

FAST FACTS: CORE HARDWARE SERVICE TECHNICIAN EXAM

The fast facts listed in this chapter and the following chapter are designed as a refresher of key points and topics required to succeed on the A+ certification exam. By using these summaries of key points, you can spend an hour prior to your exam refreshing your knowledge of key topics to ensure that you have a solid understanding of the objectives and information required to succeed in each major area of the exam.

CompTIA has established two modules for the A+ examination: the Core Hardware Service Technician module and the Operating System Technologies module. The information here is organized to follow the sequence of the Core Hardware Service Technician module test objectives, and each domain that follows includes the key points from each chapter in this book. If you have a thorough understanding of the key points here, chances are good that you will pass the exam.

This book is dedicated to the six domains covered in the Core Hardware Service Technician module. Now that you have read those chapters and answered all the review and exam questions at the ends of the chapters, you are ready to take the exam.

Albert Einstein supposedly said, “Everything should be as simple as possible, but not simpler.” These fast facts are designed as a quick study aid that you can use in less than an hour just prior to taking the exam. This chapter cannot serve as a substitute for knowing the material supplied in all the chapters in the book.

However, its key points should refresh your memory on critical topics. In addition to the information located here, remember to review the Glossary terms, which are intentionally not covered here.



Fast Facts

CompTIA uses the following domains to arrange the objectives for the Core Hardware Service Technician module:

- 1.0 Installation, Configuration, and Upgrading
- 2.0 Diagnosing and Troubleshooting
- 3.0 Preventive Maintenance, Safety, and Environmental Issues
- 4.0 Motherboard/Processors/Memory
- 5.0 Printers
- 6.0 Basic Networking

1.0 INSTALLATION, CONFIGURATION, AND UPGRADING

The 1.0 domain requires knowledge and skills required to identify, install, configure, and upgrade microcomputer modules and peripherals in both desktop and portable computer systems. The main points follow:

- System boards are also referred to as *motherboards* and as *planar boards*.
- Notches and dots on the various ICs provide important keys for replacing a microprocessor. These notches and dots specify the location of the number 1 pin, which must be lined up with the pin-1 notch of the socket.
- The ATX system board power connector contains a signal line that the system board can use to turn off the power supply. This power-saving feature is referred to as a *soft switch*.
- A good rule of thumb to remember when attaching the two AT-style power-supply connectors to the system board is that the black wires from each bundle should be side by side.
- Standard VGA resolution is defined as 720×400 pixels using 16 colors in text mode and 640×480 pixels using 16 onscreen colors in graphics mode.
- A typical IBM floppy disk has 40 or 80 tracks per surface. The tracks are divided into 8, 9, or 18 sectors each. In a PC-compatible system, each sector holds 512 bytes of data.
- The drive connected to the end of the cable is designated as drive A:.
- The average storage capacity of a CD-ROM is about 680MB.
- The SCSI interface is widely used to connect external CD-ROM drives to systems. A Centronics connector is normally used with an external SCSI cable.
- A color CRT has a metal grid called a *shadow mask* in front of the phosphor coating. The shadow mask ensures that an electron gun assigned to one color doesn't strike a dot of another color.
- Resolution can be expressed as a function of how close pixels can be grouped together onscreen. This form of resolution is expressed in terms of *dot pitch*. A monitor with a .28 dot pitch has pixels that are located .28mm apart. In monochromatic monitors, dot pitch is measured from center to center of each pixel. In a color monitor, the pitch is measured from the center of one dot trio to the center of the next trio.
- Notebook and laptop computers use non-CRT displays, such as LCDs and gas-plasma panels. Both types of display units can be operated from batteries.
- When a modem is used to send signals in only one direction, it is operating in *simplex mode*.
- In *half-duplex mode*, modems exchange data, but in only one direction at a time. Multiplexing the send and receive signal frequencies allows both

modems to send and receive data simultaneously. This mode of operation is known as *full-duplex mode*.

