Installing Red Hat Linux 8

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What is GNU/Linux?

What is Linux?

What is Linux? This is a hard question to answer because there are many different correct answers. Legally Linux is a trademark, just like Unix™ and Windows XP™. More specifically Linux is trademark number 74560867 - "computer operating system software to facilitate computer use and operation". Technical people might disagree with the trademark definition. This is how the computer programmers who created Linux define it:

Linux is a Unix clone written from scratch by Linus Torvalds with assistance from a loosely-knit team of hackers across the Net. It aims towards POSIX compliance.

It has all the features you would expect in a modern fully-fledged Unix, including true multitasking, virtual memory, shared libraries, demand loading, shared copy-on-write executables, proper memory management and TCP/IP networking.

It is distributed under the GNU General Public License - see the accompanying COPYING file for more details.

The programmers have a good definition but it contains too much jargon. We need to express the definition in terms that are more important to us. So, in plainer words, the programmers say three things:

1. Linux is an operating system kernel.
2. Linux is a Unix clone.
3. Linux is Free

I will explain each of these claims in the following sections.

Operating System Kernel

A computer system is composed of a processing unit and devices. (We will restrict ourselves to a discussion of the typical personal computer.) The processing unit is inside the beige box which sits on or under your desk. This box usually contains some devices: memory, a floppy disk drive, a CD-ROM drive, a video controller, a sound card, ethernet card or modem. Other devices are connected to the box by wires or by infrared signals: keyboard, mouse, monitor, printer. The operating system kernel controls communicaction between the devices and whatever application is operating at a particular moment. For instance, when you use a word processing application, the operating system controls how your keyboard interacts with the word processor, the operating systems passes information from the application to the monitor to show the text on the screen. When it's time to save your work, the application instructs the operating system to copy the information from memory to the disk drive. Because the operating system does all the communicating with devices,

the applications don't need to know exactly who manufactured your hard drive or how big your monitor might be. The applications can be easily installed on a wide variety of different hardware, because the operating system knows all about the different hardware devices.
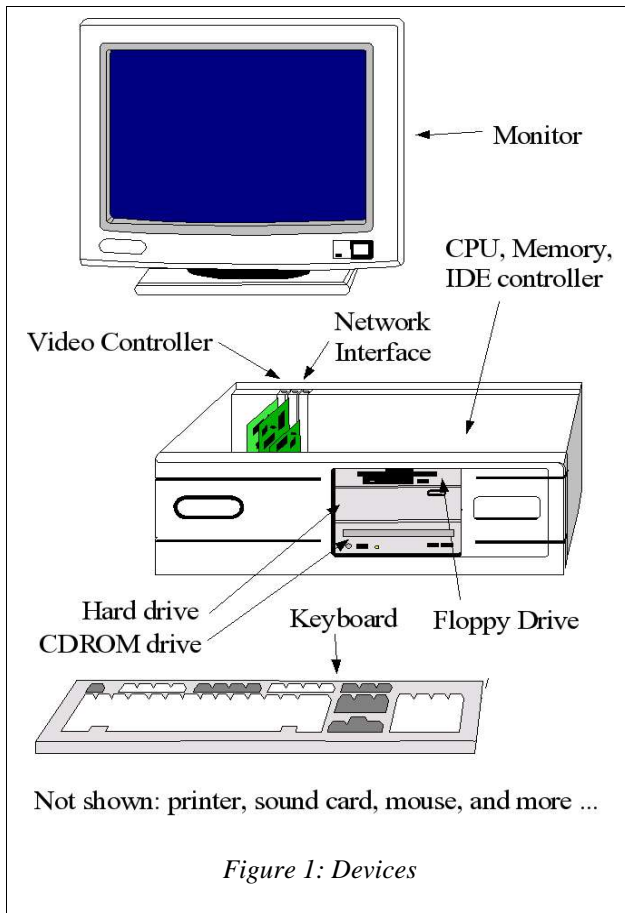

Not shown: printer, sound card, mouse, and more ...

Figure 1: Devices

Some parts of an operating system are not always required. For instance, the graphical user interface or text command prompt that you see on a Windows or Linux computer isn't absolutely necessary – just think about your DVD player, it's a computer and it doesn't need those things. If you strip off all the "unnecessary" functions, then eventually you will be left with a small set of instructions which are absolutely necessary for the processing unit to communicate with the devices. This small set of necessary instructions is called the operating system kernel.

