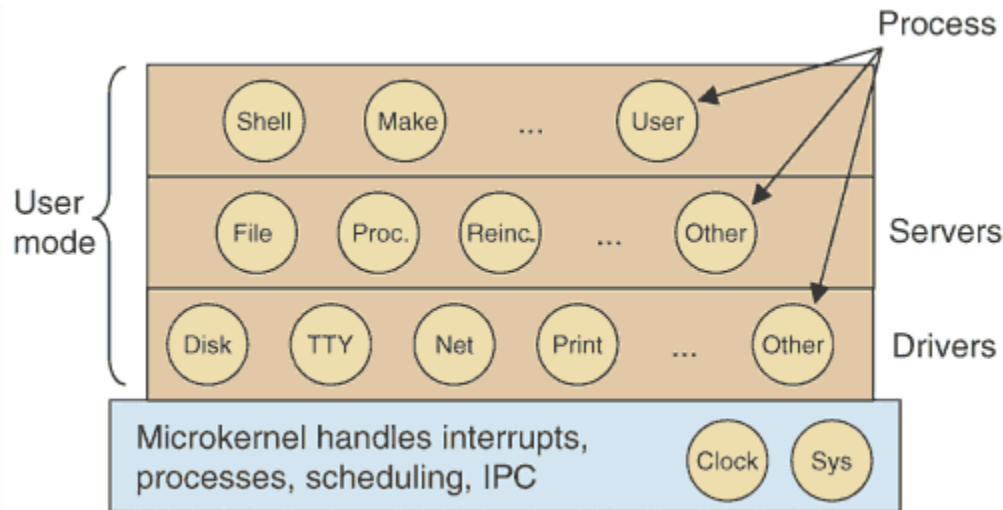


Fig. 1. The MINIX 3 architecture

The components communicate by passing fixed-length messages. For example, a user process requests file I/O send sending a message to the file server, which then checks its cache and if the needed block is not present, sends a message to the disk driver process to go get the block. While sending a message adds a little bit of overhead (about 500 nsec on a 3-GHz Pentium 4), the system is still quite responsive. For example, a complete system build, which requires over 120 compilations, takes well under 10 sec.

### User View

From the user's point of view, MINIX 3 looks like UNIX, except less bloated. It comes with the X Window System and over 400 standard UNIX programs, including:

Shells: ash, bash, pdksh, rsh

Editors: emacs, nvi, vim, elvis, elle, mined, sed, ed, ex

Language tools: cc, gcc, g++, bison, flex, perl, python, yacc

Programming tools: cdiff, make, patch, tar, touch

Networking: ssh, telnet, ftp, lynx, mail, rlogin, wget, pine

File utilities: cat, cp, bzip2, compress, mv, dd, uue, GNU utilities

Text utilities: grep, head, paste, prep, sort, spell, tail

Administration: adduser, cron, fdisk, mknod, mount, cvs, rcs

Games: dungeon, nethack

Currently the user interface is just X, but someday a GUI may be added if a suitable lightweight GUI can be found. Here are some screen shots.

### Availability

MINIX 3 is open source software, under the BSD license. It has its own Website from which the a bootable CD-ROM image containing all the sources and binaries can be downloaded. To install it, just boot the CD-ROM, login as root, and type: *setup*.

Installation takes about 10 minutes. After installation, a large number of packages can be installed from the CD-ROM or the Website by just typing: *packman* to select the choices. Currently MINIX 3 runs on x86 hardware, but ports to the PowerPC and Xscale are underway. It also runs fine on virtual machines such as VMware and Xen.

Since MINIX 3 went public in late 2005, the Website has had over 300,000 unique visitors and the CD-ROM image has been downloaded some 75,000 times. Currently, the site is getting over 1000 visitors a day. There is an active Google USENET newsgroup, comp.os.minix, where people ask and answer questions, post new software, and discuss MINIX 3. MINIX 3 is a community effort and your help is most welcome. Go get the system, try it out, and join the future.