- When a PC is turned on, the entire system is reset to a predetermined starting condition. From that state, it begins carrying out software instructions from its BIOS program.
- A SIMM module can be inserted in only one direction because of a plastic safety tab at one end of the SIMM slot.
- SIMMs and DIMMs are keyed, and it is almost physically impossible to plug them in incorrectly.
- When ordering a replacement power supply, you must remember to take into account the system's form factor and wattage rating requirements. The wattage rating is a measurement of the total power the supply can deliver to the system. Heavily equipped systems require power supplies with higher wattage ratings.
- A good rule of thumb to remember when attaching the two power connectors labeled P8 and P9 to the system board is that the black wires in each bundle should be next to each other, in the middle.
- On the ATX back panel, many of the system board-related I/O functions have been grouped into a standardized block of connections. The panel features two six-pin PS/2 mini-DIN connectors. The lower connector is for the keyboard, whereas the upper connector is intended for use with a PS/2 serial mouse. Just to the right of the keyboard and mouse ports are two USB connectors for attaching USB devices to the system. The master I/O block contains two DB-9M COM port connectors for use with serial devices and a DB-25F parallel-port connector for SPP, EPP, and ECP parallel devices. A DB-15F connector is the standard for the PC game port and is used to attach joysticks and other game-playing devices. The audio block features standard RCA jacks for the microphone, audio-in, and speaker connections.
- Plugging a keyboard in to a system while power is on may cause the system board to fail due to the power surge and ESD that may occur between it and the system board.
- When the ATX specification adopted the same connector for both the keyboard and mouse, it introduced an opportunity to plug these devices into the wrong connectors.
- The FDD signal cable is designed to accommodate two FDD units. If the drive is the only floppy drive in the system or is intended to operate as the A: drive, you should connect it to the connector at the end of the cable. If it is being installed as a B: drive, you should attach it to the connector toward the center of the cable. A small twist of wires between the A: and B: connectors differentiates between the drives.
- After the primary partition is established and properly configured, an additional partition, referred to as an *extended partition*, is also permitted. However, the extended partition may be further subdivided into 23 logical drives (all the letters in the alphabet minus *a*, *b*, and *c*).
- The FDISK utility in MS-DOS version 4.0 raised the maximum size of a logical drive to 128MB, and version 5.0 raised it to 528MB. The FDISK utility in Windows 9x provided upgraded support for very large hard drives. The original version of Windows 95 set a size limit for logical drives at 2GB. The FDISK version in the upgraded OSR2 version of Windows 95 extended the maximum partition size to 8GB.
- When newer operating system versions provide for partitions larger than 528MB, another limiting factor for the size of disk partitions is encountered: the BIOS. The standard AT-compatible BIOS had a

hard-drive capacity limit of 504MB. To overcome this limitation, newer BIOS versions include an Enhanced mode, which employs LBA techniques to permit the larger partition sizes that are available through the Windows operating systems to be used.

- In Windows 9x, an advanced CD-ROM device driver called CDFS was implemented to provide protected-mode operation of the drive. Windows 9x retains the MSCDEX files for real-mode operation.
- Like other computer power-supply types, a portable power supply, also referred to as an *AC adapter*, converts commercial AC voltage into a single DC voltage that the computer can use to power its components and recharge its batteries. Similar DC-to-DC controllers are available that permit notebook computers to draw power from DC sources such as cigarette lighter sockets in automobiles.
- When an LCD panel fails, the most common repair is to replace the entire display panel/housing assembly. To replace the LCD panel, you must use a panel that is identical to the original, to ensure that it fits the plastic display housing.
- Because no current passes through the display to light the pixels, the power consumption of LCD displays is very low. The electrodes can be controlled (that is, turned on and off) by using very low DC voltage levels.
- Although the PC card's software driver can be executed directly on the card (instead of being moved into RAM for execution), the system's PC card enablers must be loaded before the card can be activated.
- Each device in a PC-compatible system that is capable of interrupting the microprocessor must be assigned its own unique IRQ number. The sys-

tem uses the IRQ numbers to identify which device is in need of service.

