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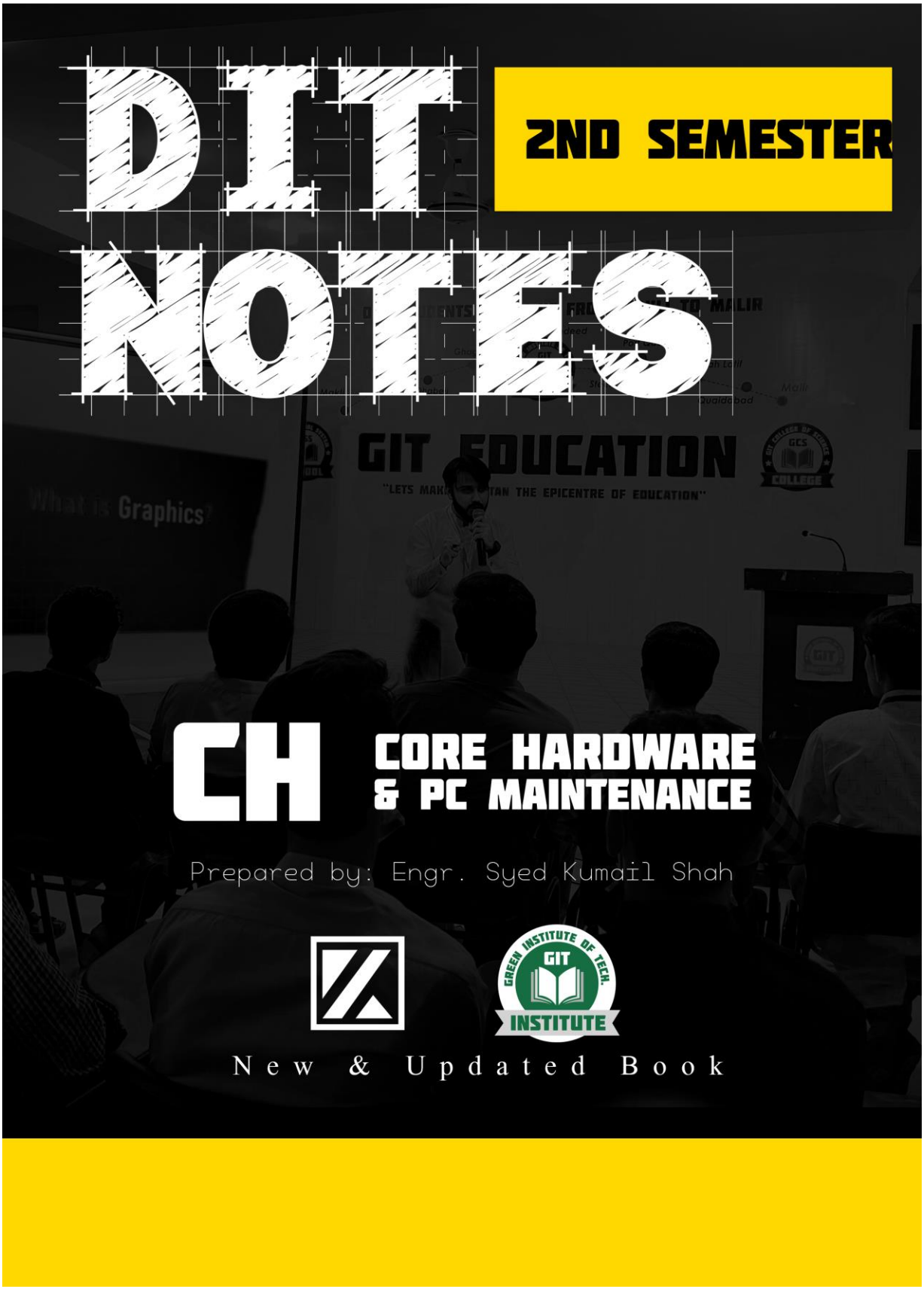

CH CORE HARDWARE & PC MAINTENANCE

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New & Updated Book

UNIT-1

Hardware Components of Personal Computer

System Board/Motherboard

The system board, also known as the motherboard, but sometimes referred to as the mainboard, is the primary circuit board into which all of the other components connect. In essence, the system board is the part that brings all other parts together. In the early days of PCs, the motherboard provided a socket for a CPU, a place for memory, expansion slots for add-on devices, and some other basic system functions, but not much else. Additional functionality, like connectors for hard disk drives, sound cards, mice, and so on, was provided through expansion cards that plugged into the motherboard's expansion slots.

Today's motherboards tend to adopt a more integrated approach, often combining hard disk, floppy disk, video, parallel ports, serial ports, modem, network card, USB, mouse, keyboard, joystick, and sound into the motherboard itself. When a motherboard offers this functionality, it is said to do so "on-board," as in on-board video.

Motherboards come in a variety of sizes and shapes known as form factors. The form factor defines such things as how big a case is required to fit it into, and determines everything from the type of memory and processors used to the connectors and location of the expansion slots.

The two most common types of motherboards used today are the older Advanced Technology (AT) motherboards and the AT Extended (ATX) motherboards. For a detailed discussion on motherboards,

Power Supply

The power supply is the means by which a computer system gets its "juice." A power supply is necessary because computer components actually use a smaller amount of power, and in a different format, than that which flows out of the wall socket. In practical terms, a computer power supply takes the alternating current (AC) voltage supplied through the cable connecting it to the wall, converts it to direct current (DC), and drops the voltage to a fraction of what was supplied. The conversion and reduction process generates heat, which is why power supplies have fans built into them to aid cooling.

There are two primary types of power supplies: AT power supplies, which have unique connectors to fit on an AT motherboard, and ATX power supplies designed to work with ATX motherboards. If you ever need to replace a power supply, you will need to ensure that you purchase the correct one for the job.

Processor/CPU

Processors, or to give them their proper name, central processing units (CPUs), are the brains of the computer system. They are the means by which all processing in the computer occurs.

Processors come in a variety of shapes and sizes, and the type of processor used must be compatible with the motherboard into which it is to be plugged. In other words, all processors are not compatible with all boards.

Processors generate a significant amount of heat—heat that can damage or even destroy a processor if it is not dissipated. For this reason, processors use metal conductors called heat sinks to pull the heat away from the processor, as well as fans that typically mount directly on top of the heat sink to move the hot air away from it. Heat sinks are made with fins that serve to increase the surface area of the sink and so improve the efficiency of the heat dissipation. Figure 1-1 shows a CPU with a heat sink and fan.

Memory

When we talk about memory, we are referring to random access memory (RAM), which is an essential part of every PC system. RAM stores information temporarily so that it can be used and accessed by the components of the system. RAM is a commonly upgraded component and one that PC technicians will be expected to frequently work with.

Storage Devices

Just like closet space in our homes, the computer system needs storage space, a place to store all of those documents, MP3s, and programs. When we talk about storage devices, we are most often referring to hard disk drives, though in today's multimedia world the category can also be expanded to include CD, CD-R and CD-RW, and DVD drives, floppy disk drives, Zip drives, tape drives, and even USB devices such as memory sticks. All of these devices make it possible to store files for later retrieval.

