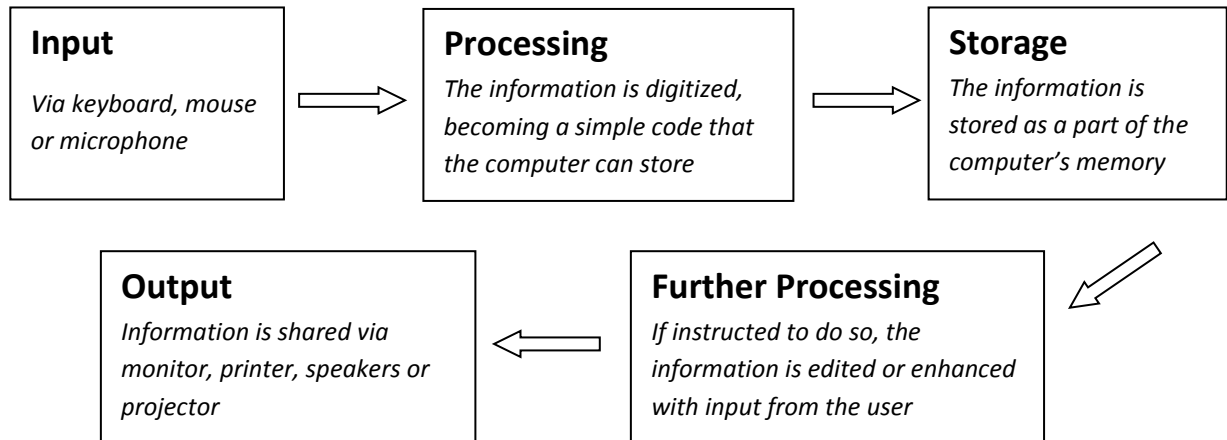


Basic Computer Technical Knowledge

How a Computer Works

A computer is a fabulous instrument that turns human inputs into electronic information that it then can store or share/distribute through various output devices. A computer performs (if instructed to do so) the steps shown in the diagram below, using information that a user provides (such as a typed sentence):



All of the equipment (hardware) and the instructions (software) needed to complete the above steps are described in the next section.

Hardware

Basic Hardware Components

Hardware is the physical equipment needed for a computer to function properly. The basic hardware parts are briefly described here.. A desktop computer is used in the photos, but all of this equipment is also found in a laptop computer.

Case. The computer case (also called a tower or housing) is the box that encloses many of the parts shown below. It has attachment points, slots and screws that allow these parts to be fitted onto the case. The case is also sometimes called the CPU, since it houses the CPU (central processing unit or processor), but this designation can lead to confusion. Please see the description of the processor, below.

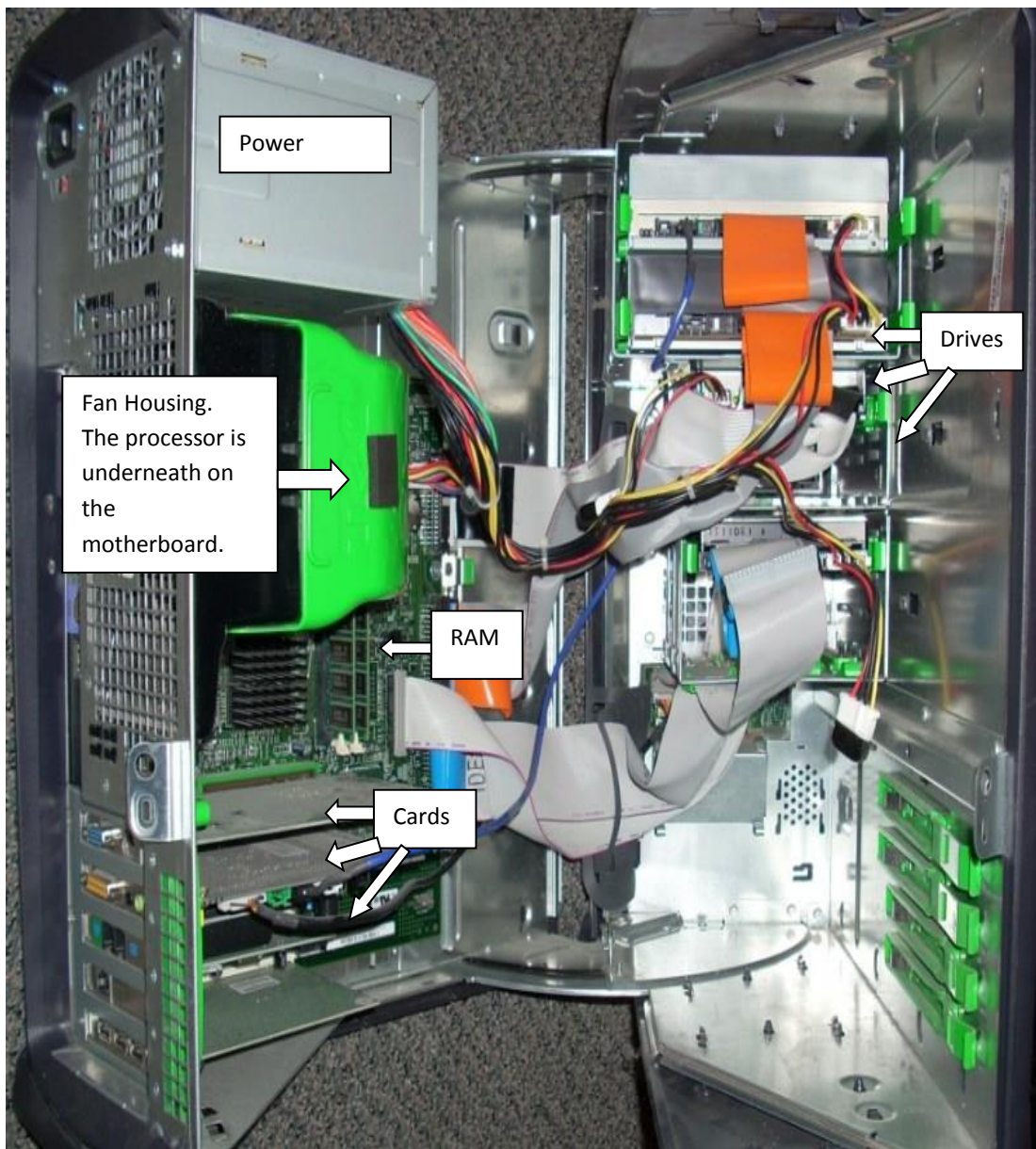
Power Supply. The power supply is used to connect all of the parts of the computer described below to electrical power. It is usually is found at the back of the computer case.