- Two serious system board-based conditions cause an NMI signal to be sent to the microprocessor. One condition occurs when an active IOCHCK signal is received from an adapter card located in one of the board's expansion slots. The other condition that causes an NMI signal to be generated is the occurrence of a PCK error in the system's DRAM memory.
- The system's FDD controller uses DMA channel 2 by default.
- In the case of an internal modem, the UART in the modem normally replaces one of the two COM port UARTs provided by a typical PC system. If the COM port UART is not disabled, the system may have trouble differentiating between the two ports, and a conflict may develop. Therefore, it is common practice to disable an onboard UART when an internal modem is installed.
- In a PC system, the FDC operates in conjunction with the system's DMA controller and is assigned to the DRQ-2 and DACK-2 lines.
- The floppy-disk drive controller is assigned to the IRQ-6 channel in PC-compatible systems.
- The first IDE drive controller responds to I/O addresses between 1F0h and 1F7h, and the second responds to addresses between 170h and 177h.
- The ATX specification employs two 6-pin mini-DIN connectors (also referred to as PS/2 connectors) for the mouse and keyboard. Of course, the fact that both connections use the same type of connector can lead to problems if they are reversed.
- The connector type is an important consideration when you purchase a mouse. You need to

- consider which type of connector will be needed for the system—9-pin serial or 6-pin mini-DIN.
- The cable length used for a parallel printer should be kept to less than 10 feet (3m).
 - If a printer port is found at 3BCh, the operating system assigns it the title LPT1. If no printer port is found at 3BCh, but there is one at 378h, however, the operating system assigns LPT1 to the latter address. Likewise, a system that has printer ports at physical addresses 378h and 278h would have LPT1 assigned at 378h and have LPT2 at location 278h.
 - You can set the interrupt level of the printer port to a number of different levels by changing its configuration jumpers or CMOS enabling setting. Normal interrupt request settings for printer ports in a PC-compatible system are IRQ5 and IRQ7. IRQ7 is normally assigned to the LPT1 printer port, and IRQ5 typically serves the LPT2 port, if installed.
 - The RS-232 standard can produce a maximum baud rate of 20,000 baud over distances of less than 50 feet (15.25m), which is the recommended maximum length of an RS-232 cable. The RS-232C version extends the length to 100 feet (30.5m).
 - Either of the physical RS-232 serial ports may be designated as COM1, COM2, COM3, or COM4, as long as both ports are not assigned to the same COM port number. In most PCs, COM1 is assigned as port address hex 3F8h and uses IRQ channel 4. The COM2 port is typically assigned port address hex 2F8h and IRQ3. Likewise, COM3 uses IRQ4 and is assigned the I/O address 3E8h; COM4 usually resides at 2E8 and uses IRQ3.
 - USB has been developed to provide a fast, flexible method of attaching up to 127 peripheral devices to a computer.
 - USB devices can be added to or removed from a system while it is powered up and fully operational. This process is referred to as *hot-swapping* or *hot-plugging* the device. The PnP capabilities of the system detect the presence (or absence) of the device and configure it for operation.
 - The root hub provides power directly from the host system to the devices that are directly connected to it. Hubs also supply power to the devices that are connected to them. Even though the interface supplies power to the USB devices, the USB devices are permitted to have their own power sources if necessary.
 - The length limit for a USB cable serving a full-speed device is 16 feet, 5 inches (5m). Conversely, the length limit for cables used between low-speed devices is 9 feet, 10 inches (3m).
 - FireWire is capable of using the high-speed isochronous transfer mode described for USB to support data-transfer rates up to 400Mbps. This makes the FireWire bus superior to the USB bus.
 - The IrDA standard specifies that IrLPT is used with character printers to provide a wireless interface between a computer and a printer.
 - IrDA protocols specify communication ranges up to 6.6 feet (2m), but most specifications usually state 3.3 feet (1m) as the maximum range.
 - In most cases, the IDE drive comes from the manufacturer configured for operation as a single drive, or as the master drive in a multidrive system. To install the drive as a second, or slave, drive, you usually need to install, remove, or move a jumper block. Some hosts disable the interface's Cable Select pin for slave drives. With these types of hosts, you need to install a jumper for the Cable Select option on the drive.