There are three basic types of storage—magnetic, optical, and silicon. Magnetic storage devices include hard disks, floppy disks, and proprietary formats like tape and Zip disks. Optical storage includes all of the CD- and DVD-based media. Silicon-based storage is a relatively new addition to this category, and includes storage devices like USB memory sticks and memory cards like those used in digital cameras. At the moment, the cost of these is high and the capacities are low, but as with everything else in technology, prices are falling and capacities are going up. Soon they will offer a viable alternative to other removable media.

Monitor/Display Devices

Computer monitors are one of the means by which we interact with the computer system. A computer can function without a monitor, and in fact some systems can be used in this "headless" fashion, but in general every PC has a monitor.

Monitors come in different types. The traditional cathode-ray tube (CRT) monitor is what you are most likely to see in your travels, but there is an increasing trend toward liquid crystal display (LCD) screens, which are also called flat-panel displays.

There are two types of desktop monitors, Video Graphics Array (VGA) monitors and Super Video Graphics Array (SVGA) monitors. The difference between the two is that the SVGA monitor is capable of displaying a higher-definition picture. SVGA monitors are more common nowadays, but if you are working with an older computer system, you might find yourself staring at a VGA monitor.

Modem

Modulators/demodulators, or modems, are devices that offer translation services. Their job is to translate the digital signals sent from your computer into analog signals that can be transferred over a

conventional phone line. At the other end of the line, another modem is required to once again convert the analog signal back into digital format so that the receiving computer can understand it.

Modems come in both internal and external versions. External modems are housed in a box and normally require an external power supply. Connectivity to the PC can be achieved via serial communication or via USB. Internal modems are installed in an expansion slot inside your computer. Of the two types, internal modems are far more common and, unfortunately for us as technicians, often more problematic in terms of configuration and management.

Firmware

Firmware is a program (software) that is stored on a chip (hardware) but is not considered to be software or hardware. In other words, it is between hardware and software—in between soft and hard comes firm. The terms BIOS and firmware have been used interchangeably and serve to confuse the issue. Firmware simply refers to the programs that are stored in chips and not on hard disks or other such devices.

BIOS/CMOS

In the computer world, it is software that tells the hardware what to do. The first set of instructions given to the computer as it boots up comes from the basic input/output system (BIOS).

The BIOS firmware is stored in the complementary metal-oxide semiconductor (CMOS), a special chip on the motherboard that holds the various BIOS settings. These settings include things like the parameters for the hard disks, the boot order, and the status (either enabled or disabled) of on-board devices. Because the BIOS is firmware, it can be updated, though it requires a special program to achieve this. The process of upgrading the BIOS is referred to as flashing. The BIOS can be flashed to provide additional functionality or to correct a problem with the current version of the BIOS. The procedure for upgrading the BIOS is covered later in this chapter.

BIOS settings are configurable through a special program. This program can normally be accessed by pressing a specific key, or combination of keys, on boot-up.

The CMOS is a chip that stores the settings for the BIOS. The CMOS is a type of RAM, which means that if the system is powered down, it will lose its settings. Of course, having to reinstall hardware settings every time the computer is shut down would be very inefficient. Instead, the CMOS RAM is powered by a battery so that its settings will be retained. As with any battery, however, it will at some point lose power and be unable to hold the settings. This situation is seen from time to time when the system boots and the hardware configurations have to be reset every time. Simply replacing the battery corrects this problem.

Ports

One of the terms you are going to hear with great frequency when working with computers is ports. The term ports are actually very broad and can refer to many different things. As you will see throughout this book, ports refer to the physical connectors the system uses to communicate with other system devices. Ports of this nature carry names such as COM1 or COM4, and are used by devices like the mouse or modem to communicate with the system. Another port type, LPT ports, can be used by printers to facilitate communication between the printer and the computer.

Peripheral Ports, Cabling, and Connectors

Working with Cables

Cables are relatively simple things to work with. In most cases it's just a matter of plugging one end into the computer and the other into the peripheral device. To make things even easier, most cable connectors are either made so that they will only fit into a connector one way, or "keyed" so that it's easy to tell which way the connector should fit. Add to that the fact that many cables look different from other cables, and what you have is a simple way of connecting devices.

Cable Types

Cables often come in two forms, shielded and unshielded. Shielded cables have a wire mesh or foil added between the inside wire and the outer sheath designed to protect the cable from outside interference. Unshielded cables are cheaper but do not offer a great amount of extra protection against outside interference.

Serial communication is called such because the data travels across the wire in series—that is, one bit at a time. This makes serial communication relatively slow, but at the same time, simple. Many devices, such as mice, make use of this simple form of communication.

Parallel communication is faster than serial communication because it transmits data in parallel—that is, 8 bits at a time. It's like having eight cashiers working in that crowded grocery store.

Peripheral Ports

There are a number of different peripheral ports used by the computer system, each of which is used to connect certain types of peripherals. Each port also uses a specific design of connector and a number of pins to make the physical connection.

Serial Ports

Serial ports are most commonly used for connections to mice and modems, though they are also used for a multitude of other devices as well. They come in 9-pin and 25-pin versions, and use the DB-9 and DB-25 connectors, respectively. Typically, a PC will have at least one, if not two, serial ports. Serial port 1 (COM1) is typically reserved for the serial mouse, and if you have a modem connected to your system, it will often occupy serial port 2 (COM2). Like most other devices connected to the computer system, the serial ports require both an I/O and IRQ address to function. Table 1-4 shows the resources used by serial ports.

Parallel Ports

Parallel ports are used primarily for connectivity to printers, but they can also be used for connecting to other devices such as scanners and external storage devices. Parallel data transfer is faster than serial, which makes the parallel port more suitable in these instances. Most systems are equipped with only a single parallel port, but it is possible to add more ports if needed. When

connecting a printer to the parallel port, we use a DB-25 connector on one end and a 36-pin Centronics connector on the other. Figure 1-5 shows the connectors on a parallel printer cable.

Joystick Ports

Gaming has always been a popular function for a PC, so much so that all but the earliest PCs (and servers) come with a game or joystick port.

USB Ports

USB is increasingly being seen as the interface of choice for devices like digital cameras, external hard drives, and the like. USB offers many advantages over other interfaces, such as serial, including faster speeds, bidirectional communications, powered connections, and plug-and-play support. PCs and laptops now come with at least two, if not four, and sometimes six, USB ports. For more USB ports, you can add hubs to provide support for a maximum of 127 devices (though this theoretical maximum is not really practical). There are currently two versions of USB available. USB 1.1 has a speed of 12 Mbps, and USB 2.0 has a maximum speed of 480 Mbps. The USB 2.0 standard (also referred to as Hi-Speed USB) is designed to be backward compatible from the peripheral end, meaning that you can connect a USB 2.0 device to a USB 1.1 port on the computer, though it will obviously only operate at USB 1.1 speeds.