Fan. A fan is needed to disperse the significant amount of heat that is generated by the electrically powered parts in a computer. It is important for preventing overheating of the

various electronic components. Some computers will also have a heat sink (a piece of fluted metal) located near the processor to absorb heat from the processor.

Motherboard. The motherboard is a large electronic board that is used to connect the power supply to various other electronic parts, and to hold these parts in place on the computer. The computer's memory (RAM, described below) and processor are attached to the motherboard. Also found on the motherboard is the BIOS (Basic Input and Output System) chip that is responsible for some fundamental operations of the computer, such as linking hardware and software. The motherboard also contains a small battery (that looks like a watch battery) and the chips that work with it to store the system time and some other computer settings.

Drives. A computer's drives are the devices used for long term storage of information. The main storage area for a computer is its internal **hard drive** (also called a hard disk). The computer should also have disk drives for some sort of removable storage media.



A

Figure 1 - Inside a Desktop Computer Case

floppy disk drive was very common until recent years, and is still found on many older desk top computers. It was replaced by **CD-ROM** and **DVD drives**, which have higher storage capacities. The current standard is a **DVD-RW** drive, which can both read and write information using both CD and DVD disks. The USB ports (described later) on a computer can also be used to connect other storage devices such as **flash drives** and **external hard drives**.

Cards. This term is used to describe important tools that allow your computer to connect and communicate with various input and output devices. The term “card” is used because these items are relatively flat in order to fit into the slots provided in the computer case. A computer will probably have a sound card, a video card, a network card and a modem.

RAM. RAM is the abbreviation for random access memory. This is the short term memory that is used to store documents while they are being processed. The amount of RAM in a computer is one of the factors that affect the speed of a computer. RAM attaches to the motherboard via some specific slots. It is important to have the right type of RAM for a specific computer, as RAM has changed over the years.

Processor. The processor is the main “brain” of a computer system. It performs all of the instructions and calculations that are needed and manages the flow of information through a computer. It is also called the CPU (central processing unit), although this term can also be used to describe a computer case along with all of the hardware found inside it. Another name for the processor is a computer “chip” although this term can refer to other lesser processors (such as the BIOS). Processors are continually evolving and becoming faster and more powerful. The speed of a processor is measured in megahertz (MHz) or gigahertz (GHz). An older computer might have a processor with a speed of 1000 MHz (equivalent to 1 GHz) or lower, but processors with speeds of over 2 GHz are now common. One processor company, Intel, made a popular series of processors called Pentium. Many reconditioned computers contain Pentium II, Pentium III and Pentium 4 processors, with Pentium 4 being the fastest of these.

Peripheral hardware. Peripheral hardware is the name for the computer components that are not found within the computer case. This includes input devices such as a **mouse**, **microphone** and **keyboard**, which carry information from the computer user to the processor, and output devices such as a **monitor**, **printer** and **speakers**, which display or transmit information from the computer back to the user.

Computer Ports

The peripheral hardware mentioned above must attach to the computer so that it can transmit information from the user to the computer (or vice versa). There are a variety of ports present on a computer for these attachments. These ports have gradually changed over time as computers have changed to become faster and easier to work with. Ports also vary with the

type of equipment that connects to the ports. A computer lab manager should become familiar with the most common ports (and their uses), as described below.

