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Performing shell operations

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Networking with the shell

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Command reference

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Guess what? Wheels have been round for a really long time, and anybody who “reinvents” the new wheel is generally considered a crackpot. It turns out that “round” is simply a good form for a wheel to have. It may be boring, but it just tends to roll better than a square, and “hipness” has nothing what-so-ever to do with it.

Linus Torvalds, creator of the Linux kernel
This chapter introduces the Linux operating system and describes a typical installation process.
Introducing Linux

Linux is a computer operating system that can run on a variety of hardware including the popular Intel system found on most desktop computers. It is a modern derivation of the powerful Unix operating system that was introduced way back in 1969. In recent years the popularity of Linux has increased dramatically as computer users have discovered its many benefits:

- Linux is released under the GNU General Public License that ensures it remains free to all users – no-one can charge for this operating system so you will never have to pay for it. It’s available for free download on the Internet but you may have to pay a distribution charge if you prefer a copy on CD/DVD
- Access to the source code of Linux is unrestricted and it may be changed. This has allowed thousands of programmers around the world to refine the code to improve performance
- Linux is truly a multi-user, multi-tasking operating system that allows multiple users to simultaneously work with multiple applications without experiencing any traffic problems. Many of the world’s web servers run on Linux for this very reason
- Linux is an extremely stable operating system – continuous uptimes of more than a year are not uncommon. It can be upgraded “on the fly” so it only needs a reboot to add hardware
- There are a large number of quality applications available to run on the Linux platform. These are comparable to commercial applications that run on other operating systems but, like Linux, these too are free of charge. For instance, the free OpenOffice suite offers similar functionality to the Microsoft Office suite
- With open-source software an administrator can know exactly what a program can do and the security dangers it presents. An open-source application cannot secretly gather information about the user or send confidential information to third parties
The evolution of Linux

In 1983 a visionary programmer named Richard Stallman began a movement called the GNU Project. Its philosophy was that software should be free from restrictions against copying or modification in order to make better and efficient programs. This inspired programmers around the world to create programs driven by efficiency rather than by financial incentive.

By 1991 the GNU Project had created a lot of software tools including the GNU C Compiler written by Stallman himself. At that time many of these tools were incorporated into a Unix-compatible operating system by a 21-year old student at the University of Helsinki. His name was Linus Torvalds and he named the operating system Linux (LINUs - uniX).

Linux was made available for download on the Internet so other programmers could test and tweak the source code, then return it to Linus Torvalds. After a period of enthusiastic development Linux 1.0 was made available globally under the GNU General Public License which ensured it would remain free.

Programmers were keen to explore Linux and soon found some amazing uses for it. In April 1996, researchers at Los Alamos National Laboratory used Linux to run 68 PCs as a single parallel processing machine to simulate atomic shock waves. At $150,000 this supercomputer cost just one-tenth the price of a comparable commercial machine. It reached a peak speed of 19 billion calculations per second, making it the 315th most powerful supercomputer in the world. It proved to be robust too – three months later it still didn’t have to be rebooted.

Linux continued to grow in popularity as a text-based operating system while Windows became the dominant graphical desktop operating system. Recognizing that most PC users want the point-and-click convenience of a graphical environment, the Linux camp began to develop a system comparable to the Windows desktop.

From a handful of enthusiasts in 1991 to millions of users now – Linux has come of age. Today’s sleek K Desktop Environment (KDE) and the Gnome environment now offer a user-friendly alternative for Windows users – Linux for the desktop!
Choosing a Linux distro

At the very heart of Linux is a bunch of tried and tested compiled code called the “kernel”. The kernel provides the operating system with its core functionality, much like the engine in a car. It takes care of the basics, such as helping other programs access hardware and sharing your computer’s processor among various programs.

In addition to the kernel, Linux contains a number of system-level programs, such as the services to handle your email, web connection and bootloader. Consider these as a car’s transmission, gears, and chassis – without these the engine is not much use.

Linux distributions generally also include a large number of user-level programs – the applications for daily use. For instance, web browsers, word processors, text editors, graphics editors, media players, and so on. These are the finishing touches to the car that ensure a great ride – whitewall tires and soft leather upholstery.

All of these components are bundled together in a wide variety of Linux distribution packages, commonly referred to as “distros”. Just as all the components of a car are bundled together to make a complete car.

In the same way that there are many makes and models of cars there are many Linux distros to choose from. The most well known distros are RedHat, SuSE, PCLinuxOS and Ubuntu. Each distro has its own installer and unique default configuration according to what the distributor considers to be the best arrangement. The ideal one for you will depend on your own personal preferences and how you want to use Linux. The most popular distros are described below to help you choose.