- ▶ The EIDE, or the ATA-2 interface, permits up to four IDE devices to operate in a single computer system.
- ▶ In addition to the new DMA transfer modes, the fastest IDE enhancements—referred to as Ultra, ATA 4/Ultra ATA 66, and Ultra ATA 100—extend the high data throughput capabilities of the bus by doubling the number of conductors in the IDE signal cable to 80. Although the number of wires has doubled, the IDE connector has remained compatible with the 40-pin IDE connection, but each pin has been provided with its own ground conductor in the cable.
- ▶ The IDE controller structure is an integrated portion on most PC system boards. This structure includes BIOS and chipset support for the IDE version the board will support, as well as the IDE host connector.
- ▶ A SCSI chain could be used to connect a controller to a hard drive, CD-ROM drive, high-speed tape drive, scanner, and printer.
- ▶ A system's first standard controller can handle up to 7 devices; an additional SCSI controller can boost the system to support up to 14 SCSI devices.
- ▶ The priority levels assigned to SCSI devices are determined by their ID numbers, with the highest-numbered device receiving the highest priority. This setting (that is, 7 in a Standard SCSI system) is typically used with the SCSI host adapter (controller card).
- ▶ The maximum recommended length for a complete standard SCSI chain is 20 feet (6m). You can realistically count on about 3 to 5 feet (1m to 1.5m) of internal cable, so you should reduce the maximum total length of the chain to about 15 feet (4.5m).
- ▶ A newer SCSI specification, referred to as Ultra 320 SCSI, boosts the maximum bus speed to 320Mbps, uses a 16-bit bus, and supports up to 15 external devices. Ultra 640 SCSI has a speed of 640Mbps and a cable length of 7m.
- ▶ Two types of signaling are used with SCSI interfaces: single-ended (SE) and differential-ended (DE). Single-ended signaling transmits signals in a straightforward manner in which the information is applied to a signal line and referenced to ground. Differential signaling applies reciprocal versions of the same signal to two wires at one end of the cable and compares them at the other end.
- ▶ The High-Voltage Differential (HVD) SCSI signaling specification refers to the +5 Vdc and 0 Vdc signal levels used to represent data bits. These voltage levels were implemented with the original SCSI-1 bus and have been included with all the specifications up to the Wide Ultra SCSI version.
- ▶ Low-Voltage Differential (LVD) signaling operates on 3-volt logic levels instead of the older TTL-compatible 5-volt levels.
- ▶ Poor or incorrect SCSI terminations cause a variety of different system problems, including failed system startups, hard-drive crashes, and random system failures.
- ▶ Passive termination is the simplest and least reliable method of termination. It employs nonactive resistors to terminate the bus. Passive termination is fine for short, low-speed SCSI-1 buses, but it is not suitable for faster SCSI buses.
- ▶ Active termination adds active elements, such as voltage regulators, to the resistors used in passive termination, and provides for more reliable and consistent termination of the bus. Active

termination is the minimum requirement for any of the faster single-ended SCSI buses.