Serial Port. This port for use with 9 pin connectors is no longer commonly used, but is found on many older computers. It was used for printers, mice, modems and a variety of other digital devices.

Parallel Port. This long and slender port is also no longer commonly used, but was the most common way of attaching a printer to a computer until the introduction of USB ports (see below). The most common parallel port has holes for 25 pins, but other models were also manufactured.

VGA. The Video Graphics Array port is found on most computers today and is used to connect video display devices such as monitors and projectors. It has three rows of holes, for a 15 pin connector.

PS/2. Until recently, this type of port was commonly used to connect keyboards and mice to computers. Most desktop computers have two of these round ports for six pin connectors, one for the mouse and one for the keyboard.

USB. The Universal Serial Bus is now the most common type of port on a computer. It was developed in the late 1990s as a way to replace the variety of ports described above. It can be used to connect mice, keyboards, printers, and external storage devices such as DVD-RW drives and flash drives. It has gone through three different models (USB 1.0, USB 2.0 and USB 3.0), with USB 3.0 being the fastest at sending and receiving information. Older USB devices can be used in newer model USB ports.

TRS. TRS (tip, ring and sleeve) ports are also known as ports for mini-jacks or audio jacks. They are commonly used to connect audio headphones and microphones to devices such as computers.

Ethernet. This port, which looks like a wider version of a port for a phone jack, is used to connect network computers via category 5 (CAT5) cable. Although many computers now wirelessly, this port is still the standard for networked computers. Some computers have a narrower port for an actual phone jack. These are used for modem connections over telephone lines.

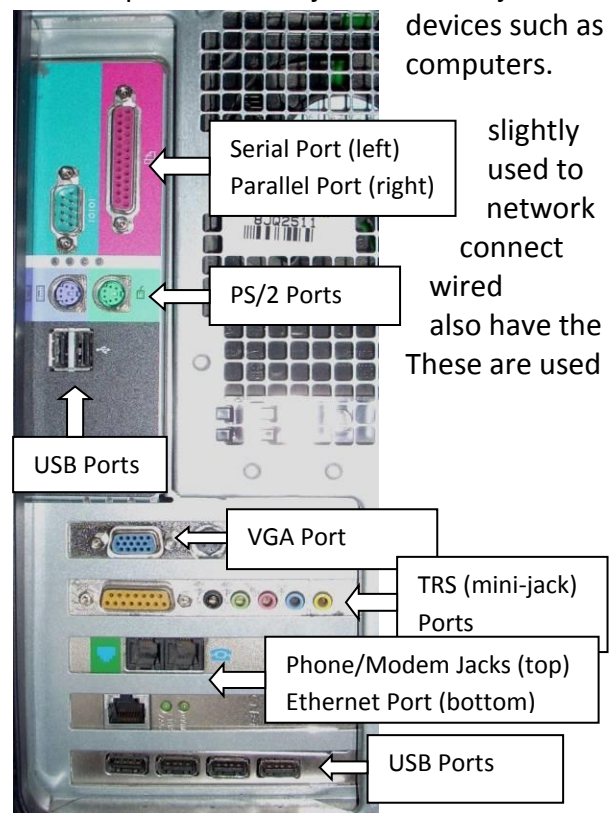


Figure 2 - Back of Desktop Computer Showing Ports

Fixing Hardware Problems

Tools and Safe Repair Practices

What tools will a computer lab manager need to perform basic hardware repair? This will depend on the type of computers being worked on, and also on what tools are locally available. However, good quality screwdrivers in different sizes will be on every lab's equipment list. The majority of the screws encountered in computers are of the Phillips type (the screw head has an X shape on the top), but flat head and hex head screws may also occur. A computer lab manager can look and see what types of screws are in use in the lab before making a purchase. Magnetic tip screwdrivers can be very useful since the screws will stay magnetically attached to the screwdriver while the lab manager locates the screw hole. However it is very important to avoid touching the tips of magnetic screwdrivers to RAM or hard drives, since the magnetic storage on those devices could be damaged. A pair of needle nose pliers may also be useful to assist when working in narrow spaces.

For cleaning computer parts, a computer lab manager will need some method for blowing dust out of computer hardware. If an electric blower is available, this is a very good option. Otherwise a hand operated blower (with a bellows or bladder attached to a narrow outlet) will do. If affordable, a computer lab manager can also purchase compressed air in aerosol cans. For dusting and cleaning computer and monitor cases, a lint free cloth is best. Screens (LCD and CRT) can be cleaned with slightly damp cloths or with small amounts of mild cleaning solutions that have been reported to be safe for computer monitors. If RAM needs to be cleaned, isopropyl alcohol and lint free swabs can be used.

There are several safety concerns (both for the lab manager and for the computer equipment) that need to be attended to. They are listed below.