RedHat Fedora

One of the most publicized Linux distros comprising the commercial RedHat Enterprise Linux product line and the unsupported free Fedora Core distro that is developed by the community, serving as a test base for RedHat Enterprise Linux. **Pros:** Widely used, excellent community support, innovative. **Cons:** Limited product life-span of the free edition, poor multimedia support. Free download at [http://www.fedoraproject.org](http://www.fedoraproject.org).
Novell SUSE

The community-based openSUSE distro, sponsored by Novell, is another distro with desktop focus which has received positive reviews for its installer and YaST configuration tools. The documentation, which comes with the boxed product, has been labeled as the most complete, thorough and usable by far. This distro provides the base for Novell’s award-winning SUSE Linux Enterprise products

**Pros:** Attention to detail, easy-to-use YaST configuration tools.

**Cons:** Huge distro – including over 1,500 bundled packages.


PCLinuxOS

A polished community edition based on the Mandriva Linux distro, which uses the K Desktop Environment (KDE) to manage the graphical user interface (GUI). The slogan “Radically Simple” describes its intention to be the most user-friendly distro for users migrating from the Windows operating system. The PCLinuxOS distro is gaining much popularity due to its instant familiarity and support for many media formats straight out of the box – including MP3, Quicktime and Microsoft’s wmv format.

**Pros:** User-friendly interface, good native multimedia support.

**Cons:** Smaller community than more established distros.

Free download at [http://www.pclinuxos.com](http://www.pclinuxos.com).

Ubuntu

This sophisticated community distro employs the popular Gnome GUI desktop manager. It has the advantage of a fixed six-month release cycle and a clearly set product lifetime of 18 months. Ubuntu provides great documentation and offers free CDs with free shipping to anywhere in the world. It does not include proprietary media codecs, to comply with legal requirements, but provides a one-click facility to add them on demand after installation. At the time of writing this edition is acknowledged to be the most popular Linux distro – so is used throughout this book to describe the many features of the Linux operating system.

**Pros:** Great community of developers and users, fixed release cycle.

**Cons:** Proprietary software not supplied by default – but can be easily added.

Evaluating hardware

Before installing Linux on a computer it is necessary to evaluate its hardware specifications for suitability. The table below suggests minimum specifications for processor, memory and hard disk (HD) drive.

<table>
<thead>
<tr>
<th>Hardware item</th>
<th>Suggested minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU speed</td>
<td>300Mhz – 1.0Ghz+ is better</td>
</tr>
<tr>
<td>RAM memory size</td>
<td>256Mb – 512Mb+ is better</td>
</tr>
<tr>
<td>HD drive capacity</td>
<td>5Gb – 10Gb+ is better</td>
</tr>
</tbody>
</table>

It’s easy to discover the CPU, RAM memory information, and HD capacity if Windows is already installed on the computer:

1. Click on the Start button, then the Control Panel menu item to launch the Control Panel folder window
2. In the Control Panel, click the System icon to launch the System window on Windows 7 or Windows Vista (the System dialog on Windows XP)
3. Read the Processor and RAM values, comparing them to the minimum requirements in the table above

Don’t forget
If you’re using Windows XP the settings are on the General tab in the System dialog.
Click on the Start button, then the Computer menu item (My Computer on Windows XP) to launch the Computer folder window.

In the Computer window click on the Local Disk labelled C: to reveal its Total Size and Free Space.

Compare the Total Size and Free Space values to the minimum requirements in the table opposite.

Consideration should also be given to the hardware used to connect to the Internet. Connection via a PCI ethernet card, or on-motherboard ethernet controller, is very well supported in Linux and virtually all hardware of this type is suitable.

Modern standalone external modems are also well supported, for both wireless and wired connection, but older internal modems can be rather more problematic. Many computers supplied with an internal PCI modem will only work with Windows software. These so-called “winmodems” are unsuitable for connection to the Internet in Linux. If you have an internal modem and find it is unusable in Linux you will probably have to replace it with different hardware before you can connect to the Internet. Usually the easiest solution is to connect an external modem via a traditional RS232 serial port.

If you are really determined to try to get a winmodem working in Linux visit www.linmodems.org for lots of useful advice.
Making space for Linux

An operating system is installed on an area of the HD drive called a “partition”. When Windows is the only installed operating system its partition will normally occupy the entire HD drive. To install Linux in this situation there are three possible options:

1 **Delete the Windows partition** – replacing it with Linux partitions that occupy the entire drive. This option will delete the Windows operating system along with all the applications and data files. It creates a dedicated Linux computer which will immediately start Linux when the PC gets switched on.

2 **Reduce the Windows partition size** – so that it no longer occupies the entire drive, then create Linux partitions in the resulting free space. This option will retain the Windows operating system, applications and data files. It creates a “dual-boot” computer that allows the user to choose whether to start Linux or Windows whenever the PC gets switched on.

3 **Add a second HD drive to the system** – this allows Linux partitions to occupy the entire second drive and retains the Windows operating system, applications and data files on the first drive. It too creates a dual-boot computer that allows the user to choose whether to start Linux or Windows whenever the PC gets switched on.