Because the kernel's job is to communicate with all the devices kernel programmers must create a specific kernel module for each possible piece of hardware. (Sometimes people call these modules "device drivers".) Creating these kernel modules is a huge programming problem because of the enormous number of devices that may be connected to personal computers, and often each device make and model requires a different kernel module. The programming challenge is enormous - the 2.4.0 Linux kernel contains over three million lines of source code. So

```
From: torvalds@klaava.Helsinki.FI (Linus Benedict Torvalds)
Newsgroups: comp.os.minix
Subject: What would you like to see most in minix?
Summary: small poll for my new operating system
Message-ID: <1991Aug25.205708.9541@klaava.Helsinki.FI>
Date: 25 Aug 91 20:57:08 GMT
Organization: University of Helsinki

Hello everybody out there using minix -

I'm doing a (free) operating system (just a hobby, won't be big and
professional like gnu) for 386(486) AT clones. This has been brewing
since april, and is starting to get ready. I'd like any feedback on
things people like/dislike in minix, as my OS resembles it somewhat
(same physical layout of the file-system (due to practical reasons)
among other things).

I've currently ported bash(1.08) and gcc(1.40), and things seem to work.
This implies that I'll get something practical within a few months, and
I'd like to know what features most people would want. Any suggestions
are welcome, but I won't promise I'll implement them :-)

Linus (torvalds@kruuna.helsinki.fi)

PS. Yes - it's free of any minix code, and it has a multi-threaded fs.
It is NOT protable (uses 386 task switching etc), and it probably never
will support anything other than AT-harddisks, as that's all I have :-(.
```

Figure 2: The First Email

how can a piece of software this big be available for free? That's where the Internet played an important role.

But in September 1991 Linus Torvalds completed version 0.1 of Linux. At that time the Linux kernel supported very few devices. Basically, the 0.1 Linux kernel only supported the devices that were on Linus' PC in Finland: the 80386 microprocessor, one model of hard drive, and one model of VGA adapter. It didn't even support floppy disks. But in August 1991 Linux sent an open email onto a Usenet newsgroup asking for help (see above). By the end of 1991 other programmers had added support for multilingual keyboards, floppy disks, more hard drives, and four types of video display. Through Internet collaboration, the kernel grew until today it's safe to say that the Linux kernel supports more hardware than any other operating system.

Unix Clone

I don't want to go into too much history, but again some background is unavoidable. Unix is an operating system created by AT&T many years ago. The Unix operating system was designed for multi-user, corporate environments using expensive computer systems. Most large computer companies have created their own Unix clones to operate their expensive computers: IBM has AIX, HP has HPUX, Xerox has Xenix, SGI has Irix, and so on. Unix was powerful but too expensive and memory hungry to run on early IBM PCs. But when Compaq released the first IBM PCs based on the Intel 80386 microprocessor, some Unix clones began to appear. However the Unix clone software, such as SCO Unix, was expensive and required a lot of memory, which was expensive at that time. The problem was that most university students and junior faculty could afford either the RAM or the software, but not both. What they needed was free software.

Free Software

So far we have talked about the Linux kernel. But a Linux kernel by itself does nothing. A kernel without applications is like a screwdriver without screws - it's the screws that make a screwdriver useful, and similarly it's the applications that make the kernel useful. Fortunately there happened to be a bunch of Free applications ready to run on Linux, courtesy of the Free Software Federation.

The Free Software Federation promotes the use of Free Software. In 1984 the FSF launched the GNU Project. The GNU Project aims to create a complete Unix-like Free operating system: both applications and kernel. But since most members of the GNU Project already had a version of the Unix kernel to work with, they decided to write the applications first. The GNU Project started in 1984, so in the 1990s when Linux arrived, the GNU Project had already completed a set of Unix-like applications which are ideally suited for use with the Linux kernel. A Linux kernel running GNU applications is called a GNU/Linux system. Linux and GNU together create a functional operating system.

You may have noticed that I have capitalized the word "Free" in the previous paragraphs. In the English language, the word "Free" has two meanings: Free as in liberty and free as in no-cost. In this course, Free with a capital F means "Free as in liberty". And free with a small f means free as in no-cost. Free Software is about liberty. Free Software may not be free - I can charge you money for Free Software, as long as I follow the four rules of software Freedom. These are the four rules:

0. The freedom to run the program, for any purpose (freedom 0).
1. The freedom to study how the program works, and adapt it to your needs (freedom 1). Access to the source code is a precondition for this.
2. The freedom to redistribute copies so you can help your neighbour (freedom 2).
3. The freedom to improve the program, and release your improvements to the public, so that the whole community benefits (freedom 3). Access to the source code is a precondition for this.