**Author:** Andy Tanenbaum

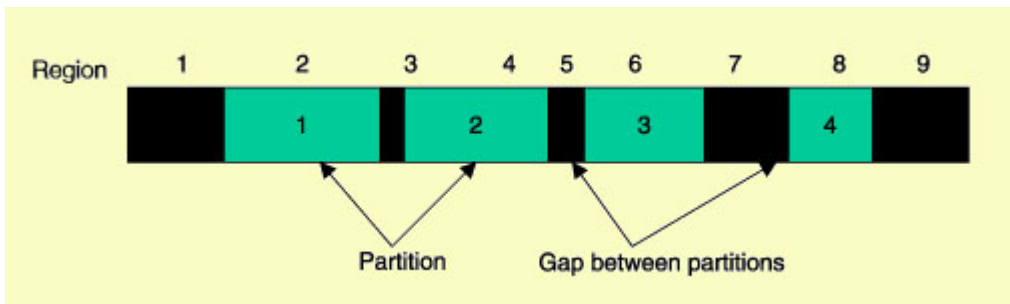
## ○ Installing Minix Operating System

### Disk Partitions

#### 1. Introduction to Partitions

When the IBM PC was first launched, it came with a simple disk operating system called MS-DOS, provided by Microsoft. IBM made a decision that a PC might ultimately have up to four operating systems installed at the same time. Each operating system would have its own portion of the disk, called a **partition**. For this reason, the first sector of each disk on a PC, called the **MBR** (Master Boot Record), contains a table with four entries, each giving the starting and ending locations of the four partitions.

The order of the four entries in the MBR need not correspond to the actual order of the partitions of the disk, and there may be gaps between the partitions and before the first one and after the last one. Some thought reveals that in the worst case, a disk may have as many as nine regions: four partitions and five gaps, like this.



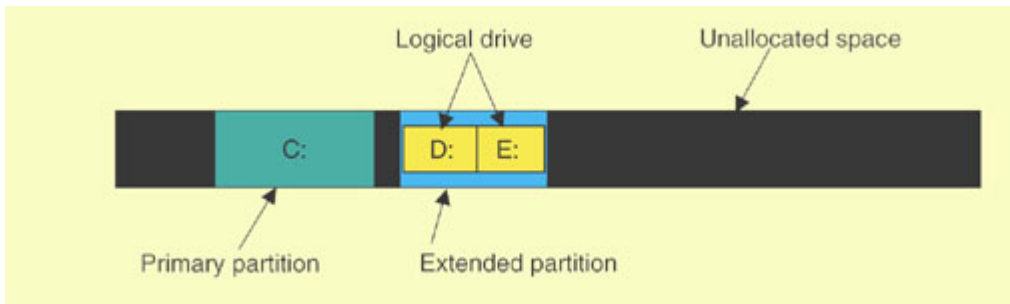
It is also possible for a single operating system to use multiple partitions. For example, a user might decide to partition the disk with two partitions, one for the operating system and one for user data. This arrangement makes it easy to back up user data without having to back up the operating system. It also makes it easy to install a new version of the operating system without losing any user data.

It was not too long before IBM and Microsoft decided that four partitions was not enough. Rather than simply make the partition table in the MBR bigger (which would not have been backward compatible with previous versions of MS-DOS), it was decided that up to three of the partitions could be marked as **EXTENDED**, meaning that they contained one or more subpartitions, called **logical drives**. A partition that is not an extended partition is called a **primary partition**. Together, the primary and extended partitions comprise the four **top-level partitions**.

Unfortunately, nearly all disk partitioning software displays the primary and extended partitions, and logical drives in such a way as you might think they are all equals. This is definitely not true and is quite confusing as each logical drive is a subpartition of some enclosing extended partition. In addition, some partition management software displays

partitions in the order they appear in the MBR, rather than in order of their disk addresses.

MS-DOS and Windows are normally configured with one primary partition and optionally one extended partition. In most cases, the primary partition is called C: an extended partition, if present, contains, D:, E:, etc., depending on how many logical drives have been created there. The advantage of putting D:, E:, etc inside an extended partition, instead of allocating each one its own primary partition, is that it leaves MBR partition table slots available for other operating systems. Below is an example disk showing one primary partition (C:) and one extended partition containing two logical drives (D: and E:).



It is important to realize that the entire concept of drive letters, like C:, is an MS-DOS concept, later taken over by Windows. No variant of UNIX, such as BSD, Linux, or MINIX 3, uses drive letters at all. All UNIX systems simply deal with the four top-level partitions in the MBR.

## 2. Partitions and MINIX 3

When installing MINIX 3, you have to deal with two resources: partitions and free disk space. MINIX 3 needs one primary partition (i.e., one MBR table slot) as well as 200 MB of free contiguous disk space. Logically, one of four conditions holds:

- 

Condition	One MBR slot is free	200 MB contiguous disk free
1	true	true
2	true	false
3	false	true
4	false	false

Each case must be dealt with separately. The first one is easy. MINIX 3 can be installed immediately. During setup, it will ask if it can take the disk space and you will agree. The second case is harder. Some existing partition must be deleted or resized to free up 200 MB of disk space. The third and fourth cases require deleting a partition to free up an



MBR table slot. Additionally, one of the remaining partitions may have to be resized to free up enough disk space. Note that if a partition is deleted, all data on it will be lost.