- Forced perfect termination (FPT) is a more advanced form of active termination in which the diode clamps are added to the circuitry to force the termination to the correct voltage. This virtually eliminates any signal reflections or other problems and provides for the best form of termination of a single-ended SCSI bus.
- Several ECC file transfer protocols have been developed for modem communications packages. These protocols are capable of detecting bit-level errors and can also recalculate and repair a defective bit in the bit stream. The parity-checking scheme employed with common memory systems is simply a single-bit error-checking operation. If an incorrect bit is detected in the memory that is read back, a parity check error is created and an NMI signal is passed to the microprocessor. Some of the most common modem protocols include Xmodem, Ymodem, Zmodem, and Kermit.
- When an IrDA device is installed in a system, a Wireless Link icon appears in the Windows Control Panel. (Remember that infrared port operations must first be enabled through the CMOS Setup utility.) When another IrDA device comes within range of the host port, the icon appears on the Windows desktop and in the taskbar. In the case of an IrDA printer, a printer icon appears in the Printer folder.
- If you install a new microprocessor in a system that does not have an auto-detect function for the microprocessor, you must make sure that the BIOS version will support the new processor and that the Core Voltage, Bus Frequency, and Bus Ratio settings are properly configured for the new processor. If these items are not set correctly, you could burn up the new microprocessor, not get the system to start at all, encounter random errors during normal operations, fail to start the operating system, or get an incorrect processor type or an incorrect processor speed during the POST routines.
- When the microprocessor is upgraded, the BIOS should also be upgraded to support it. In newer system boards, this can be accomplished by flashing (that is, electrically altering) the information in the BIOS with the latest compatibility firmware.
- If the system BIOS doesn't possess the flash option and does not support the new microprocessor, you need to obtain an updated BIOS IC that is compatible with the new processor (and with the system board's chipset). The old IC must be removed from the board and replaced by the new IC. This upgraded BIOS can normally be obtained from the system board manufacturer.
- Before you flash the BIOS, it is a good idea to make a backup copy of your BIOS settings on a floppy disk. This enables you to recover to your old settings in the event that the new BIOS information does not work with your system.
- Mismatched memory speeds and memory styles (registered/unregistered, buffered/unbuffered, ECC, and so on) can cause significant problems in the operation of a system. These problems can range from preventing bootup to creating simple soft-memory errors.
- When the system's BIOS doesn't support LBA or ECHS enhancements, the drive capacity of even the largest hard drive is limited to 528MB. Almost all newer BIOS versions support LBA and ECHS enhanced drives.
- Installing a new ATA-66 or ATA-100 drive in a system by using the old IDE cable causes the drive's operation to be diminished to the level of the old drive. Without a new cable, communication with the drives is limited to the lesser standard determined by the 40-conductor signal cable.

- PCMCIA Type I cards, which were introduced in 1990, are 3.3mm thick and work as memory-expansion units.
- PCMCIA Type II cards are 5mm thick and support virtually any traditional expansion function (typically a modem), except removable hard-drive units. Type II slots are backward compatible, so Type I cards work in them.
- PCMCIA Type III cards are 10.5mm thick and are intended primarily for use with removable hard drives. Both Type I and Type II cards can be used in Type III slots.
- A PCMCIA Type III card uses only one of the two 68-pin JEIDA connectors, but it takes up the entire opening.
- The latest variation of the PCMCIA standard is Cardbus, which is a redefined and enhanced 32-bit version of the PC Card standard. The main purpose of this new specification is to extend the PCMCIA bus to higher speeds with more powerful devices and to provide support for 32-bit I/O and memory data paths.
- Although the Cardbus slot is designed to work with older PCMCIA and PC Card devices, the same is not true concerning the use of Cardbus cards in older slot types. The Cardbus card is keyed with a physical sheath around its pins so that it does not plug into the traditional PC Card socket.
- A relatively new power source for portable computers and hand-held devices is the fuel cell. Fuel cells are power-generating technologies that use electrochemical reactions between hydrogen and oxygen to produce electrical power.
- In some configurations, the microprocessor clock is set at a higher speed than the IC manufacturer suggests. This is referred to as *overclocking the processor*. Because the basic microprocessor is running faster than designed, both the front-side bus and the PCI bus run faster than their stated values by a factor directly proportional to the amount that the microprocessor is overclocked.
- Newer liquid-based microprocessor cooling systems cool and circulate water to carry heat away from the processor. These systems consist of a water reservoir tank, a water pump that circulates water throughout the cooling system, a condenser coil radiator with fans that cool the water and exhaust heat into the outside atmosphere, and a CPU cooling block that connects directly to the microprocessor and extracts heat from it.
- The most common drive arrays are RAID systems. RAID is an acronym for Redundant Arrays of Inexpensive Disks. Later usage of the term *RAID* exchanges the word *Independent* for *Inexpensive*. Five levels of RAID technology specifications are given by the RAID Advisory Board. Three of those levels are described here:
 - RAID-0 (Striped Disk Array without Fault Tolerance).
 - RAID-1 (Mirroring and Duplexing) is a redundancy scheme that uses two equal-sized drives, where both drives hold the same information. Each drive serves as a backup for the other. Duplicate information is stored on both drives. When a file is retrieved from the array, the controller reads alternate sectors from each drive. This effectively reduces the data read time by half.
 - RAID-5 (Independent Data Disks with Distributed Parity Blocks) provides a parity function to rotate through the different drives. Under this system, error checking and correction is the function of all the drives. If a single drive fails, the system is capable of

regenerating its data from the parity information on the other drives. RAID 5 is usually the most popular RAID system because it can be used on small arrays, and it has a high level of error recovery built in.