Linux Distribution

A GNU/Linux system is a collection of pieces of software written by many different individuals and organizations scattered all over the world. This is a very different production method than used by commercial operating system vendors such as IBM, Microsoft and Sun. If you wanted to install Sun's Solaris operating system then Sun would sell you a CD-ROM that contains all the Solaris

components. But if you want to install a Linux system where do you get the software? You get Linux from the kernel developers, the shell and binutils from the Free Software Foundation, the windowing system from the Xfree86 Project, the word processor from Star Division, the web browser from Netscape, and so on. Downloading hundreds of pieces of software from hundreds of different web sites is inconvenient. To make matters worse, the producers of all this software distribute it in source code format, so you needed all the compilers and development libraries. So after you've downloaded all this code and software you have to compile it - we are talking about several million lines of code, so this could take a few days on a personal computer. Don't forget that some of these packages require other packages to compile - so you must compile and install the packages in the correct order. Finally when everything is compiled and installed, you have to write your own initialization files. Getting early versions of GNU/Linux working was a job for post-graduate students - Linux was too difficult for business or home use.

In 1993, a company named Yggdrasil thought about the Linux license and the difficulties installing Linux. Then Yggdrasil invented a new type of software business. Yggdrasil copied all the Linux software onto a CD-ROM and sold the CD-ROM (remember Free means liberty, not

for certain operating systems. For instance, Microsoft Frontpage only runs on Microsoft Windows. (In a later lesson I will explain how to run some Microsoft Windows applications on a Linux machine.) So if your required application only runs on one operating system, you have to use that operating system.

If you have some flexibility to change operating systems then you should consider which operating system is best for you. There are three things to consider: (1) How difficult is it to learn? (2) How difficult is it to use? (3) How much does it cost? The following table compares the three major commodity operating systems using these three dimensions.

Inexperienced computer users might find the decision too confusing, so for what it's worth, here is my recommendation:

Linux: if you are interested in how your computer works (i. e. you are a computer science student or a hobbyist), then you should use Linux.

Linux: if you are interested in free or Free software, then you should use Linux.

Macintosh: if you don't care how the machine works, then buy a Macintosh.

Windows: if you must use a specific application that only runs on Microsoft Windows, then buy Microsoft Windows.

Table 1-1. Linux, Windows or Macintosh?

	Linux	Microsoft	Macintosh
How much does it cost?	Free	Expensive	Expensive
How difficult is it to learn?	Hard	Easy	Easiest
How difficult is it to use?	Easy	Easy	Easiest

no-cost). Yggdrasil called their invention a Linux distribution. Finally all the Linux software could be obtained from a single source, but you still had to compile everything yourself. The next step was for the company to compile all the source code for you and sell you a CD-ROM containing just the binary files. No more compiling from source - you just buy an Intel 80386 Linux distribution, or a Sun Sparc Linux distribution, or a Motorola 68000 Linux distribution. The last problem was configuration: although theoretically Linux should be able to work with just about any hardware, figuring out exactly how to configure Linux to work with specific hardware, especially fancy video and sound cards, remained difficult until recently. During the last few years competition between Linux vendors has resulted in distributions which automatically configure almost all hardware configurations. The three easiest to use distributions today are Red Hat, Mandrake, and Debian.

Linux, Windows or Mac?

Before you install Linux, you should consider whether Linux is the right choice for you. The first question that you should ask yourself is, "Is there a specific application that I have to use?" Some applications are only available

INSTALLING RED HAT LINUX

Why Red Hat?

There are many distributions of Linux. We will use the Red Hat distribution because that is the distribution I use.

Dual boot

We will assume that you already have Microsoft Windows installed on your computer, and that you want to install Linux in a dual boot configuration. This means that both Windows and Linux will be installed on your hard drive (or different hard drives in the same computer) and when you start the computer you will see a menu offering you the choice of booting Microsoft Windows or Red Hat Linux.

Back up your data

Before attempting to install Linux you should make a backup copy of any documents, graphics, and/or databases that you have created. In most cases these files should be in the My Files folder. Unfortunately, some applications save your files in other places, so you must launch each application and find out where it saves your documents. As

you find the documents, you should copy them to a floppy diskette, a CD-R, or a backup hard drive.