A common case that many beginners face is the second one: the entire disk consists of a single primary Windows partition, C:. There are three available MBR table slots for MINIX 3 to choose from, but there is no free disk space. The only solution is to resize the C: partition to free up at least 200 MB of space.

To delete or resize a partition, you need a program called a **partition editor**. MINIX 3 has such a program, called **part**, but you have to be careful using it since one typing error can wipe out your disk.

Complicated as all this may be, there is one more complication we have to explain. Each primary partition or logical drive contains one file system. Extended partitions do not contain file systems--they just hold logical drives. Imagine a car trunk (a disk) that can hold up to four boxes (partitions), each of which can contain a fragile bowl (file system) or one or more smaller boxes that each contain one bowl. An outer box with two bowls (a primary partition with two file systems) is not permitted.

Many different kinds of file systems exist. Windows alone supports four types: FAT-12, FAT-16, FAT-32, and NTFS. MINIX 3, Linux, BSD, and other UNIX systems each have one or more supported file system types. If all you want to do is delete an entire partition and free up all its disk space, then the type of file system it holds is irrelevant. The problem comes in when you want to resize (e.g., reduce) a partition to free up some disk space at the end. In order to resize a partition, the partition editor has to understand the internal layout of the file system on it and different partition editors understand different file system types.

In summary, you have to make sure you have a free partition (MBR table slot) and 200 MB of contiguous disk space. If you already have this, you can start installing MINIX 3 now. If you can achieve this situation by just deleting an existing partition, you can also start installing MINIX 3 now since the setup procedure allow you to delete partitions. However, if you first have to resize a partition, you need a partition editor that can resize the partition you have selected for reduction and you have to do this before starting the MINIX 3 installation using a partition editor that can handle the type of partition you want to resize.

### ***3. How to Partition Your Disk***

Before starting to manage your disk partitions, be sure to **back up your files** to CD-ROM or DVD to prevent losing them all in the event something goes wrong during the partitioning process. It has been known to happen. In what follows, we will assume you are running Windows, since most people running BSD or Linux have already encountered this problem and presumably now know how to partition disks.

What you have to do depends on whether you have enough free space and a free partition. Keep in mind that the goal is end up with at least one free partition and at least 200 MB of contiguous free disk space.

### 3.1. Step 1: Inspect the disk.

Determine how many partitions you have and their types as well as their sizes. On Windows 95, 98, and ME, all partitions are FAT partitions. On Windows 2000 and XP they could be either FAT or NTFS. On Windows Vista, they are most likely NTFS. To find the partition information, please follow the procedure below.

#### Windows XP and Vista:

1. Click on *Start > Run*
2. Type *diskmgmt.msc* in the *Open* box
3. Click *OK*

### 3.2. Step 2: Decide on a course of action.

If there is 200 MB of contiguous free space and not more than 3 partitions, you can begin installing MINIX 3 now. Similarly, if there are one or more partitions that you are willing to delete and whose removal will give you 200 MB of contiguous free space, you can also begin installation now. If all four top-level partitions are in use, you must select at least one for deletion. If there is a free partition (i.e., MBR table slot) but insufficient free disk space and you want to keep all partitions, you have to select a partition for resizing.

### 3.3. Step 3: Defragment the selected partition.

If a partition has to be resized to free up enough space, first defragment it to put all the data at the beginning and leave all the free space at the end to make resizing possible. Windows comes with a defragmenting program. The click sequence for starting the disk defragmenter is as follows: *Start > Programs > Accessories > System Tools > Disk defragmenter*. When the program starts, click on the partition to be defragmented and then click on 'Defragment.' Then defragment the same partition again as a second pass usually finds more fragments.

### 3.4. Step 4: Resizing the partitions

If you need to resize a partition, you need to find a suitable partition editor that can resize partitions of your chosen type. If you are using Windows Vista, you should use the built-in partition editor. Some commercial programs exist, but we will focus on free partition editors here.