IEEE 1394

IEEE 1394, or FireWire as it is more commonly known, is a hot-swappable interface used for installing all manner of external devices, from hard disk drives to digital cameras and MP3 players. FireWire has a maximum speed of 400 Mbps and supports up to 63 devices. FireWire's consistently high data rates make it popular in applications such as camcorders, where large volumes of data need to be transferred at high speeds.

Peripheral Connectors

Having looked at the peripheral ports commonly found on a PC, we can now look at the physical connectors used by these ports. The following sections describe some of the more commonly used ones.

DB-9

DB-9 connectors are used for serial communication ports. Most PCs will come with at least one DB-9 port, though most come with two. Some PCs will have one DB-9 connector and one DB-25 connector.

DB-15

DB-15 ports are used for joystick, or game port, connectors. Most PCs will come with a single DB-15 connector, though it is possible to add more if you need to connect more devices.

Nowadays, the most common application for a DB-25 connector is a parallel port. When used as a parallel port, the DB-25 connector on the back of a PC is a female connector. In the past, DB-25 male connectors for serial ports were also common, but most PCs now use DB-9 connectors for this purpose. DB-25 connectors are also used with some external SCSI implementations. SCSI is discussed later in this chapter. Figure 1-7 shows examples of a DB-9 and a DB-25 connector.

RJ Connectors

Registered Jack (RJ) connectors are small plastic connectors used for connecting multiline cables. RJ connectors have a flange that acts as a locking mechanism when it is inserted into its receptacle. There are two RJ connectors commonly associated with PCs—RJ-11 and RJ-45.

RJ-11

The RJ-11 connector is used for telephone cables. In a PC environment, The RJ-11 connector can accommodate up to six wires, but in telephone cable applications only two or four wires are used. Most commonly you will see RJ-11 connectors on phone cables when working with modems.

RJ-45

RJ-45 connectors are used with twisted-pair network cabling. They can accommodate up to eight wires. They are slightly larger in size than RJ-11 connectors, which make it easy to distinguish between the two.

BNC

British Naval Connectors (BNC connectors) are used in networks that use thin coaxial cabling. BNC connectors have a kind of "twist-and-lock" (or push-and-turn) system that uses locating pins on the receptacle. The connector is aligned with and pushed onto the pins, and then twisted into place. At the end of the twist, the connector locks into small depressions in the twist groove.

PS/2 Mini-DIN Connectors

Mini-DIN connectors were first used in PCs by IBM in their PS/2 range of personal computers, which is how they came to be known as PS/2 connectors. DIN connectors get their name from Deutsche Industrie Norme, the German standards organization that created them. Mini-DIN connectors are used for connecting mice and keyboards to PCs. The term Mini-DIN is used because the connector is smaller than the standard DIN keyboard connector.

DIN-5 Connectors

DIN-5 is the connector type associated with the old-style AT keyboard connectors. DIN-5 connectors have five pins that are arranged in a crescent shape at the bottom of the connector. A "key" at the top of the connector is provided for correct orientation in the socket. With the advent

of the newer-style Mini-DIN (PS/2) keyboard connectors, DIN-5 plugs have all but disappeared from new systems.

USB Connectors

The universal serial bus interface has two types of connectors associated with it. A small, flat-looking connector is defined as the host or hub connector. A smaller, squarer connector is defined as the peripheral connector. Although this is the defined method of dealing with USB connectors, it is not uncommon for peripheral devices to have a host-type connector. In this case, the cable has the same connector on both ends.

IEEE 1394 (FireWire)

IEEE 1394, or FireWire, ports come in both four- and six-pin versions. In each case, one side of the connector is shaped to ensure that it can only be plugged in correctly. Figure 1-12 shows an example of an IEEE 1394 port and connector.

Installing and Configuring ATA/IDE Devices

First off, the terms AT Attachment (ATA) and Integrated Device Electronics (IDE) are one and the same; both define a type of hardware interface that is commonly used to attach devices such as hard drives and CD-ROM drives to a computer system. For the purposes of this book, we will usually refer to the ATA/IDE interface simply as IDE.

- ATA-1

  The ATA-1 standard was formalized in an attempt to eliminate compatibility issues that were arising with the ATA interface. This compatibility problem was particularly evident when drives from different hardware manufacturers were linked together as a slave and a master.

- ATA-2

  The ATA-2 standard, also known as Fast ATA (a name that made SCSI supporters smile), offered significant speed improvements over the ATA standard. Another notable addition was the support of logical block addressing (LBA). LBA is simply a means for the computer to recognize hard drives larger than 504 MB. For those of us with partitioned hard disks, this came as a welcome addition. The ATA-2 standard, like its predecessor, has been retired.

- ATA-3

  ATA-3 introduced the self-monitoring analysis and reporting technology (SMART), a technology that allowed the device to monitor itself while allowing the operating system to notify the user of potential device failure. ATA-3 also introduced new security features that allowed devices to be password-protected. Surprisingly, the ATA-3 standard did not

enhance transfer speeds; therefore, the ATA-3 standard was not well received in the marketplace. ATA-3 had the shelf life of bananas.

- ATA-33 (ATA/ATAPI-4)

  Things started to get more interesting with the introduction of the ATA-33 standard, which is also referred to as ATA/ATAPI-4. This standard, the first of the Ultra-DMA (UDMA) standards, introduced many improvements, bringing us considerably closer to where IDE technology is today. The other major feature of the ATA-33 standard was AT Attachment Packet Interface (ATAPI). ATAPI is an interface extension that accommodates devices such as CD-ROM and tape drives. Finally, the ATA-33 interface introduced a new 80-conductor, 40-pin cable. It was intended to reduce or eliminate interference, but as it turned out, it was not necessary for use with ATA-33.

- ATA-66 (ATA/ATAPI-5)

  The ATA-66 (ATA/ATAPI-5) standard was published as recently as 2000, and as ATA-33 doubled the speed of ATA-3, ATA-66 doubled that of ATA-33. The ATA-66 standard did require the use of a new 80-conductor, 40-pin cable to connect the hard disk to the system.

- ATA-100 (ATA/ATAPI-6)

  All of this brings us to where we are today. The latest and greatest standard in the works is the ATA-100, which will be using the latest DMA transfer modes, allowing data transfers at 100 MBps. Once again, the 80-conductor, 40-pin cable is required.

Installing and Configuring Peripheral Devices

In today's computing world, we have a multitude of peripheral devices that we need to know how to configure and install on a computer system. Many of the procedures and strategies used to connect and manage these devices are common throughout.

Today, however, unless there is a problem, installing all manner of peripheral devices is managed through the Plug and Play magic. Today when we install peripheral devices such as Uninterruptable Power Supplies (UPS), digital cameras, printers, scanners, modems, and virtually any other device, the installation procedures follow some generic and common steps.

Most devices would be installed in the following manner:

- Read the manual: The documentation that came with the device is the best for discovering those installation guidelines. Depending on the OS used on the system, the installation procedures are likely to vary, the manual will let you know. If the manual is lost, the manufacturer's Web site will likely provide the same information.