Backup Hard Drive

Regardless of what operating system you use, you should make backups of your documents. After all, you never know when a hard drive might stop working, and how many hours of work and what vital information could you lose if your hard drive dies? I recommend using a second hard drive for backup copies. Even slow hard drives are much faster than tape, floppy, or CD-ROM. And old 2.5 gigabyte hard drives are available in my area for $50 (Cdn). In my opinion, that would be a well spent $50.

Collect information

In the old days (that is to say, two years ago) installing Linux was a hackers job. It was important to know what hardware you were installing on. This has changed. Red Hat 8 has an excellent installer which detect modern hardware. In truth, if you have old hardware (ISA cards, fixed frequency monitor, and so on) you should get someone else to install Linux for you. Still, it doesn't hurt to know what hardware you have. I recommend that you have the following information before you install Linux:

Table 1-2. Device Information

Device	What to Record
Video card	Manufacturer, model, amount of video RAM
Monitor	Manufacturer, model, horizontal & vertical refresh rates, bandwidth
Modem	Manufacturer and model number
Network card	Manufacturer and model number

So where do you get all this information? When you bought your computer you should have received a piece of paper listing the details of the machine (often listed on the invoice) and a box of manuals. That's a good place to start. If you don't have manuals, then look at the back of the machine for make and model numbers. If you are already running Microsoft Windows on the computer, open the Control Panel and double-click on the System icon. You should be able to get your information there.

Partitioning the Hard Drive

Hard drives may be logically divided into smaller sections named partitions. There are several good reasons to do this. The first reason is that you might want to run both Linux and Microsoft Windows using the same hard drive - each operating system requires its own partition. The second reason is that a basic Linux installation requires two

partitions: one for the Linux files and the second for the swap space. The assumption in this course is that your PC is already running Windows, so we will assume three partitions: root filesystem, swap space, and windows.

Shrinking the Windows Partition

So we need three partitions, but the problem is that we already have Microsoft Windows on our hard drive and its one partition has used all our hard drive space. If this is the case, then you need to shrink your Windows partition. You can use the commercial Partition Magic utility, or you could use the Free GNU Partition Editor (parted). If you decide to use GNU parted, then you might be interested in this tutorial.

Changing the Boot Device

Red Hat comes on bootable CD-ROMs. You must change the computer's startup procedure so that the computer boots from CD. When you turn on your computer you should see a message like "Press `Del` to enter setup". When you see that message press the `Del` (or whatever other key your PC might indicate). Now you are in your computer's motherboard setup program. This setup program controls how the computer's mainboard operates, so you should only change things if you know what you are doing. Here is what you need to know to tell your PC to boot from CD-ROM.

Once in the setup program, you should see a text menu. Unfortunately, the exact wording for the different menu items might be different for different computers. You should see something like "Advanced BIOS Features". Often it is the second menu choice. Select that menu item using the arrow keys and pressing `Enter`. Now you will see a screen full of menu items, many or all of which you don't understand. Look for a menu item labelled `Boot Device` or `First Boot Device` and select it. You should see a pop-up menu with a list of boot devices. Select the CD-ROM device (move the highlight bar and press Enter). Then go back to the main menu using the `Esc` key, look for the **Save Settings** menu item and select it.

Now that you have changed the boot device, put Red Hat disc 1 in the CD-ROM drive and reboot your PC.

Welcome to Red Hat Linux

When the Red Hat Linux installation program starts, the first screen you see will be a page of text welcoming you to Red Hat Linux and telling you about the different types of install. We will do a default install, so just press Enter.

Assumptions

I have no idea what hardware and software you might have. But I can't cover all possibilities, so I have to make some assumptions. Here are the assumptions:

1. Your computer has a Pentium central processing unit (CPU) (or an equivalent AMD processor). There are two reasons why I make this assumption. First, Red Hat will install and run on computers which have 386 and 486 processors, but I call these "slow computers" and Linux on Slow Computers is an advanced lesson. Second, Red Hat discs are available for DEC Alpha and Sun SPARC CPUs, however the installation process and some software is different, so I won't cover that.

2. You already have a copy of Microsoft Windows installed on your harddrive.

You will have to wait about sixty seconds while the installation program loads and prints some diagnostic messages. Then you will have an opportunity to test the CD-ROM. Use the arrow keys to select the "Skip" option, then press Enter. There will be a longer wait while the installation program identifies your video hardware. Then you will see a graphical "Welcome to Red Hat Linux" screen. Notice the screen format. On the left side is an "Online Help" window. The window has a scrollbar, so you can scroll the window down to read long help messages. This help window will appear throughout the installation, and you should read the help messages. In this lesson, I will assume that you have read the help message and I will tell you what to do.