The process for resizing a partition under Windows Vista is below:

1. Click on *Start > Run*

2. Type *diskmgmt.msc* in the *Open* box
3. Click *OK*
4. Right-click the partition you want to resize, and then click 'Shrink Volume'

If you are using Windows XP or earlier, you will need to use a third-party tool. The main free option is to use a Linux LiveCD that includes GParted, an open-source partition editor. All of the LiveCDs work the same way: You first download a CD-ROM image containing a bootable Linux system. These images files are normally about 700 MB. Then you decompress the file if need be and burn it to a CD as a CD image file. Then you boot the computer and wait until setup completes. The result will be a running Linux system, albeit with nothing installed on the hard disk. Then you have to run the partition editor, *gparted*, to resize a partition. Detailed instructions for MEPIS 8.0 are given below, but the others are similar. Again, before using any partition resizer, back up your data to CD-ROM or DVD.

### Using MEPIS

- After the CD-ROM boots, hit ENTER
- In the Login box, use Username=root and Password=root; click on 'Login'
- Wait until the CD-ROM stops (takes several minutes)
- Press Alt+F2 to bring up the 'Run command' dialog.
- Type: *gparted* in the dialog box
- Click on the disk to resize, usually */dev/sda*
- Right click on the partition and select 'Resize' from the menu
- Enter the new size, followed by Enter
- Click 'Resize/Move'
- In the 'Edit' menu, click on 'Apply All Operations' and then click on 'Apply'
- When it says 'All operations successfully completed,' press 'Close'
- Close the *gparted* window
- Press Control+Alt+Delete
- Select 'Restart Computer'

## Installing MINIX 3

This page describes the process of installing MINIX 3.

If you want to run MINIX 3 on a virtual machine instead of natively, see the installation page for your VM of choice before reading this page:

- [Running MINIX 3 on VMware](#)
- [Running MINIX 3 on Qemu \(and KVM\)](#)
- [Running MINIX 3 on Bochs](#)
- [Running MINIX 3 on Parallels](#)
- [Running MINIX 3 on VirtualBox](#)
- [Running MINIX 3 on Microsoft VirtualPC 2007](#)

### 1. Preparation

Please make sure your system meets the [Installation Requirements](#) first. If you already have the CD-ROM (e.g., from the book), you can skip steps 1.1 and 1.2, but it is wise to check the [download page](#) to see if a newer version is available.

You may need to change the *Boot Order* in the BIOS so that the machine boots off the CD-ROM, as opposed to the hard disk.

#### 1.1. Download the MINIX 3 CD-ROM image

Download the MINIX 3 CD-ROM image from the [download page](#). If you do not have an IDE CD-ROM, be sure to get the USB CD-ROM image or the USB memory stick image. Alternatively, you could run MINIX 3 in a Virtual Machine, such as VMware.

#### 1.2. Create a bootable MINIX 3 CD-ROM

Decompress the downloaded file. You will get a CD-ROM image file with extension *.iso*. The *.iso* file is a bit-for-bit CD-ROM image. Burn it to a CD-ROM disk to create a bootable MINIX 3 CD-ROM. Please consult your CD burning program's documentation to learn how to burn *ISO* images to CD-ROM media.

If you are running Windows and do not have a CD-ROM burning program, take a look at [ISO Recorder](#) for a free one and use it to create a CD image.

#### 1.3. Create a bootable MINIX 3 USB Memory Stick

Download the compressed USB image (e.g., [usb\\_image-3.1.2a.zip](#)) from the [download page](#) to your hard drive. Then, uncompress the USB image. Now you should "copy" the image file to your USB stick sector by sector. On Linux systems you can use the *dd* command. For windows systems you can download [DD for Windows](#).

⚠ **WARNING:** Please be careful when copying the image to your USB stick. If you specify the wrong output device when running *dd*, you could lose precious data. Please triple-check the arguments to the *dd* command before running it. ⚠

On Windows you may run the following command to copy the image to your USB stick (assuming the USB stick is *f:*):

```
dd if=usb_image-3.1.2a of=\\.\f: --progress
```

On Linux you may run the following command to copy the image to your USB stick (assuming the USB stick is */dev/sdb*):

```
dd if=usb_image-3.1.2a of=/dev/sdb
```

#### 1.4. Determine which Ethernet Chip you have

MINIX 3 supports several Ethernet chips for networking over LAN, ADSL, and cable. These include Intel Pro/100, RealTek 8029 and 8139, AMD LANCE, and several 3Com chips. During setup you will be asked which Ethernet chip you have, if any. Determine that now by looking at your system's documentation.

Alternatively, if you are using Windows, go to the device manager as follows:

```
Windows XP: Start > Control Panel > System > Hardware > Device Manager  
Windows Vista:
```

System requires double clicking; the rest are single. Expand the + next to "Network adapters" to see what you have. Write it down. If you do not have a supported chip, you can still run MINIX 3, but without Ethernet.