- Obtain the latest drivers: One of the biggest battles we face in modern installations is having the correct drivers on hand. Windows may have built in drivers for the device which typically work well but if not, you may have to obtain the drivers from the manufacturer's Web site.

- Physically connect the peripheral device: With our modern OSs, once the device has been physically connected, it will likely be detected by Plug and Play. If it has, Windows will attempt to install drivers for the device. If it cannot find those drivers, you will be prompted to supply those drivers.

- If a device does not work after being connected and doesn't install after these steps, you will switch to troubleshooting mode.

- Now that we have outlined the general procedures for adding peripheral devices to the PC, we can look at some of the specifics for certain devices.

Monitor/Video Card

Some components are a little more difficult to upgrade than others, and while there is nothing particularly tricky about monitors and video cards, there are a few additional considerations we need to be aware of.

Monitors

Monitors are the means by which we visually interact with the PC. How they display images is an important element in how comfortable we are when using the system and so, to a technician, understanding what defines how an image appears on the screen is important.

Refresh Rate

The refresh rate defines how fast the picture on the monitor is redrawn. Most monitors today are capable of refresh rates of 65 Hz and higher, though many people consider 80 Hz as the ideal starting point for configuring the refresh rate. Even if you are able to set the refresh rate of your monitor considerably higher (100 Hz), you should be wary of doing so unless you are completely sure that the monitor can handle it.

Monitors have a specific range of refresh rates that a given monitor can accommodate, but most also specify a recommended resolution and refresh rate. These are the settings at which the manufacturer believes the monitor will work best, and they should know.

Resolution

Perhaps more than any other characteristic, the resolution defines how the picture appears on the screen. The resolution is defined by the number of pixels from left to right (the horizontal resolution) and from top to bottom (the vertical resolution). The best resolution has as much to do with the preferences of the user as it does with what the monitor and video card are capable of. Some users like low resolution and big chunky icons. Others seem to prefer squinting to see microscopic icons on a monitor that is configured to a resolution somewhere between here and the afterlife. Monitors are capable of a certain resolution, and the actual resolution used by the monitor is dictated by the video card.

Dot Pitch

The dot pitch of a monitor is defined by how far apart the pixels are on the screen. The actual measurement refers to how many 1/100ths of a millimeter dots of the same color are away from each other. The lower the dot pitch value, the better the picture will be. Today's modern monitors have dot pitches around the low .20s, for example .21 to .25. As with most other things, it is possible to get both higher and lower dot pitches. Unlike resolution and refresh rate, the dot pitch is fixed, and not determined by the video card—it is defined by the hardware of the monitor.

Video Cards

There was a time when video cards were simple affairs, their function being to make sure a picture, any picture, appeared on the monitor. Nowadays, things are more complicated as graphical operating systems, applications, and games make the need to have high-quality video on the PC a necessity, not a luxury.

Video Card Resolution

The maximum resolution offered by a video card depends on the color depth (the number of colors being used) and is limited by the amount of memory on the video card. For example, an SVGA resolution of 800600 using 16 million colors will require 2 MB of video RAM. On modern video cards this consideration is irrelevant because most come with at least 16 MB of RAM, but if you are configuring an older system you will need to know how much RAM is required for a given resolution and color depth combination.

Video cards are one of those expansion cards that PC technicians will become very familiar with replacing and upgrading. Like any other expansion card, there are a few considerations to keep in mind during the upgrade process.

- Slot compatibility

  In addition to the standard slot types (PCI, ISA) that are used by video cards, there are also video-specific bus slots such as VL-Bus and AGP. Make sure the video card you intend to install in the system is compatible.

- Video shadowing

  Video cards have read-only memory (ROM) on them that contains routines for frequently performed functions. Video shadowing is the term given to copying the contents of this ROM into RAM, which can yield a small improvement in performance. Be aware, though, that enabling video shadowing can cause stability problems with some systems, so if you enable shadowing and then begin to experience odd and seemingly random system problems, you might want to try turning it off.

- Drivers

  Whenever you install a new video card, it is very important that you use the correct and most recent drivers for the card. If the wrong drivers are used, you might get a poor display or no display at all. Refer to the manufacturer's Web site for the most recent drivers.

Modem

Unlike most other peripheral devices, modems can be either internal or external. Of the two, external modems are typically easier to install and configure. When connecting an external modem to your computer, the modem plugs into a COM or serial port on the back of your computer. If your modem is plug and play capable, it will be automatically detected and installed. If not, you will need to manually install the modem and device driver into the operating system. The external modem will not need its own resources; rather, it uses the IRQ and I/O address of the port it is plugged into.

To install an internal modem, the case will have to be taken off and the modem installed into one of the system's free expansion slots. The funny thing about internal modems is that even though they are internal, they still require the use of one of the system's COM ports. Though not physically cabled to that port, they will use the resources of that port. Modems can be assigned COM ports provided no other device is using those resources. When it comes to assigning a COM port to your modem, remember that COM1 and COM3 share an IRQ and COM2 and COM4 share an IRQ. This means if another device is using COM3, you cannot use COM1, and the same for COM2 and COM4. Legacy modems used jumpers to determine the IRQ and I/O address that it would use; today, Plug and Play manages modems for us.

Whether the modem is internal or external, there are two RJ-11 sockets built into it. One of the sockets is to used to connect the modem to the telephone jack on the wall. This socket is often labeled as the Line socket. This is used to dial a remote location such as an ISP. The other RJ-11 socket, usually labeled Phone on the modem, is used to connect a phone so it can be used when the modem is off.

Installing Floppy Drives

The procedures for installing floppy drives are similar to those for installing other devices such as CD-ROMs, hard disks, or tape drives. What we have is a cable that connects the device to the

motherboard and a power connector to provide the power to the device. The floppy drive connects the floppy controller using a 34-wire flat ribbon cable and a 34-pin connector. The floppy drive cable is typically gray with one edge marked red or sometimes blue. The color markings identify that end as pin 1 of the cable; pin 1 of the cable has to be aligned with pin 1 of the floppy drive.

When attaching the floppy drive to the motherboard floppy controller, you must also take care to connect it in the correct way. Pin 1 of the cable must attach to pin 1 on the floppy controller. On most motherboards pin 1 is clearly identified, but on some others it can be a bit of a mystery. You don't have to worry much because a cable installed in reverse will not hurt the system—but the floppy drive will not work. You can tell if the cable is in reverse because the floppy drive LED will stay lit. If this is the case, switch the cable around the other way.

Computers can have two floppy drives installed with both attaching to a single cable. The floppy drive that is connected to the end of the 34-pin cable will be given the A: designation; the floppy drive that is attached to the middle cable connector will be designated as the B: drive. The differentiation is made using a twist in the cable between the two connectors.

USB Peripherals and Hubs

USB has emerged as the number one method of connecting peripheral devices to the computer. The reasons for this are simple: it is very fast, and because of plug and play, easy to install. Add to that the fact that USB devices are hot swappable (that is, they can be plugged in and out of the system without powering off), and one would wonder why we use the old parallel and serial ports.