The option to install an additional HD drive for Linux is a popular choice for many people as they have often upgraded their original HD drive to a larger one, and so have their original drive spare. It also has several benefits over the other options:

- The free space on the Windows drive is not reduced
- It removes the risk of data loss through partition resizing
- The familiar Windows operating system is retained
- It distinctly separates the two operating systems
- Drive failure would only disrupt one operating system

Resizing partitions is a scary process where data loss can, and does, occur – even in expert hands. All contents of the partition must be backed up before attempting this operation.
Adding a second HD drive

Most modern PCs can accommodate up to four EIDE (Enhanced Integrated Device Electronics) devices, such as HD drives and CD/DVD drives, but typically ship with just two – one HD drive and one CD drive. This means that one or two more drives can be added simply by plugging them into the existing system.

The first HD drive in a system is known as the “Master” HD drive and a second HD drive is called the “Slave” HD drive.

A “jumper” connects two tiny pins to determine if the drive should be regarded as a Master (MA) drive or Slave (SL) drive. The top of each HD drive usually has a diagram depicting which pins need to be connected in each case.

1. Ensure that the jumper on the original drive is set to Master, then set the jumper on the second drive to Slave.
2. Connect the wide data cable to the Master HD drive, by the plug at the end of the cable – not the plug part way along the cable.
3. Now connect the data cable to the Slave HD drive, by the plug part way along the cable.
4. Connect the power cables to both drives, then close the PC case.
5. Start up the PC and check that both drives are now detected by the system – if the second drive is not detected change the BIOS settings to “auto-seek” it when booting up.

Hot tip

If you are not comfortable working inside your PC case a computer store should be pleased to undertake the fitting of a second drive for a modest fee.
Beginning installation

If you choose to install Linux on the same HD drive as Windows, it’s a good idea to clean up the disk before starting the installation.

1. Click on the Start button, then the Computer menu item (My Computer on Windows XP) to launch the Computer folder window

2. Right-click on the HD drive icon and select Properties from the context menu to launch the Properties dialog

3. Choose the Tools tab in the Properties dialog then click the Check Now button to open the Check Disk dialog

4. In the Check Disk dialog, select both options then click its Start button to schedule a disk check – you may now need to restart your computer to run the scheduled check

5. When the disk check has completed, click on the Defragment Now button in the Properties dialog to tidy up the file system – after the defragmenter has rearranged the files on the hard disk you’re ready to install Linux
6. Download your favorite Linux distro then burn it as a filesystem image on an empty CD disk. For example, download Ubuntu from www.ubuntu.com/download — or simply order it on a free CD at the same location.

Linux installations begin by booting the computer from the CD. This requires the computer BIOS (Basic Input/Output System) settings to seek boot instructions from the CD drive before using those on the HD drive. If your computer looks to boot from the HD drive first, you will need to change the BIOS settings.

7. Open the BIOS Setup Utility (typically by holding down the Delete key right after the memory test when the computer is first switched on) then locate the boot device order in the advanced BIOS features.

8. Make the CD drive the First Boot Device, and the HD drive the Second Boot Device — then save the settings and exit the BIOS Setup Utility.

9. Place the Linux image disk in the CD drive then start the computer to see a Welcome dialog load from the CD disk.

10. Choose the menu option “Try Ubuntu” without making any changes to your system — Linux then loads entirely in RAM memory and displays a working desktop without changing anything on the HD drive.

11. Click the “Install” icon that is displayed on the desktop to begin the procedure to install Linux on the HD drive.

Hot tip

Like Ubuntu, many Linux distros have a “Live CD” that let you initially try out Linux without installing anything on your HD drive.
Partitioning the disk

The Linux installer begins by asking you to select the language you prefer to use during the installation process, your location, and keyboard layout, before moving on to partitioning the HD drive. This prepares the disk by creating a partition for the Linux operating system and a swap partition for dynamic processes.

To create a “multi-boot” system select the option to add Linux side by side, or for greater control select the “Manual” option – then click the Forward button to launch the Prepare Partitions dialog.

1. Select the “free space” item – then click the Add button to launch the Create Partition dialog.

If there is no existing free space on the HD drive you can use the Change button to resize a Windows partition – but ensure all your data is backed up first in case of data loss when resizing.

Beware
The option to “Erase and use the entire disk” will remove all existing operating systems and data content.

Hot tip
If there is no existing free space on the HD drive you can use the Change button to resize a Windows partition – but ensure all your data is backed up first in case of data loss when resizing.
Specify a Logical Swap partition, of a size roughly double that of the RAM memory installed on your system, then click OK to update the Prepare Partitions settings.

Select the free space now remaining, then click the Add button again and specify a 7-10 Gb partition of type “ext4” with a mount point of “/” – this will contain the Linux operating system and allow space for additions.

Again select the free space now remaining, then click the Add button once more and specify another partition to occupy all remaining disk space. This should also be of type “ext4” but with a mount point of “/home” – to contain all the user-created files. The partition table settings should now look something like those below:

---

The “fourth extended” ext4 filesystem is now the preferred filesystem of many Linux distros. It is backward-compatible with its predecessors ext3 and ext2.

Separating the operating system and user files into separate partitions allows Linux to be reinstalled later while retaining the user’s data.