If you are running Linux, you can run the following command to find out which Ethernet card you have.

```
lspci | grep Ether
```

#### 1.5. Partition your hard disk

You can boot the computer from your CD-ROM if you like and MINIX 3 will start, but to do anything useful, you have to create a partition for it on your hard disk. But before partitioning, be sure to **back up your data to an external medium like CD-ROM or**

**DVD** as a safety precaution, just in case something goes wrong. Your files are valuable; protect them.

Unless you are sure you are an expert on disk partitioning with much experience, it is strongly suggested that you read the tutorial on [disk partitioning](#). If you already know how to manage partitions, create a contiguous chunk of free disk space of at least 200 MB, or if you want the sources, 1 GB. If you do not know how to manage partitions but have a partitioning program like *Partition Magic*, use it to create a region of free disk space. Also make sure there is at least one primary partition (i.e., Master Boot Record slot) free. The MINIX 3 setup script will guide you through creating a MINIX partition in the free space, which can be on either the first or second IDE disk.

**WARNING: If you make a mistake during disk partitioning, you can lose all the data on the disk, so be sure to back it up to CD-ROM or DVD before starting. Disk partitioning requires great care, so proceed with caution.**

## 2. Booting

By now you should have allocated some free space on your disk. If you have not done so yet, please do it now unless there is an existing partition you are willing to convert to MINIX 3.

### 2.1. Boot from the CD-ROM

Insert the CD-ROM into your CD-ROM drive and boot the computer from it. If the computer boots from the hard disk instead of the CD-ROM, boot again and enter the BIOS setup program to change the order of boot devices, putting the CD-ROM before the hard disk.

**NOTE: If you have problems booting from the CD-ROM, check that your BIOS is set to IDE/Legacy mode if you have SATA devices.**

### 2.2. Boot over network using PXE

It is possible to boot your computer over network. This requires a host and a client computer. See [this page](#).

## 3. Running the setup script

When the *login* prompt appears, login as *root*. Press *Enter* when prompted for a password.

To start the installation of MINIX 3 on the hard disk, type

```
setup
```

After this and all other commands, be sure to type ENTER (RETURN). When the installation script ends a screen with a colon, hit ENTER to continue. If the screen suddenly goes blank, press CTRL-F3 to select software scrolling (should only be needed on very old computers). Note that CTRL-key means depress the CTRL key and while holding it down, press "key."

#### 4. Installing to the Hard Disk

These steps correspond to the steps on the screen.

##### 4.1. Select keyboard type

When you are asked to select your national keyboard, do so. This and other steps have a default choice, in square brackets. If you agree with it, just hit ENTER. In most steps, the default is generally a good choice for beginners. The *us-swap* keyboard interchanges the CAPS LOCK and CTRL keys, as is conventional on UNIX systems.

##### 4.2. Select your Ethernet chip

You will now be asked which (if any) of the available Ethernet drivers you want installed. Please choose the numerical option (e.g., 1) that corresponds to your driver. The setup script will then save the corresponding driver keyword (e.g., *fxp*) and some options in the system file */etc/inet.conf*.

If you are running MINIX 3 in a Virtual Machine, see the following table to determine which selection to make:

Virtual Machine	NIC Selection
KVM	3. Realtek 8139 based card (also emulated by KVM)
QEMU	5. Realtek 8029 based card (also emulated by Qemu)
Bochs	6. NE2000, 3com 503 or WD based card (also emulated by Bochs)
VMWare	7. AMD LANCE (also emulated by VMWare and VirtualBox)
VirtualBox	7. AMD LANCE (also emulated by VMWare and VirtualBox)
VirtualPC	10. DEC Tulip 21140A in VirtualPC

The following table tells you shows all the NIC options, as well as the driver name that corresponds to each option.

NIC Selection	Corresponding Driver Name
0. No Ethernet card (no networking)	(n/a)

1. Intel Pro/100	fxp
2. 3Com 501 or 3Com 509 based card	dpeth
3. Realtek 8139 based card (also emulated by KVM)	rtl8139
4. Realtek 8169 based card	rtl8169
5. Realtek 8029 based card (also emulated by Qemu)	dp8390
6. NE2000, 3com 503 or WD based card (also emulated by Bochs)	dp8390
7. AMD LANCE (also emulated by VMWare and VirtualBox)	lance
8. Intel PRO/1000 Gigabit	e1000
9. Attansic/Atheros L2 FastEthernet	atl2
10. DEC Tulip 21140A in VirtualPC	dec21140A
11. Different Ethernet card (no networking)	(n/a)

The installer says, "You can always change your mind after the setup." If you do, you will need to know the driver code above and adjust `/etc/inet.conf` by hand. Instructions are in the [FAQ](#). The latest details can be deduced from a close reading of the script `/bin/setup`.