- **Working Environment.** The computer work room should be clean, well organized and properly lit. Avoid hazards to the computer (such as dust or moisture) and hazards to the workers (such as electrical cords that can be tripped over). The lab manager should also consider good organization as a way to make repair work more efficient. It should be easy for a worker to return to a project without any difficulty finding the parts involved.
- **Static Electricity.** Static electricity discharges (sparks) can be significantly damaging to computer equipment such as RAM, CPUs and motherboards. Therefore it is important for the computer lab manager to ground him or herself before working with computer equipment. The *tip box* here gives some suggestions. If electrostatic mats or grounding wrist straps are available locally,

Tips for Avoiding Electrostatic Shocks

1. Avoid walking around as much as possible while working on a computer. Shuffling your feet (particularly on carpeted surfaces) can build up electrostatic charges.
2. Make sure to ground yourself before beginning a computer repair. The simplest way to do this is to touch a large metal object (such as a filing cabinet or metal computer case).
3. Before picking up each new computer component, ground yourself again.

these items can also be used to prevent electrostatic shocks.

- **Electrical Shock.** Before opening up the case of a computer or any other electronic device or cleaning it with any fluid, make sure that it is unplugged. Otherwise, electricity can be transmitted through the electronic device and into the worker's body. This can cause severe injury or even death. Laptop batteries should also be removed before performing any laptop computer repairs. It is best to avoid attempting repairs on computer monitors, particularly CRT monitors due to a risk of a dangerous electrical discharge.

Assignment #1

Part A - Computer components are ever changing and making improvements. To make sure you are up to date on the latest technology, you will need to write a word document containing the latest specs on the major components discussed above.

Part B – Once your teacher has received your word document and verified it is completed to their satisfaction, you will move to the computer workstation where you will be responsible for disassembling a computer, cleaning it, and then reassembling all of the parts.

Software

Software Types and Categories

As mentioned in [section 2.1](#), computer software is the term used for the instructions that have been programmed to allow a computer to process information. Software comes in three main categories, described below:

Operating Systems. These are the basic software programs that are needed to for a computer to work. They give a computer the basic information needed for it to process and store information. Currently all common operating systems are also graphical user interfaces (GUIs) which means they use graphics to help the user to easily input instructions, and open other programs. The most common operating systems (OS) are the Windows family of operating systems, from Microsoft. A computer lab manager is likely to encounter Windows 2000, Windows XP, Windows Vista and Windows 7 (the most recent Microsoft OS) in a computer lab. Other operating systems are described in the next section.

Utility Software. This is a broad category of programs that allow a computer to perform tasks that aren't a part of the operating system, but are still practical and useful. For example, a utility might instruct a computer on how to copy (burn) information to a CD-ROM disk, or it might be an anti-virus program (see [section 3.3](#)).

Productivity Software. This is one term used to describe the type of software used to perform standard office computer tasks. Word processing, presentation, spreadsheet and database software are all common examples of productivity programs. The most common set of productivity programs is Microsoft Office, offered by the Microsoft Corporation.

Proprietary Software vs. Open Source Software

The Microsoft operating system and productivity software packages mentioned above are very common and used around the world in business and education. The Apple Corporation also has very popular and successful operating systems used for their Macintosh computers. Despite the success of these software products, they aren't the best choices for everyone. They are proprietary, which means that their use and modification are restricted. They can be quite costly to buy licenses for, and they are not adaptable to meet local needs. Some users, particularly in developing countries, illegally use unlicensed (also known as pirate) copies of this software. This is legally unwise, and can also keep the user from accessing important software updates.

Users who cannot afford proprietary software or prefer software that can be locally modified, can choose to use open source (often called free and open source or FOSS) software. For most of the standard computer uses, an open source software option is available. This includes the Linux family of operating systems (which includes Ubuntu, a common operating system in African countries) and the OpenOffice.org productivity programs. The Source Forge website (www.sourceforge.net) is a good resource for finding and downloading open source programs. While open source software often does not come with professional support available, there are user groups found on the Internet who can offer assistance to puzzled users. This training module does describe how to perform some tasks using the Ubuntu operating system, but does not provide thorough coverage. Further assistance with Ubuntu is available through the website: <http://help.ubuntu.com>.

When first setting up a computer lab, the steering committee for a computer project should discuss the benefits of both proprietary and open source software and make an informed and intentional choice on which way to go. The computer lab manager should then make sure that he or she is aware of all policies related to software choices.

It is possible that a computer project will choose to use proprietary software for some purposes and open source software for others. For example, a project might be able to obtain used computers that have a Windows operating system legally installed (such as through a

Microsoft Authorized Refurbisher) but these computers do not include other Microsoft programs. In this case the organization might choose to continue to run Windows on its computers, but choose open source options for all utility and productivity software.

Assignment #2

Once your computer is reassembled and working. It is time to put a fresh version of the operating system on your machine. Please reformat the HDD and install a version of windows provided to you by your instructor. Once the OS is installed please make sure all of the drivers are functioning and that all windows updates have been installed.