2.0 DIAGNOSING AND TROUBLESHOOTING

The 2.0 domain requires the ability to apply knowledge related to diagnosing and troubleshooting common module problems and system malfunctions, including knowledge of the symptoms related to common problems. In particular, the domain expects the technician to be able to recognize common problems associated with each module and their symptoms, and identify steps to isolate and troubleshoot the problems. Given a problem situation, interpret the symptoms and infer the most likely cause. Likewise, the technician should be able to identify basic troubleshooting procedures and tools and ways to elicit problem symptoms from customers. The main points follow:

- The first step in checking any electrical equipment that shows no signs of life is to check the external connections of the power supply.
- A 201 error code indicates a RAM failure.
- RAM failures basically fall into two major categories and create two different types of failures: soft-memory errors and hard-memory errors. *Soft-memory errors* are errors caused by infrequent and random glitches in the operation of applications and the system. You can clear these events just by restarting the system. *Hard-memory errors* are permanent physical failures that generate NMI errors in the system and require that the memory units be checked by substitution.
- You need to make sure that the replacement RAM is consistent with the installed RAM. Mixing RAM types and speeds can cause a system to lock up and produce hard-memory errors.
- If only the new RAM type is installed, a system could present a number of different symptoms, including producing short memory counts in the POST.
- If a system consistently locks up after being on for a few minutes, this is a good indication that the microprocessor's fan is not running or that some other heat buildup problem is occurring.
- If a system refuses to maintain time and date information after the CMOS backup battery has been replaced, you should check the contacts of the holder for corrosion.
- A typical symptom associated with keyboard failures is an IBM-compatible 301 error code display.
- When a system detects a stuck key on a keyboard, it produces an error message.
- An unplugged keyboard or a keyboard with a bad signal cable produces a keyboard error message during startup.
- Disconnecting or plugging in a keyboard while power is on can cause the keyboard or its system board support circuitry to fail.
- As the mouse is moved, the trackball picks up dirt or lint, which can hinder the movement of the trackball and cause the cursor to periodically freeze and jump onscreen.
- If a Windows video problem prevents you from seeing the driver, you should restart the system, press the F8 function key when the `Starting Windows` message appears, and select Safe Mode. This should load Windows with the standard 640×480 16-color VGA driver (the most fundamental driver available for VGA monitors), and it

should furnish a starting point for installing the correct driver for the monitor being used. If the monitor is an EPA-certified Energy Star-compliant monitor, this test might not work. Monitors that possess this power-saving feature revert to a low-power mode when they do not receive a signal change for a given period of time.

- Due to the high voltage levels, you should never wear antistatic grounding straps when working inside a monitor.
- The built-up charge on an anode must be shorted to ground so the monitor can be handled safely. You typically perform this operation with a large, long-handled screwdriver and a shorting clip.
- The voltage levels that are present in a computer during operation are lethal. Electrical potentials as high as 25,000 volts are present inside a unit when it is operating.
- You can remove built-up electromagnetic fields from the screen through a process called *degaussing*, which can be done by using a commercial degaussing coil. However, newer monitors have built-in degaussing circuits that can be engaged through the front panel controls.
- A typical symptom associated with floppy-disk drive failures during bootup is the display of an IBM-compatible 6xx (such as 601) error code.
- A typical symptom associated with floppy-disk drive failures during bootup is the FDD activity light staying on constantly, indicating that the FDD signal cable is reversed.
- Reversing the FDD signal cable causes the FDD activity light to stay on continuously. The reversed signal cable also erases the master boot record from the disk, making it nonbootable.
- A typical symptom associated with hard-disk drive failures is the display of an `Invalid Media`

`Type` message, which indicates that the controller cannot find a recognizable track/sector pattern on the drive.