All manner of devices can be attached to the system using the USB interface. The USB system will provide power to some devices, such as mice and keyboards, but other devices, such as printers, scanners, and external hard disks, will require their own power. Most computers come with one or two USB ports, allowing two USB devices to be attached to the system. Today, however, we often need more than two USB ports; that is where USB hubs comes into play.

PC Cards

In the desktop world, if we want to attach a new network card to the system, we need to remove the case and install the new card. Portable systems do not require us to take anything apart. Adding devices such as modems, network cards, and sometimes even memory is done using PC Cards.

In the early 1990s, the Personal Computer Memory Card International Association (PCMCIA) set out to establish standards by which peripheral devices could be connected to portable computers. The result is the PCMCIA, or as it is more commonly known, the PC Card. PC Cards are about the size of a credit card and provide us with hot swappable devices that can more easily be added to a system than their desktop counterparts.

PC Cards come in three types, appropriately named Type I, Type II, and Type III. The difference between these cards is in their designed function and their thickness. Type I cards are 3.3 mm thick and were originally designed for flash memory. Type II cards, the most common, are 5.0 mm thick and used for devices such as modems, network cards, and other I/O devices. Type III PC Cards are 10.5 mm thick and are used for hard drives.

Infrared Devices

Infrared communication provides us with the ability to attach devices such as keyboards and mice to our systems without the need for physical cabling. To accomplish this, infrared devices communicate with the computer using light waves instead of cables. Infrared communications are not lightning fast, providing up to 4-Mbps transfer speeds. They are limited in distance as well; the sending and receiving devices in the infrared communication can be no more than 1 to 3 meters apart.

Infrared communications are known as a point-to-point, line-of-sight technology. This means that the sending infrared device must be facing the receiving infrared device for the communication to happen. If anything blocks the line of sight between the devices, the communication might fail. Modern computers and some printers come with built-in infrared ports; other systems require an external or internal infrared adapter to be installed. Internal adapters install like any other expansion card, and external adapters are connected using the system's serial or USB port.

Upgrading the Personal Computer Components

Upgrading has become a fact of life in the computer world, and as a technician you can expect to become very familiar with the process of upgrading all manner of PC components.

Upgrading the Processor

It seems like faster processors are introduced on a weekly, if not daily, basis. For most of us who are satisfied with our current processor, the release of a new one goes largely unnoticed. Still, the time will come when either the processor you are using quits or it simply can't provide enough processing power, and you will need to upgrade.

The ability to support a higher level of processor will depend on the physical configuration on the motherboard, the capabilities of the board chip set, and the system BIOS. In some cases, the BIOS might need an update to accommodate the new processor. Often, a new processor was not designed to be used with some boards, and you might find yourself replacing the processor and motherboard at the same time.

Steps in a Processor Upgrade

Successful processor upgrades do not happen by accident; rather, they follow some pretty clear guidelines. Removing and upgrading a processor without a good idea of what you are doing can cause undesired results. Following are the steps for upgrading a processor.

- System inspection

  Before upgrading the processor, closely examine the inside of the case. It is good to get a look at what you are in for. Does your existing processor fan and heat sink provide adequate cooling for the new processor? Does your motherboard physically support the new processor? Pay close attention to the processor form factors and the socket or slots used on the motherboard because this will determine what kind of processor can be installed in the system. Keep in mind that, even if the physical connection is correct, not all processors will work in all motherboards. Furthermore, refer to the motherboard documentation to determine the processor speeds that the board can support.

- Removing the old processor

  The difficulty involved in removing a processor is determined somewhat by the motherboard used and by the type of socket or slot the processor is situated in. If it uses a zero-insertion force (ZIF) socket, the first thing to do is disconnect the heat sink and fan from the processor. Many heat sinks clamp right to the base of the socket, and care should be taken when unlatching the clamps. Once the heat sink is out of the way, ZIF sockets use a release lever to free the processor from the socket. Lift this locking lever, and when the lever is in its full upright position, the processor should slip right out.

- Installing the new processor

  When you're installing the new processor, there is one simple rule: always follow the documentation provided with the processor. There can be issues even for something as seemingly straightforward as a CPU installation. For instance, if you have just purchased a new Pentium III for your system and you confirm that the motherboard uses Slot 1 with retention mechanisms, that might not be enough. Some of the original Single Edge Contact Cartridge packages used retention mechanisms not recommended with the Pentium III cartridge. In fact, if you were to make the simple mistake of using the wrong retention mechanisms with your new Pentium processor, you might be voiding your warranty.

- Setting up the motherboard

  Most modern high-end motherboards will automatically detect the speed of the new processor. There are, however, motherboards that still require jumper settings. When the setting of these jumpers is required, refer to the motherboard manual to find the location of the jumpers on the motherboard, and adjust the jumpers accordingly.

- Final check

  Before powering up the system, be sure to check that the processor is securely seated and that the fan and heat sink are properly attached to the processor.

Memory Upgrades

RAM upgrades became fairly cheap and easy to do, people started believing that upgrading RAM was a cure-all for the majority of performance-related system issues. More has become better, but in reality, a RAM upgrade can be a fruitless endeavor if done for the wrong reasons. That said, if nothing else, upgrades can prevent the humiliation of being the only computer owner on the block with only 64 MB of RAM.

Steps in a RAM Upgrade

Upgrading the system's memory is often the easiest upgrade you can perform, which is probably why many nontechnical people are doing their own memory upgrades these days—bad news for PC repair shops. There are really only a few things to be mindful of when performing a memory upgrade; this section walks you through the general procedures.

- Inspect the system

  When upgrading your memory, you will have to crack open the case and check out a few details. First, look at the available sockets to see how many there are, how many are available, and what type they are, whether SIMMs or DIMMs. It would be unwise to start an upgrade and then find out you bought 96 MB of 72-pin SIMMs when you needed a DIMM module. As part of the inspection, it would also be a good idea to check the motherboard manual to see if there are any socket restrictions or memory capacity issues. The general rule of thumb when installing memory is to never mix your RAM.

- Removing old RAM

  Removing the existing RAM is a straightforward process. Ensure that the power is turned off, and as an extra precaution, disconnect the power connectors from the motherboard because some motherboards maintain a live circuit even when the system is switched off. It is also a good idea to take the few extra seconds to disconnect any cables that might get in the way. It might take a few seconds to reconnect them later, but it is time well spent because trying to install RAM can be tricky enough without the additional hurdles.

- Installing new memory

  Installing RAM in a system takes a little concentration and focus. This is not a good time to rush to get the job done. Both SIMMs and DIMMs are keyed, ensuring that the memory is installed in the correct way. With new memory, make sure the module is correctly aligned before applying force. SIMMs and DIMMs do not install the same. SIMMs are inserted on an angle, not straight in. Tilt the RAM slightly; if it's aligned properly, it should slide in with very little effort. Because these modules fit in at an angle, the order in which they are placed into the socket comes into play. When you're inserting SIMMs, the lower banks are filled first to allow for the angle insertions. DIMM modules fit straight into the socket. DIMM installation often takes more force than does installation of their SIMM cousins.