Tips for Installing an Operating System

1. Make sure that the computer is set to boot first from the CD/DVD drive. To do this, enter the BIOS Setup program when starting up the computer. This will require pressing a key during startup. The key (often one of the function keys or the delete key) is specified at the bottom of the first screen during boot up. When the BIOS Setup program opens, scroll down (using the down arrow) to the "First Boot Device" line, and then use the onscreen instructions to select CDROM and save the change.
2. Shut down the computer, put the operating system CD or DVD into the drive, and then start the computer again.
3. The installation will automatically start, and you will be guided through the process by on screen tips and questions. Make sure you read each screen!
4. You will be asked for your preferences in regards to installation language, time and currency formats and keyboard layouts. Please note that the more common keyboard layout in your country might be United States English, even for those using the British English language.
5. When prompted, enter the product key (for Microsoft Windows operating systems). This is an important step for affirming the legality of your copy, and will allow your computer full access to online updates. Make sure, however, that you know how many computers your product license is good for, and then do not load the operating system onto too many computers.
6. When prompted, choose the location (which partition) for installing the operating system. You may also be given the option of creating new partitions at this step. If so, the partition created for the operating system should be at least 20 GB, preferably 30 GB. Make sure that you format the partition using the NTFS file system.
7. Follow any more on screen prompts and then wait patiently for the installation to finish.
8. Don't forget to change your boot order back to the original setting!

Computer Maintenance

Virus and Malware Prevention and Removal

Viruses, spyware and other malicious programs can all be referred to together as malware. Malware prevention is a significant maintenance task for a computer lab manager. Without vigilance, a computer lab will quickly become prey to malware. It will spread from machine to machine causing the computers to slow down, work improperly or possibly even stop working altogether. The computer lab manager needs to make sure that all of the computers have anti-virus software installed, and that this software is set up so that it regularly updates its virus databases and scans the computers. The **tip box** here gives more details on how to do this.

The computer lab manager also needs to have strict policies in place to prevent virus infection. Since viruses are easily spread by the use of flash drives, the policy could prohibit the use of flash drives, or require them to be scanned by a staff member before use. Another policy to consider is the prohibition of downloading, since unsuspecting users can accidentally download malware. A firewall that blocks dangerous downloads can also be useful.

Tips for Using Anti-Virus Software

1. You can get very good antivirus protection using the free edition of AVG, available online at <http://free.avg.com>. No anti-virus software is perfect, however, so you might choose to have a back-up antivirus program as well. Avast antivirus, available at www.avast.com will work well and will not conflict with AVG if it is not set up to scan automatically. Another good back-up program is Malwarebytes' Anti-Malware program, available at www.malwarebytes.org.
2. After installing antivirus software, make sure that you have selected the settings needed for the software to automatically download and install updates from the Internet. This allows the software to protect against newer viruses. To change the settings for AVG choose **Update Manager** from the **Overview** screen.
3. When setting up antivirus software, make sure that you choose the proper settings so that the computer is automatically scanned for viruses on a regular basis (such as every day at 12:00). Also make sure that you have selected for the scheduled scans to "run on computer startup if task has been missed". In other words, if you have chosen to have scans run at 8:00, but the computer isn't turned on until 10:00, it will still run a scan. In AVG these options are chosen by choosing **Manage Scheduled Scans** from the **Computer Scanner** screen.
4. Make sure that your computer has the proper date and time set. If it is not set properly, the update manager and schedule scans may not run at the time you desire. If your computer does not keep proper time, this is a sign that the small (watch style) battery on the motherboard needs to be replaced.

Assignment #3

PART A - Once your computer is up and running, it is time to protect your investment. Please choose a free anti-virus program and install it on your machine. Once installed run a scan and show your instructor the results.

PART B - Virus protection does not cover everything. Install malware bytes on your machine and run a scan. Show the instructor your results when complete.

Computer Hardware Maintenance

There are some common hardware problems that can be avoided, or at least made less frequent by taking particular preventive measures with computers. These preventive measures are listed below.

Dust Control. Dust is very harmful for computer parts. Excess dust can cause mechanical failures, particularly on computer components with moving parts. Minimizing dust in a computer lab is an important part of computer maintenance. Computer lab cleaning advice is discussed further in Module 2. The computers themselves should be regularly dusted (wiped with a dry cloth or duster) and if the computers are housed in a particularly dusty area, the use of dust covers (when the computers are turned off) is advised. In addition, when a computer case is opened for other repairs, the dust that has built up inside the case should be blown out. This works best with forced air. Different mechanical and electrical tools are available to compress air. These tools are described in [section 5.7.1](#).

Heat Control. Computer parts, in particular the CPU, produce a large amount of heat while operating. It is important for this heat to dissipate, so that the computer is not damaged by overheating. Computers do have fans and heat sinks, but these will only work well if the air flow to the computer is not blocked. This means, for example, that a laptop computer should not be left running for any length of time on a soft surface (like a sofa) that conforms around it, and a desktop computer case should not be used while in an enclosed cabinet. In addition, it is ideal that the computer lab temperature be kept low. Using air conditioners is a good option, since the windows can also be kept closed to minimize dust, but many computer projects cannot afford air conditioners or the associated electricity costs. Therefore curtains (to reduce the heat of the sunlight), open windows and fans are often the best alternatives, although their use requires increased vigilance against dust.