### 4.3. Create or select a partition for MINIX 3

You will first be asked if you are an expert in MINIX 3 disk partitioning. If so, you will be placed in the `part` program to give you full power to edit the Master Boot Record (and enough rope to hang yourself). If you are not an expert, press ENTER for the default action, which is an automated step-by-step guide to formatting a disk partition for MINIX 3.

#### 4.3.1. Select a disk to install MINIX 3

An IDE controller may have up to four disks. The setup script will now look for each one. Just ignore any error messages. When the drives are listed, select one. and confirm your choice.

If you have two hard disks and you decide to install MINIX 3 to the second one and have trouble booting from it, see [Installation Troubleshooting](#).

#### 4.3.2. Select a disk region

Now choose a region to install MINIX 3 into. You have three choices:

1. Select a free region



2. Select a partition to overwrite
3. Delete a partition to free up space and merge with adjacent free space

For choices (1) and (2), type the *region number*. For (3) type:

```
delete
```

then give the region number when asked. This region will be overwritten and its previous contents lost forever.

#### 4.3.3. Confirm your choices

You have now reached the point of no return. You will be asked if you want to continue. If you do, the data in the selected region will be lost forever. If you are sure, type:

```
yes
```

and then ENTER. To exit the setup script without changing the partition table, hit *CTRL-C*.

#### 4.4. Reinstall choice

If you chose an existing MINIX 3 partition, in this step you will be offered a choice between a Full install, which erases everything in the partition, and a Reinstall, which does not affect your existing */home* partition. This design means that you can put your personal files on */home* and reinstall a newer version of MINIX 3 when it is available without losing your personal files.

#### 4.5. Select the size of */home*

The selected partition will be divided into three subpartitions: *root*, */usr*, and */home*. The latter is for your own personal files. Specify how much of the partition should be set aside for your files. You will be asked to confirm your choice.

#### 4.6. Select a block size

Disk block sizes of 1-KB, 2-KB, 4-KB, and 8-KB are supported, but to use a size larger than 4-KB you have to change a constant and recompile the system. If your memory is 16 MB or more, use the default (4 KB); otherwise, use 1 KB.

#### 4.7. Wait for files to be copied

Files will be automatically copied from the CD-ROM to the hard disk. Every file will be announced as it is copied. When the copying is complete, MINIX 3 is installed. Shut the system down by typing:

shutdown

Always stop MINIX 3 this way to avoid data loss as MINIX 3 keeps some files on the RAM disk and only copies them back to the hard disk at shutdown time.

You can now remove any CD-ROM or floppy disk and turn off the computer. When you boot up again, you will be running MINIX 3.

⚠ If you are running a virtual machine, you will need to unmount the ISO image and tell the VM to boot from the hard disk. See the installation page for your VM for how to do this.

### *5. Next Steps*

Now that you've installed MINIX 3, you can go about configuring it. If you plan on booting multiple operating systems (i.e., you didn't install the MINIX boot loader to your Master Boot Record), you should read [Running Multiple Operating Systems](#).

You should also read [Post Installation](#) for some configuration tips and instructions on how to install packages. To do anything useful, you will need to install some packages as the base system is very barebones.

## ➤ **Running Minix 3 on Microsoft Virtual PC 2007**

This page describes the process of installing MINIX 3 on Microsoft Virtual PC 2007.

### ***1. Preliminaries***

Installation of Microsoft VirtualPC 2007 on a windows machine.

### ***2. Virtual Machine Setup***

Before you install Minix 3, you will need to create a new virtual machine configuration. The VM configuration specifies the parameters of your Virtual machine, e.g., how much memory you want the VM to use, how big you want the virtual hard disk to be, etc.

#### **2.1. Create a Virtual Machine -- Virtual PC console**

Once the console window has appeared click the "New. . ." button (right side above "settings").

Click "next" in the wizard that pops-up

Ensure "create a virtual machine" is selected (radio button is marked), click next then name your VM, if you do not specify a location then the default will be used (my doc > my VMs)

Select "Other" from the "Operating System:" dropdown list and click next.

You can leave the RAM at its recommended level, or set VirtualPC to adjust the ram as and when. (I selected 60mb of ram and dont seem to have much trouble). click next once satisfied.