- Final check

  After the RAM is installed, take a few minutes to make sure that the RAM is seated properly and all of the cables are reconnected. Once done, you are ready to boot up the system.

- Testing the new RAM

  It doesn't take long to see if the RAM has been installed correctly. If all works as it should, the system will boot up with the new RAM configuration. Often, however, the system will halt and require that you access the BIOS to save the new RAM configuration. To do this, simply enter the BIOS and then exit, saving changes on exit. It is not usually necessary to actually make changes; just go in, save, and get out.

Troubleshooting the Memory Installation

Troubleshooting the memory installation is not a difficult process, but there are a few steps to follow, starting with the most obvious possibilities and heading toward the remote ones.

- Confirm that the RAM module is properly seated in the socket and that it is in the correct socket. Many RAM failures are due to the seating of the RAM. If necessary, remove the newly inserted RAM and reinstall it.
- Remove the new memory and replace it with the old memory to help isolate the problem. If the system boots with the old module installed, try putting the new module in a different socket; this will determine if the problem is with the RAM or perhaps with the socket itself. Also, try the new module with and without the old RAM installed to eliminate any compatibility issues between the types of RAM.
- Confirm socket requirements. Some computers can be very specific about where RAM goes in the sockets. Some computers require the largest RAM module to be in the lowest bank, and others require all memory sockets to be filled. Confirm socket considerations with the motherboard manual and manufacturer's Web site.

Upgrading Hard Drives

Outside of RAM, perhaps the most common upgrade is that of hard disks. While once we wondered how we would possibly fill that 2-GB hard disk, we are now out of space and wishing for a new 100-GB hard disk. Upgrading hard disks is likely going to be a frequent occurrence in your role as a PC technician. This section looks at the specific steps involved in upgrading an existing hard drive with a new one. One disclaimer, however: the procedures included in this book assume that the data has been adequately backed up and will not cover the process of transferring data from one drive to another.

Without proper handling, it is possible that you can damage the drive before it even has a chance to power up. Take these precautions:

- The new drive should remain in its antistatic bag until it is ready to be installed.

- Handle the drive by the corners or sides, keepings your hands off of the circuitry.
- Do not apply undue pressure to the top of the hard drive.
- Make sure all system power is off before installing the new drive.
- Use the correct screws when mounting the hard drive.

Upgrading SCSI Hard Drives

Installing a new hard drive into an existing SCSI bus is typically a straightforward process, at least as long as you follow some basic guidelines.

- System inspection

  Before doing the SCSI upgrade, it is a good idea to have an understanding of what is currently in the system and how it is configured. Document such things as termination location and type, connector types on the SCSI host adapter, SCSI IDs being used, and cabling. Some systems have their cabling labeled to make some sense out of the cabling strategy, but just as many do not. Remember, you might be installing the SCSI device in a system that already has multiple SCSI hard disks, CD-ROM drives, and tape devices. The sheer mass of cabling and connectors can get very confusing, so make a lot of notes.

- Set the jumpers

  The next step in the SCSI installation procedure involves setting the SCSI hard drive's jumpers. All devices on a SCSI bus must have a unique ID. These IDs can be 0 through 7 for Narrow SCSI implementations, and 0 through 15 for Wide SCSI. If you're upgrading and replacing a hard drive, the ID of the drive being replaced is typically used. If you are adding a hard drive, you need to determine which IDs are available for you to use.

- Configure termination

  A SCSI bus has to be terminated at the physical ends of the bus to prevent signal reflection. When installing a hard drive, you must ensure that termination is set properly. The SCSI host adapter will often be used as the terminator for one end of the bus, leaving the last device on the bus needing termination. If the new drive you are installing is the last one on the bus, you will have to set the termination. For termination issues specific to the device you are installing, refer to the manufacturer's Web site, where such information is readily available.

- Mounting the drive and attaching the cables

  The physical installation of the drive into the system is not a difficult task, but there are a few points to keep in mind. Secure the drive in the system with the screws that came with the hard drive, or use the correct-size screws, and do not over tighten them. Other than that, mount the drive facing the right direction, and you should be set.

Upgrading IDE Hard Drives

When it comes time to upgrade your IDE drive, at least you can take comfort in the fact that it is generally easier than upgrading SCSI drives. Still, an upgrade is an upgrade, and they all bring with them an element of danger. When you're using IDE drives in a master and slave configuration, it is recommended to use drives from the same manufacturer. Though there are disk standards in place, problems can still arise when connecting two different drives.

- System inspection

  Before installing that monstrous new IDE drive, take a look inside the computer case. When it comes to IDE drives, there are a few things to be on the lookout for. If you are replacing an existing IDE drive, check its designation (whether it was a master or slave), and configure the new one accordingly. If you're installing a new drive, check the installed IDE devices for their designations. You might have to make an existing IDE drive a slave and make the new one a master. Ensure that the cables have sufficient connectors, and at the correct spacing intervals, to which you can attach the new devices.

- Set the jumpers

  It is very difficult to set the jumpers after the drive is installed, not only because it is very difficult to determine which pins the jumpers are set on, but also because the jumpers themselves can be well hidden and out of the reach of the technician's fingers. Most jumper settings are listed on the hard drive itself and clearly list the jumper placement for master, slave, and cable select.

- Mount the drive and attach the cable

  Use the manufacturer's recommended mounting procedures, found in the hard drive documentation. For the most part, mounting simply involves finding an empty slot in the case and securing the drive in place with the appropriate screws or clips. Once mounted, the next step is to attach the IDE cable to the new drive. The trick with attaching the IDE cable is simply to match pin 1 of the cable to pin 1 of the device. The red strip on IDE cables represents pin 1 for the cable. When you're attaching the cables to the hard drive, ensure that they are lined up so no pins are bent in the process. As with any other device, hard drives need power, so connect the power cable to the drive, and you are ready to go.

- Final inspection

  Double-check the cabling within the system to make sure nothing has been dislodged. When you're working within the crowded space and with the shorter IDE cabling, it is quite common to accidentally pull the cable from the motherboard IDE controller. Also, check the power connector and cables to other devices, as they can often get dislodged in the upgrade process.

Upgrading the BIOS

When the computer system is first started, it must access the BIOS program. The BIOS program provides the instructions the computer needs in order to boot. Without these instructions, the CPU, for example, has no means or method to talk with the rest of the system, neither hardware nor software.

Because hardware needs to have access to the BIOS instructions every time the computer is started, it makes sense to have these instructions stored permanently on the system itself. Read-only memory (ROM) provides this permanent storage. Once data and BIOS programs have been written to the ROM chip, it cannot be removed. What happens, however, when the system requires an upgrade or modification to the existing BIOS ROM program? That's when electrically erasable programmable read-only memory (EEPROM) comes into play.

EEPROM is a little friendlier than the traditional ROM chips, bridging the gap between the system's main memory and the ROM chip by having characteristics of both. It can receive new information like main memory and can hold this information when the computer is powered down. EEPROM, also referred to as flash RAM, allows the changing of the programs held on the chip. EEPROMs are updated with the use of programs that can be downloaded from the manufacturer in a process called flashing. Upgrading a BIOS refers to the process of flashing the EEPROM chip to update its programs.