Surge Protection. In many countries, the electrical supply does not have a uniform (well controlled) voltage. Voltage is also variable due to surges that occur, particularly during thunderstorms and when power is returning after an outage. Voltage surges can be very

damaging to computers and other electrical components, and it is important to protect against these events. The simplest form of surge protection is to purchase surge protecting power (adaptor) strips. These devices contain 4 or 5 outlets that are protected by a fuse that is blown in case of a power surge. The quality of these power strips varies, though, and they cannot be guaranteed to be the safest form of surge protection. A second form of surge protection is a surge suppressor that is installed where the main power enters a computer lab. These devices, though more expensive, are of higher quality and will protect all of the electrical components plugged in to electrical sockets within the room. A third option to consider is to purchase uninterruptible power supplies (UPSs) to share between every two computers in a computer lab (since a UPS includes six to ten electrical sockets). A UPS regulates the voltage sent to the sockets located on the UPS itself, and also contains a battery that allows for continued operation of a computer after a power outage. Depending on the UPS model and the amount of equipment attached to the UPS, the battery might last for an hour or for just a few minutes, but even just a few minutes allows enough time for the user to save their work and shut the computer down properly.

Laptop Maintenance Issues. For computer labs using laptop computers, there are a couple of additional issues to be aware of that can affect the lifespan of the computer. Because laptop computers are moved around from place to place and handled more roughly than desktop computers, they are more likely to have hardware problems develop. One problem area, for example, is in the AC adaptor port. If it is found in the back of a laptop computer, it is easy for the computer user to tilt the laptop backwards and unintentionally place pressure on the AC adaptor as it is forced against the table top. The AC port (and any other port located on the back of a laptop) can be easily damaged from this stress. Therefore computer users should be instructed on the proper technique to use when picking up a laptop computer. A second problem area for laptop computers is that the screws on the laptop body gradually become loosened as the computer is moved about. A computer lab manager should periodically (perhaps twice a year) tighten the screws on all laptop computers.

Peripheral Hardware Use and Maintenance

Peripheral hardware will also last longer if it is well maintained. For peripheral hardware such as printers, projectors and external drives, all of the advice above about heat, dust and power surge control is still relevant and important. In addition, there are some tips below for using printers and projectors that will help these pieces of equipment work efficiently and last a long time.

Efficient Use of a Printer. Most computer labs will have at least one printer for the use of the computer lab manager and selected computer lab users. Printers are a great resource, but if not controlled well they can be overused. This puts unnecessary wear on the printer, and

also uses up expensive ink and paper. It would be wise for a computer lab manager to have in place some policies about what sort of material can be printed, and when color ink use is allowed. Users should also be instructed to preview their work before printing, to avoid printing unnecessary pages. In addition, many printers have different printing settings that control the quality of the printouts and thus the amount of ink used. Inkjet printers, for example, usually have an option for “draft” or “fast” printing that uses significantly less ink, but still looks reasonably good. To find this option when printing a document, select **Print** from the **File** menu (or the Office Button in MS Word 2007). When the print menu opens, there will be a **Properties** button next to the selected printer. Clicking here will bring up choices such as the print quality and whether the printout should be in color or black and white.

Assignment #4

Install a printer on the computer. Once the proper drivers have been installed, please print a test page to show your instructor.

Setting Up or Customizing a Computer

When a Computer Arrives

What should be done before using a new computer? This depends very much on where the computer came from and what software was already installed. If a computer project receives new computers complete with an operating system and all productivity software, little needs to be done before using the computers. The computer lab manager should check, however, to make sure the computer is fully set up to meet the needs of the project. Some items to investigate are listed here:

- Does the computer already have all of the programs that are desired for the project? This could include, for example, an Internet browser, productivity (office) software, antivirus software or perhaps some educational software.
- Does the computer already have all of the files that are desired for the project? For example, an educational project might want to have an encyclopedia or some educational presentations loaded on all of the computers.
- Does the computer have separate user accounts with passwords? This is a good way to control what access some users have to particular programs, files or settings. See [section 4.5](#) for more information. Another option to consider is installing and using Microsoft SteadyState as a way to control what part of a computer certain users can access (see Module 2, section 6.2.4 for more information).

Partitioning a Hard Drive

A partitioned hard drive is one that has two (or more) different sections for storage of different types of information. In some cases, one partition is used to store the operating

system and related files, while the other partition is used to store user documents and settings. This partitioning is valuable in cases when the hard disk has not failed, but the partition with the operating system needs to be reformatted due to some sort of localized problem. Then the computer user's documents and settings are not lost in the process. This sort of partitioning is usually done when installing a computer operating system. Computer lab managers can see the tip box in the next section for more information on this process.