Click the Next button at the bottom right corner of the screen.

Language Selection

Next you choose the language that you want the installation program to use. This only applies to the installation program - the languages that Linux will use are selected later. English should already be chosen, so just click the next button.

Keyboard configuration

Unless you know exactly what your keyboard is, just accept Red Hat's recommendations by clicking the Next button.

Mouse configuration

Again, unless you know exactly what type of mouse you use, then use the Red Hat recommendations by clicking Next. I should point out that Red Hat has a hard time telling the differnce between a 3 button PS/2 mouse and a PS/2 wheel mouse, so if you have a wheel mouse and Red Hat says it's a 3 button, you might want to change it.

Installation Type

Red Hat supports four different types of installation: Personal Desktop, Workstation, Server, and Custom. Select the Personal Desktop radiobutton and click Next.

Partitioning

We already talked quite a bit about partitioning. The installation program gives three options: Automatic, Disk Druid, and fdisk. Automatic will erase any data on your hard drive – we don't want to do that because we want to keep our Microsoft Windows partition. If you have used fdisk before and are comfortable with it, then use fdisk. Most people should select Disk Druid and click the Next button.

Disk Setup (using Disk Druid)

The Disk Setup screen has three sections: the top section of the screen contains a bar graph of each hard disk, representing approximately how much of the disk has been allocated to each partition. The middle section contains six buttons: New, Edit, Delete, Reset, RAID, and LVM. The bottom section contains a table showing the details of each partition and the remaining free space (if any exists). The

table should show two entries: /dev/hda1 and Free. /dev/hda1 is our MS Windows partition – we want to leave that partition alone. But we need to create two new partitions: the Linux swap space and the Linux root partition.

Now we have to add the swap partitions. First select the Free entry (click on it) then click on the New button. Now we see the Add Partition screen. Change the File System Type to swap. Change the size to twice the amount of RAM installed on your system. For instance, if your system has 64 MB of RAM, set the swap size to 128 MB. Make sure that the Fixed Size option is set, and click the "Force to be a primary partition" box. Then click **OK**.

So we repeat the operation for the root partition. Select the Free entry then click the New button. Change the mount point to **/** and select the **File System Type** to **ext3**. Click the **Fill to maximum allowable size** radiobutton and click the **Force to be a primary partition** check box. Then click the **OK** button. You will see a warning like this:

> ### Warning
>
> Warning: Boot partition / may not meet booting constraints for your architecture. Creation of a boot disk is highly encouraged.

Ignore this warning – click the Continue button. Then click the **Next** button.

Boot Loader Configuration

Red Hat Linux will install a boot loader on your hard drive. The boot loader lets you select which operating system you want to run when you start your computer. By default, Red Hat installs the GRUB boot loader, and sets Red Hat Linux as the default operating system. You might want to change the default operating system to MS Windows.

When you are finished, click the **Next** button.

Network Configuration

We will set up our network in a later lesson. Just click **Next**.

Firewall Configuration

We will discuss firewall configuration in a later lesson, so just click Next.

Additional Language Support

This is where you select which languages Linux will support. As you can see, Linux supports many languages. We will accept the default (English (USA)) by clicking Next.

Time Zone Selection

In the text selection box, change from World to North America. Then you can move the mouse pointer around the map of North America to select a city - the name of the city you are pointing to appears in the text box under the map. Find the Montreal and click on it, then click the Next button.

Time Zone Selection

Linux needs to know what time zone you are located in. You can click on the interactive map or select a nearby city manually in the text box. Click on Montreal and click the Next button.

Account Configuration

You must set the root password, and it must be at least six characters long. Define the password and confirm the password by typing it again in the confirmation textbox. Write the root password down in your notebook. Then click the Add button to create a user account. Select a short word for the user name - I always use "andrew" for my user account. Then enter your full name. Enter and confirm a password for your user account. Write the user name and password in your notebook, then click the OK button. Click the Next button.

Package Group Selection

There will be a pause while the installation program reads the package database from the CD-ROM. Then you will see a summary of the elements which will be installed as part of the default personal desktop. At the bottom of the screen are a pair of radiobuttons. You can accept the recommended elements, or customize the list. We will accept the recommended elements and click Next. (In a later lesson we will learn how to install additional packages.)