Flashing can be a dangerous process. If the upgrade flash process is disrupted, for example, by a power outage, or the computer shuts down unexpectedly, the BIOS chip can be damaged and there is really no fix for this. Of equal concern is trying to flash the wrong upgrade to the BIOS chip. While some manufacturers make intelligent programs that can sense a mismatch, others don't. Similar to power disruptions, flashing the wrong upgrade can also permanently damage the BIOS chip.

RAID

Many of us operate our computer systems with a single hard drive, but in many cases, extra, or redundant, hard disks are used for fault tolerance. When used in such a configuration, we are incorporating something called a redundant array of independent disks (RAID). The function of RAID is quite simple, to provide a method to safely store and access data in case of hard disk failure. There are several different RAID designs that can be used, known as RAID levels.

In a RAID 0 configuration, data is written across multiple hard disks. For instance, when you save information, some of it is stored on the first hard disk, some on the second, and so on. This process is known as disk striping. When data is written to multiple hard disks simultaneously, it allows for faster data throughput, significantly increasing overall performance. RAID 0, sometimes referred to as disk striping without parity, is not a fault-tolerant RAID solution. If one hard disk fails, the data stored on all disks is lost and must be reinstalled from backups. Because RAID 0 is not fault tolerant, it is rarely used in real-world applications. RAID 0 requires a minumum of two hard disks.

RAID 1 is an easy and cheap fault-tolerant solution. RAID 1, also known as mirroring, writes data twice to separate hard disks, making an exact mirrored copy of the data. In this case, if one of the hard disks were to fail, there would be an exact copy that can be accessed. RAID 1 requires two hard disks.

The final RAID solution mentioned in the CompTIA objectives is RAID 5. RAID 5 is similar to RAID 0 in that it stripes data across several hard disks. Unlike RAID 0, however, RAID 5 requires a minimum of three hard disks with one hard disk being used for parity information. If one of the hard disks were to fail in a RAID 5 configuration, this parity information is used to re-create the data from the damaged hard disk, allowing the data to be recovered.

Troubleshooting Procedures and Best Practices

This section will outline the general troubleshooting procedures that you are likely going to follow when presented with a troubleshooting situation.

1. Determine the Severity of the Problem

When repairing PCs, you'll find there are some problems that have a major impact on the user and what they need to do, and some problems that are at best an annoyance. A failed hard drive, for instance, is far more important than a sound card that doesn't work. PC technicians have to be able to tell the difference between the small stuff and the big, and that isn't always easy. When it comes to any PC repair, the first and foremost concern is whether there is any potential for a loss of data. Problems that fall into this category are malfunctioning backup devices, corrupt hard disks, or virus activity. Make no mistake, when it comes to problem severity, those related to losing data will always take precedence.

2. Gather Information Necessary to Isolate the Problem

One of the most important steps in troubleshooting a problem is actually finding the problem itself. Admittedly, this sounds like common sense, but the process of gathering information to make an accurate problem diagnosis is often overlooked. The only way to really get the information needed to isolate the problem is to ask the right questions. For instance, if a user is complaining of data loss, appropriate questions can determine who is experiencing data loss, when is it happening, how frequently is it happening, and what exactly is meant by "missing" data. With these answers, it is possible to begin to isolate the cause. It is then possible to determine if the data loss is a result of human error, software error, or hardware error without ever touching a computer. Information gathering might seem like a waste of time, but in fact, it can significantly increase your efficiency in isolating the problem and can decrease the amount of time it takes to fix the problem.

3. Interviewing Users

PC technicians know that getting accurate information from a user can often be a very difficult endeavor. Gathering information from users often requires finely tuned communication and interpretive skills, and can resemble a game of charades more than a tech support session. It is

important to remember that many users have limited technical knowledge and are quite happy with that. Your job is to glean as much information from them as you can, including the frequency of the problem, the applications being used, whether the problem has occurred in the past, whether they have modified the system in any way, and if there have been any error messages displayed (and if so, which ones).

4. Interpreting Computer Errors and Generated Logs

Computers and operating systems provide their information in the form of log files, alerts, and messages. Although it's helpful to have events documented, sometimes the logs and error codes can be as difficult to understand as the most confused user. For instance, your system could be experiencing trouble and reports the error code 513xx0067. Sometimes, it would be just as easy to rebuild the system as track down the error. Still, the information is there, and a call to the operating system support line, or a visit to the operating system manufacturer's Web site, with the log information in hand, can probably help you get the answer to your problem.

5. Using Your Senses

Never underestimate the power of your own senses to determine the cause of a problem. We are not talking about ESP here, but our five senses. If, upon entering a room, you notice that there is smoke coming from the computer, talking to users or checking logs might be an unnecessary step in the troubleshooting process. Visual inspections of equipment are often part of the PC technician's daily routine. Eyes, ears, and nose play an important role in isolating and preemptively troubleshooting a problem.

6. Determine the Potential Cause or Causes

After the information is collected, you can begin to determine possible causes. Asking the appropriate questions can narrow the issue down to a few possible options; and after this is done, you can make a list of the potential problems and decide which ones should be tested first. As stated several times, it is a good idea to start with the easiest things first and work from there. For instance, if it is determined that a client computer cannot access the network, check the cabling before changing network settings, and before replacing the network card as well. Before all of those steps, verify that the computer is turned on; take nothing for granted. Often, even in the midst of a seemingly complex problem, the easiest solution is the right one.

7. Fix the Problem

After all of that, you are now ready to fix the problem. If all goes according to plan, the problem you have isolated is the cause, and its fix will be the remedy. All too often, however, despite our best efforts, the fix does not work, and you have to start from step 1 and try again.

8. Review and Document

Often neglected as a troubleshooting step, keeping records about the troubleshooting procedures along the way is perhaps one of the most vital aspects of any troubleshooting procedure. When

documenting a troubleshooting procedure, be sure to write down each step you took and the result. Remember that it might not be you reading this documentation the next time something goes down, so make sure that the steps you took can be followed by someone else. In fact, assume that you are writing for someone else; this often encourages a little bit better writing.

Preventative Maintenance of Computer Hardware Components

Some of these cleaners are obviously wrong for our needs. In this section we answer these questions and identify the products to use for cleaning computer components and even provide a little personal insight gleaned from a few mistakes we've made over the years.

Liquid Cleaning Compounds

Most of us are aware that computer systems and associated peripherals are sensitive devices; they do not like a lot of water and most cleaning products available. So what can we use?

Water and a Damp Cloth

In the high-tech world, one of the most often used cleaning supplies is the very nontechnical soapy water and lint-free damp cloth. Considering that the exterior of most computers and peripherals is plastic or metal, a damp cloth and a little soapy water are just great for cleaning these surfaces. There are a few caveats here, however. The cloth must only be damp and not wet. The last thing you want to do is spill drops of water onto the actual components of the system. Before wiping down the outside of components, you need to unplug them. Water and electricity don't mix. Finally, the water and damp cloth solution is for cleaning the exteriors of devices only, not the internal components. There are better "solutions" for those.