First time use or if you dont have an existing Virtual hard disk you need to select "A New virtual Harddisk".

Clicking "Next" at the hard disk location screen should be fine.

"Finish" will setup the VM and its harddisk file.

#### **2.2. Installation**

Assuming you have downloaded and decompressed a MINIX 3 ISO image from the [download page](#), you can mount the ISO file:

Once you have your Virtual Machine Started (be quick here) from the Virtual PC console Select "Capture ISO image" option from the "CD" menu.

Then you can follow the normal installation instructions.

When the installation is over, type

```
shutdown
```

When you get the `d0p0s0>` prompt, select "Action" -> "close" -> "Turn off".

### ***3. Booting Minix 3***

Now, you have installed Minix 3 on the virtual machine. First thing that needs to be sorted is that, next time you boot, you want to boot from the operating system, and not from the CD image.

1. Select the "Release MINIX3.\*.\*r\*.\*.\*" option from the "CD" menu.

Great, now you can boot into the newly installed operating system.

### ***4. Post-install Configuration***

You should read Post Installation for some configuration tips.

## ➤ Running Minix 3 on VMware

This page describes the process of installing MINIX 3 on VMWare.

### 1. Preliminaries

Please install [VMWare](#). VMWare binaries can be downloaded from their webpage.

### 2. Virtual Machine Setup

Before you install Minix 3, you will need to create a new virtual machine configuration. The VM configuration specifies the parameters of your Virtual machine, e.g., how much memory you want the VM to use, how big you want the virtual hard disk to be, etc.

#### 2.1. Create a Virtual Machine -- VMware Server

In the main menu of VMware, select **New Virtual Machine**.

1. Press **Next** in the Welcoming Screen.
2. At the *Virtual machine configuration* menu, we select **Typical**.
3. At the *Select a Guest Operating System*, select **Other** and Version **Other**.
4. For *Virtual Machine Name*, write **Minix3** (anything would work).
5. At the *Network Type* screen, select **Use bridged networking**.
6. For *Disk Capacity*, enter something around 2GBs, although even smaller values would work. That is the size of the virtual partition where Minix will be installed. Tick the **Allocate all disk space now**.
7. Pressing **Finish** will create the Disk Image and the Virtual Machine that we will run.

#### 2.2. Create a Virtual Machine -- VMware Workstation and VMware Player (version > 3)

In the main menu of VMware, select **New Virtual Machine**.

1. At the *Wizard*, select **Typical**; and then, press **Next**.
2. For the *Guest Operating System Installation*, select **I will install the operating system later**; and then, press **Next**.
3. At the *Select a Guest Operating System*, select **Other** and Version **Other**.
4. For *Virtual Machine Name*, enter **Minix3** or some other meaningful name.
5. At the *Specify Disk Capacity*, enter 2GBs, which is enough for all packages and sources. You can make it larger if you need to add more source files.
6. At the *Ready to Create Virtual Machine*, ensure that **Power on this virtual machine after creation** is not checked; and then, press **Finish**.

You will need to edit the memory settings according to your needs. In the *Devices* section, select the **Memory**, and adjust the memory accordingly. Note that, in order to run the *X Window System* on Minix, you need at least 384MB.

### 2.3. Create a Virtual Machine -- VMware Player (version < 3)

If you are using the free VMware Player, you do not have the ability to create new virtual machines. The simplest way around that is to use [EasyVMX](#) to create your new (empty) virtual machines.

1. Choose the **Super Simple** virtual machine creator at <http://www.easyvmx.com/>.
2. Name the machine whatever you want.
3. Operating System: **Other OS** (Note: choose the one that is *NOT* 64-bit).
4. Choose appropriate memory and storage sizes (e.g., 512 MB Memory and 2GB storage).
5. Don't worry about the *LiveCD ISO*, leave that blank (it will be dealt with, later).
6. Press **Create Virtual Machine**.
7. Download the compressed file, and unpack it. It should contain a directory with a bunch of VMware files.
8. Start VMware Player, choose **Open an existing virtual machine**, and select the .vmx file in the directory you just unpacked.
9. Once the virtual machine starts, go to the *Devices* Menu; and, in the *CD/DVD* item, choose **Connect to Disk Image File (iso)**. Select the Minix3 ISO that you downloaded from the Minix 3 web-site.
10. If necessary, reset the machine with **Ctrl+R**; and, it will boot from the ISO.