About to install

This is your last chance to go back and change options before Red Hat starts writing information to your hard drive. If you want to stop the installation, just turn your machine off. If you are ready to install Linux, then click the **Next** button.

Installing Packages

First you should see a small pop up window containing the progress bar as Red Hat formats the Linux partitions. This will be followed by several info pop up windows, then Red Hat will start installing software. This may take up to an hour, so you may want to go away and read a book. You will have to change CD-ROMs partway through the installation, so if you leave the room you should check the computer every 15 minutes or so.

Boot Disk Creation

Eventually Red Hat will finish installing the software packages and will prompt you to create a boot diskette. It is a very good idea to create a boot diskette. If something strange happens, such as another operating system changing the boot sector on the hard drive, then you can use the floppy boot diskette to start Linux. Put a blank floppy in the floppy disk drive and click the Next button. When the boot diskette is ready, remove it from the floppy drive. Now label the floppy before you forget what's on it. I'm not kidding – label it right now. Many people forget to label their disks, then they don't know what's on them. If you don't label the disk then you just wasted your time making it.

Graphical Interface (X) Configuration

Red Hat should automatically select your video card from the list. Confirm Red Hat's choice from your notebook (remember that hardware list you were supposed to make?) Confirm that the video card RAM is correct, then click the Next button.

Monitor Configuration

Red Hat should automatically detect newer monitors (i.e. monitors/video card combinations which support VESA DDC). But if you have an old video card or an old monitor, then it's time to have a look at that hardware list. (You did make the hardware list, right?) Select your monitor from the list. If your monitor isn't in the list, then go to the top of the list, double click on the "Generic" category and select the one that looks closest to your monitor. If you have no idea which one will work with your monitor select the Generic Super VGA, 800x600 @ 56 Hz.

Make sure that the horizontal and vertical sync ranges are correct for your monitor (if Red Hat found your monitor by itself, then the sync values should be correct). Then click the **Next** button.

> ### Caution
> Selecting the wrong monitor could damage your monitor. If you have a lot of trouble selecting your monitor, then I suggest you abandon the Linux installation.

Customize Graphics Configuration

In the customize graphics configuration screen you may define your screen preferences for the X Windows display system. Set the Color Depth to 16 bit and the Screen Resolution to the maximum setting supported by your monitor. Note that you can set your graphics card to 24 bit, but many applications run slower on 24 bit, so unless you intend to work with photographs, you should use 16 bit graphics.

> ### Caution
> Don't set the screen resolution too high! Red Hat lists all the common screen resolutions, even if your monitor doesn't support them. If you select a resolution that is higher than your monitor's capabilities, then you could damage the monitor.

Select the **Graphical** radiobutton for login type. Click the **Next** button.

Congratulations

You have completed the installation. Now click the Exit button and take the CD-ROM out of the drive. You might want to change the BIOS settings to boot from the hard drive.

Booting Linux for the First Time

You will see many diagnostic messages, and the message "Bringing up interface eth0" might be on your screen for a long time.

Welcome to Red Hat Linux

Eventually you will get to the Welcome to Red Hat Linux screen. This is a special program which runs the first time that you boot Red Hat Linux. Click the Forward button.

Date and Time Configuration

Use this screen to set your date and time. Or, if you are connected to the interent, you can use the National Research Council's network time server: the server's name is time.nrc.ca.

When you are finished, click the Forward button.

Sound Card Configuration

Red Hat will attempt to configure your sound card. Sound cards can be the hardest thing to set up, so if you have an old sound card don't be surprised if it doesn't work. But Red Hat Linux 8.0 correctly identified the sound cards on all four of my computers, so you should be ok. Click Forward when you are finished.

Red Hat Update Agent

If you are connected to the internet, then you can use the Red Hat Network Update Agent to automatically download patches and new software for you computer. This is an excellent ser ice, and you should consider using it. But for now, I suggest that you select the No radiobutton and click Forward.

Install Additional Software

Not right now. Click Forward.

Finished Setup

Click Forward

Red Hat Login

We are done!

Homework

Read http://www.distrowatch.com/game.htm

Notes

1.   http://www.gnu.org/philosophy/free-sw.html
2.   http://www.redhat.com/docs/manuals/Linux/RHL-7.3-Manual/install-guide/

   http://www.tucows.com/system/preview/222189.html

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Red Hat

Microsoft Windows, Microsoft Word

Partition Magic from PowerQuest