Denatured (Isopropyl) Alcohol

For cleaning the inside of some components such as floppy drives, or more specifically floppy drive heads, we can use a little alcohol. The cleaning solution is typically applied with a lint-free swab directly to the heads. When we say lint-free swab, we don't mean a regular cotton swab, as often the cotton itself can jam up the very components we are trying to clean.

Even with denatured alcohol moderation is the key. You will find that when cleaning components, you only need a little alcohol on the swab. One caveat with alcohol is to not clean moving parts within components that use lubricants, such as the gears and drive motors in CD-ROMs, floppy drives, and printers. For many of these, the alcohol will clean off the lubricants that need to be there.

Regular Glass Cleaner

One of the first impulses when cleaning some computer components is to reach for the glass cleaner. In truth, glass cleaner has limited application for cleaning computer equipment. Its use should be restricted to cleaning the display screen of a CRT monitor. Glass cleaner should never be used to clean an LCD screen; it can eat right through it!

Regular glass cleaner should never be used to clean LCD displays.

In terms of liquid cleaners, water, denatured alcohol, and glass cleaner are all you will really need. The trick then is deciding which of these cleaners to use with which component. To give you some idea, we will look at some common computer components and peripherals and what it takes to clean them.

It is a best practice to make sure the computer component or peripheral device you are cleaning is unplugged before cleaning. This includes everything from mice to monitors and keyboards.

- Mouse

  The average mouse is a virtual playground for all manner of germs and bacteria. The outside of the mouse can often be cleaned using a little elbow grease and a damp and soapy cloth. On the inside, some people recommend using an eraser to clean the mouse ball. This is a double-edged sword; it can clean the ball but it has an abrasive effect and can cause small canyons on the surface of the ball and change its shape. As you can imagine, this affects the proper functioning of the mouse. A better solution is to once again use a damp cloth to wipe off the mouse ball. This should be enough to get it clean and smooth off the surface. Do not soak the mouse ball, and make sure it is dry before putting it back in its home. To clean the inside of the mouse, we would not suggest using any liquid cleaners. If the rollers on the inside are dirty, the dirt on them can be gently scraped off. In addition, a can of compressed air can be used to blow out the dust and dirt. Regular maintenance on mice can greatly prolong their life but if you find yourself working in an environment where you are supporting hundreds of computers, this can be a time-consuming task. Given the relatively low cost of mice, in some cases it might be easier just to replace the mouse with a new one if it starts giving you trouble.

- Keyboard

  The keyboard probably needs to be cleaned more than any other computer component. Most experts (if there is such a thing as a keyboard cleaning expert) suggest using distilled water to clean the surface areas of the keyboard. Using only distilled water is an important consideration as any soap or iron in the regular water can cause as many problems as it cures. We have seen some people completely soak their keyboards in distilled water and have them function normally afterward. Such an approach might work well on older, $20 keyboards, but the newer, more advanced, and more expensive keyboards require a bit more TLC. The underside of the keys can often be cleaned using just a can of compressed air. You will be surprised by what comes flying out from underneath those keys. The keyboard's surface areas typically require little more than a damp, lint-free cloth using a little distilled water. Some spills such as coffee or other liquids might require that you remove keys to get underneath them to clean. Spills such as cola, which can leave your keys sticky and nonfunctioning, might require that the keyboard be soaked in distilled water, which is OK because at this point you really do not have anything to lose. The best preventative advice we can offer on preventing spills is simply to never drink liquids around the keyboard. One important thing to remember

when cleaning a keyboard is to ensure that it is completely dry before reconnecting it to the computer. This can sometimes take more than 48 hours.

When cleaning keyboards, ensure that they are first disconnected from the computer and completely dry before using them again.

- Monitor

  If keyboards are the device we clean the most, monitors have to be a close second. Most often the display screen is simply dusty and all that is needed is to wipe the display with a lint-free cloth. For stains or spills, the best way to go is regular glass cleaner, provided, as we mentioned earlier, that it is not being used on an LCD screen. If you are using a spray cleaner, it's best not to spray the cleaner directly on to the monitor. Instead, first squirt it onto a lint-free cloth and then use that. To make things a little easier, you can also purchase presoaked antistatic cleaners that resemble little towelettes. These do a great job of removing the dust from the display. The outside of the monitor can be cleaned using a damp cloth and the vents can be cleaned using some compressed air. As mentioned earlier, to prevent water from getting inside the vents, do not use a cloth that is too wet. Again, the monitor must be unplugged before any cleaning can take place.

- LCD monitor

  The first rule of thumb is to never allow any moisture to get into your LCD monitor. If you notice moisture on your screen, wipe it off gently with a soft cloth before powering on your monitor. If for some reason moisture has managed to get into the LCD monitor, leave the monitor in a warm area until the water has had a chance to evaporate. As with CRT monitors, LCD screens are often as easy to clean as wiping them with a lint-free cloth. If you do need to rub off a stain or other such blemish, you can use a small amount of distilled water on a lint-free cloth and wipe the stain, but only when the LCD screen is completely off. Do not apply too much pressure to the screen—doing so can damage the interior of the panel.

- Floppy drive

  Floppy drives can quickly get full of dust, and over time this will cause them to fail or at the least not function as they should. The trick for floppy drives is a little denatured alcohol on a swab to clean the floppy drive heads. To remove the dust from inside a floppy drive, you might have to use a non-static vacuum (discussed later in this chapter) or a few shots of compressed air. Like some of the other components discussed here, if the floppy drive refuses to work even after a cleaning, it might actually be more economical (though not as environmentally friendly) to replace the floppy drive with a new one.

Cleaning Contacts and Connectors

The computer itself is full of contacts and connectors that must be clean in order to function as they should. If dirt or grime gets on these connectors it can prevent a proper connection between devices, or the dust itself can cause electrostatic discharge (ESD). To be clear, the types of connectors and contacts we are talking about are those found on components such as expansion cards and memory modules.

Non-Static Vacuums

As mentioned earlier, dust is an enemy to computer systems. One of the tools you are likely to see used in the war against dust is a non-static vacuum. Non-static vacuums are seen in most PC repair shops and are used for sucking the dust out of the computer case, keyboard, power supplies, and even peripheral devices (not to mention the crumbs from lunch!). However, before running to the closet and grabbing the Electrolux, it should be pointed out that non-static vacuums are specifically designed for use with computers. Regular vacuums actually create a storm of static electricity and can damage the components you are trying to clean. Save those for the carpets.

Compressed Air

For those who are not fond of vacuuming, there is another method you can use to remove the dust from inside the computer case and peripherals—compressed air. Compressed air is sold in cans and, as a computer technician, having one or two cans in your toolkit is a definite must. The compressed air is well suited for cleaning fans, power supplies, and those hard-to-reach places. The biggest drawback with compressed air is that the dust is blown everywhere. The best method is to use compressed air on the outside of a device. Some technicians prefer to use their own compressed air by blowing on components. While this is not a terribly bad thing, human breath is moisture laden and so not ideal for this purpose.