A computer lab manager can, however, create a new partition at any time. If a new computer arrives with an operating system installed but without a separate partition, the computer lab manager may want to add one or two partitions. A separate partition can also be used by a computer lab manager that would like to have two different operating systems on the same hard drive, with one operating system loaded onto each partition. The *tip box* here describes the process for creating a partition after an operating system has already been installed.

Tips for Partitioning a Hard Drive

Please Note: The instructions below are for a computer running Windows XP or Vista that a computer lab manager would like to add a partition to without reinstalling the current operating system.

1. Go to **Start → Control Panel → Administrative Tools** (for Windows Vista, Administrative Tools is found inside System and Maintenance).
2. Double click on **Computer Management**, and then from the left side of the window select **Disk Management**.
3. The window that appears will show the different disks in the computer. Right click in the space to the right of the label for the hard disk, and click **New Simple Volume**. The New Simple Volume wizard will open. Follow the prompts to format the new volume with an NTFS file system.

Please Note: if a disk is already partitioned, right clicking on a partition volume and will give you options to change its size or delete the partition.

Assignment #5

On a separate computer please reformat the hard drive so that 50% of the HDD is unformatted. Once installed partition the rest of the drive so that you have a "E" and "F" drive.

Setting Up User Accounts

A user account is a set of information that is used by a computer's operating system to designate the settings that a particular user prefers (such as desktop background or icon size), control what files and folders a user can access, and control what changes a user is permitted to make to a computer. After a new operating system has been installed on a computer, the user is required to set up an initial user account. This account is by default an administrator account, which means that the user of this account has the ability to access and change all computer settings, and install and uninstall programs as desired. In most cases, a computer lab manager will not want all of the other lab users to also have these privileges and will therefore want to set up more restricted user accounts for other computer users. Depending on the type of computer project, the lab manager might want to set up general accounts for all users of a certain type (such as an account called "students" or "clients") or they might want to set up specific password protected accounts for individual users.

User accounts can be easily set up by a lab manager who is logged into a computer using an administrator account. For a Windows computer the lab manager would select **Start → Control Panel → User Accounts**. On a computer running the Ubuntu operating system the lab manager would go to the main menu and choose **System → Administration → Users and Groups**. Once there, the lab manager will be able to set up the account and choose the privileges for those users. For Windows computers, the "standard" account type should be chosen for all users that the lab manager does not want to have administrative privileges. The lab manager can also log in to his or her administrative account on a computer to remove users or change the passwords on user accounts as needed to control access.

Assignment #6

Using the above information, you will need to set up two different accounts. One will be an administrative account and the other will need to be a regular user account. Once complete show your instructor.

Computer Troubleshooting and Repair Basics

This section of Module 1 is designed to empower the computer lab manager to take care of minor computer problems. Without the knowledge here, many lab managers will end up letting computers sit idle that could be easily put back into service, or paying for expensive repairs that could have been handled locally. There will still be times when computers fail and need to be sent out for repair by an expert, but those times should be few and far between.

Improving Slow Performance

Many of us have had an experience with a computer in which we open a program, and then find that we are waiting for over a minute for the program to actually open. Some of us have also had the experience of turning on a computer and then having to wait several minutes for the computer to fully start up and load all of the features that we are accustomed to seeing on the desktop. There can be several reasons for this sort of slow speed, and many of these reasons are due to problems that can be easily addressed. Several possible problems and the strategies for addressing them are described in the sections below. Please note that software solutions are discussed before hardware solutions since the software solutions are usually the right place to start for computers that have gradually decreased in performance over time. In some cases, however, such as much older computers with small amounts of RAM and slow processors, the hardware solutions will be more effective.

Hard Disk Fragmentation

Over time, all computer hard disks become fragmented. Fragmentation is when files are stored in different “pieces” in different places on a hard drive, depending on what storage space was available when the file was last modified. As the amount of free space on a hard drive decreases, typically the fragmentation increases. Accessing files becomes slower because the computer has to look around in different places on the hard drive to find the different pieces of a file. To address this problem, a hard drive should be defragmented. Defragmenting can also become a regular maintenance task for heavily used computers to keep them performing well. Most computers come with a defragmentation program installed. On a Windows computer it should be found in **Start → All Programs → Accessories → System Tools**. If no defragmenting program is found there, some free defragmenting programs are available from www.download.com.

Excess/Unused Files

As a hard disk becomes full, a computer’s performance is reduced. It takes more time to find and access needed files, and defragmentation is not as successful due to a lack of free space to temporarily move files to while they are being rearranged. For best performance, there should be at least 1 GB of free space on the computer’s hard disk. Therefore, it is wise for a computer user not to keep files that are no longer needed. Files that have been stored in a user’s documents folder that are no longer needed (such as extra photos or older versions of documents) are best deleted individually by the user. A computer lab manager should also have a policy and procedure for regularly deleting old files created by computer lab users on shared computers. In an educational lab, for example, the lab manager could announce that student files are deleted at the end of every term, unless the student makes special arrangements to preserve his or her work.