### 2.4. Installation

Assuming you have downloaded and decompressed a MINIX 3 ISO image from the [download page](#), you can mount the ISO file:

1. Select **Minix3** in the *Inventory List* on the left.
2. In the *Devices* section, double-click on **CD-ROM**.
3. Select **Use ISO Image**.
4. Browse, and select the **.iso** Minix image that you downloaded earlier.

Then you can follow the [normal installation instructions](#).

When the installation is over, type

```
shutdown
```

When you get the *d0p0s0*> prompt, enter **off** to shutdown the Virtual Machine.

### 3. Booting Minix 3

Now, you have installed Minix 3 on the virtual machine. First thing that needs to be sorted is that, next time you boot, you want to boot from the operating system, and not from the CD image.

1. In the *Devices* section, double-click on **CD-ROM**.
2. Select **Use Physical Drive**.

Great, now you can boot into the newly installed operating system.

1. Select **Minix3** on the *Inventory List* on the left.
2. In the *Commands* menu, Press **Start this Virtual Machine**.

### 4. Post-install Configuration

You should read [Post Installation](#) for some configuration tips.

#### 4.1. X.org

Like in other visualization tools, Minix can't get the screen resolution right under VMware. To get X11 running in the desired resolution, you start by generating an `xorg.conf` file using the command

```
Xorg -configure
```

This creates a file `xorg.conf.new` in your home directory. This needs to be completed manually, so edit it and fix the *Monitor* section so that it reads:

```
Section "Monitor"
    Identifier "Monitor0"
    VendorName "vmware"
    ModelName "VMWare Inc"
    HorizSync 1.0 - 10000.0
    VertRefresh 1.0 - 10000.0
    ModeLine "800x600" 100.0 800 900 1000 1100 600 700 800 900
    ModeLine "1024x768" 100.0 1024 1100 1200 1300 768 800 900 1000
    ModeLine "1366x768" 100.0 1360 1400 1500 1600 768 800 900 1000
EndSection
```

You may need to add another [ModeLine](#) for the resolution of your actual screen (if you want to run in full screen mode). This isn't rocket science under VMware, since most of the parameters really don't matter much. Of the [ModeLine](#) for "1024x768", all that really matters are the 1024 and the 768. The 100.0 is the refresh rate in Hz, which is pretty

much ignored under VMware (the host controls that). All the other timing values (which are important when using a physical machine with a physical monitor) are just rounded up to the next 100. So a ModeLine to display on your HDTV would read

```
ModeLine "1920x1080" 100.0 1920 2000 2100 2200 1080 1100 1200 1300
```

Keep in mind that in the current version of the X-server, the Xresolution must be a multiple of 8 pixels. That is why the ModeLine for "1366x768" uses 1360 as display width, wasting 6 physically present columns of the real screen (of my notebook).

Next you have to fix the *Screen* section of the file. Edit it so that it looks like this:

```
Section "Screen"
    Identifier "Screen0"
    Device "Card0"
    Monitor "Monitor0"
    SubSection "Display"
        Viewport 0 0
        Depth 24
        Modes "1366x768"
    EndSubSection
EndSection
```

Where *Modes* actually contains the label of the ModeLine with the resolution you want.

Save the file and copy it to `/usr/pkg/X11R6/lib/X11/xorg.conf`.

## 5. Workarounds

### 5.1. Lance workaround

In Minix 3.1.5, after working correctly for a period of time, the lance driver may stop working silently, causing all network traffic to be dropped for some period of time. Workaround: when this happens, run "service refresh lance" as root to restart the lance driver. This issue has been fixed in the Minix trunk available from Subversion.

In Minix 3.1.3, the Lance driver set-up is broken, resulting in **no network support** for Minix3 in VMware.

You can use [this set of instructions](#) to get the Lance driver to work.



## 5.2. VMWare Hardware version 6.x workaround

For Minix versions below 3.1.4, you may see the following error when running newer versions of VMWare: `*** vcpu-0:ASSERT vmcore/private/iospace_shared.h:558 bugNr=64440.`

You will need to edit the `.vmx` file corresponding to your virtual machine. It can likely be found in `~/Documents/Virtual Machines/<VM name>` or `~/vmware/<VM name>`.

You will need to remove the line:

```
pciBridge0.present = "TRUE"
```

and any similar lines for `pciBridge`, `pciBridge2`, etc. from the `.vmx` file.

## 5.3. Unable to partition hard disk

VMWare Server, by default, installs SCSI hard disks.

In Minix3.1.3a, with this default configuration, the disk partitioning step would not run automatically. In 'expert mode', I couldn't partition my disk.

I removed the SCSI hard disk and installed an IDE disk instead.