Sometimes there are other files, such as temporary Internet files, that are stored on a computer without the user knowing it. To delete these sorts of files, perform both of the following techniques:

- **Disk Cleanup.** In a Windows computer the Disk Cleanup utility is found in **Start → All Programs → Accessories → System Tools**. It scans a hard disk for unnecessary files, and then (with the user's permission) removes these files.
- **Deleting Browsing History.** When using the Internet, the browser stores the recent history of the web pages that the user has viewed, in order to make it easier to find and load these web pages again. The browser also stores other small bits of information such as data entered into forms and usernames or passwords if a user has asked a web page to "remember me" (although this is not a good idea for shared computers). This stored information can be easily deleted. In Mozilla Firefox, choose **Clear Recent History** from the **Tools** menu. In Internet Explorer, choose **Delete Browsing History** from the **Tools** menu.

Assignment #7

In this section you will need to run both a scandisk and HDD defrag. Once each item is complete record your results and show your instructor.

Excess/Unused Software

Excess software, particularly if it is software that loads when the computer is booting up, can certainly slow performance. If a user is certain that a particular program is not used and is not needed for the computer to function properly, then this software can and should be deleted, as described in [section 4.4](#). It is also possible to stop some software from automatically starting up when the computer boots. For computers running Windows operating systems, the System Configuration Utility can be used to perform this task. From the **Start** menu choose **Run** then type in "MSCONFIG" (for Windows Vista users, find the Run command line from **Start → All Programs → Accessories → Run**). From the window that appears, choose the **Startup** tab, and then unselect any programs that do not need to be enabled during computer start up.

Hard Disk Faults

Most computers come installed with a program that allows a user to scan the hard disk for faults and even repair them if possible. On many Windows computers there is a program called Scandisk, found in **Start → All Programs → Accessories → System Tools → Scandisk**. Another option is to run a program called Chkdsk, available on all Windows computers. To run Chkdsk, go to **Start → My Computer** and then right click on the image for the C: drive. Select **Properties** and then click on the **Tools** tab. Under Error Checking, click **Check Now**. The computer may require the check to happen while restarting the computer and if so will schedule this task to occur.

Malware

Viruses, worms, spyware and adware are collectively known as malware. These undesirable programs, which are usually added without a user's knowledge, can significantly slow down the performance of a computer. Keeping antivirus software up to date and running scans on a regular basis are the best ways to prevent virus infections. This is discussed further in [section 3.3](#). Occasionally, however, a computer will still become infected with a virus or other bit of malware that the anti-virus program did not catch. Some signs of these infections, other than slow speed, could be strange files popping up in folders, new small programs that appear (with an .exe file extension) or odd performance issues. When this occurs, the computer lab manager can do an Internet search using the names of the strange files or programs, or a description of other symptoms. These searches will often result in information about the particular malware infection and how to remove it. Another option for computer lab manager is to try scanning the computer with a second anti-virus program, which might identify the infection that the other anti-virus software missed. However, the lab manager needs to be aware of the possibility that the two anti-virus programs will conflict with each other and themselves cause the computer to run poorly. If a second anti-virus program is installed, the computer lab manager should make sure that it is not also set up to do any sort of automatic scanning.

Overheating

Excessive heat can cause a significant decrease in computer performance. In order to cool down an overheated computer processor, the first step to take is to try to cool the environment around the computer. Avoid operating the computer if the case is in an enclosed space (such as a drawer or cupboard). Also try to cool the room with fans or air-conditioning. The next step is to verify that all of the fans in the computer case are functioning properly. Check around the computer vents to see if the spinning of the fans can be observed or if airflow can be detected. If neither of these steps address the problem, the computer lab manager could consider installing additional fans or replacing the existing fans with higher quality ones.

How to Search for Information

It is very important that a computer lab manager not "give up" easily when presented with a computer problem. Instead the computer lab manager should turn the problem into an opportunity to gain knowledge about computers. This includes asking for help and searching for information about the particular problem, its causes and solutions. The first step in this process is to see what advice is available on the computer itself (or another one running the same operating system). With Windows computers, there are "Help and Support" documents located on the computer, and more available on the Internet. From the **Start** menu, click on **Help and Support** and then see which categories of help best match the problem.

If a computer lab manager doesn't find the needed answers using Help and Support on the computer, the next step is to find answers on the Internet. In most cases, the computer problems that a lab manager encounters will not be new or unique. Someone else would have had the same problem and would have written a description of how they solved the problem.

It is important that the computer lab manager give very specific search terms and try different terms if not successful at first. For example, if a lab manager is having problems getting the sound to work on a specific computer, “sound problems” would not be a specific enough search. The lab manager would be better trying “sound problem Dell D600” or “sound failure Dell D600”. If the lab manager knows that the problem is due to the device driver, an even better search would be “sound device driver problem Dell D600”.

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