- A typical symptom associated with hard-disk drive failures is the display of `No Boot Record Found, Non-System Disk or Disk Error, and Invalid System Disk` messages, which indicate that the system boot files are not located in the root directory of the drive.
- A typical symptom associated with hard-disk drive failures is the display of a `Missing Operating System OF Hard Drive Boot Failure` message, which indicates that the disk's master boot record is missing or has become corrupt.
- A typical symptom associated with hard-disk drive failures is the display of a `Current Drive No Longer Valid` message, which indicates that the hard-disk drive's CMOS configuration information is incorrect or has become corrupt.
- On IDE drives, you should check the Master/Slave jumper setting to make sure it is set properly for the drive's logical position in the system.
- Mixing IDE device types creates a situation in which the system cannot provide the different types of control information each device needs. The drives are incompatible, and you may not be able to access either device.
- You should check the CMOS Setup utility to make sure that SCSI support has been enabled, along with large SCSI drive support. SCSI support is not considered standard in PCs as IDE drives are.
- If a system can see the contents of a drive, the boot files have been lost or corrupted, but the architecture of the disk may be intact. You should attempt to restore the drive's master boot record (including its partition information) by typing `A>FDISK /MBR.`

- If a system cannot see a drive after booting to the floppy disk, an `Invalid Drive...` message or an `Invalid Drive Specification` message should be returned in response to any attempt to access the drive. You can use the `FDISK` utility to partition the drive and then use the `FORMAT` command to make the disk bootable.
- If the CD-ROM drive is inoperable, and a CD-ROM is locked inside it, you should insert a straightened paper clip into the tray-release access hole that's usually located beside the Ejection button. This technique releases the spring-loaded tray and pops out the CD-ROM.
- If a controller is built in to a system board and becomes defective, you may be able to install an IDE host adapter card in an expansion slot and use it without replacing the system board.
- If a printer switch box is located between the computer and printer, you can remove the print-sharing equipment, connect the computer directly to the printer, and try to print directly to the device to verify that the switching equipment is not creating a fault.
- To use the Windows 2000 or Windows XP Device Manager utility to troubleshoot USB problems, you must be logged on as an administrator or as a member of the Administrators group.
- To install a non-PnP device on a specific COM port (such as COM2), you must first disable that port in the system's CMOS settings to avoid a device conflict. If you do not, the system might try to allocate that resource to some other device because it has no way of knowing that the non-PNP device requires it.
- One of the main uses of the resistance function is to test fuses. If a fuse is good, the meter should read near 0 ohms. If the fuse is bad, the meter should read infinite.
- You can use the resistance function to test a system's speaker. To check a speaker, disconnect the speaker from the system and connect a meter lead to each end. If the speaker is good, the meter should read around 8 ohms (although some smaller speakers may be 4 ohms).
- The user is one of the most common sources of PC problems.
- If a system produces an error message (such as `The System Has Detected Unstable RAM at Location x`) or a beep code before the single beep occurs, the system has found a problem with the hardware. Such a case indicates a bad RAM memory device.
- FRUs are the portions of a system that you can conveniently replace in the field. FRU troubleshooting involves isolating a problem within one section of the system. A section consists of one device such as a keyboard, video display, video adapter card, I/O adapter card, system board, disk drive, printer, and so on. Typically, these components can simply be exchanged for replacements onsite and require no actual repair work.
- Gathering information from the user is one of the most important troubleshooting steps that technicians must perform.

3.0 PREVENTIVE MAINTENANCE, SAFETY, AND ENVIRONMENTAL ISSUES

The 3.0 domain requires knowledge of safety and preventive maintenance. With regard to safety, this domain covers the potential hazards to personnel and equipment when working with high-voltage equipment and items

that require special disposal procedures to comply with environmental guidelines. With regard to preventive maintenance, this domain covers knowledge of preventive maintenance products, procedures, environmental hazards, and precautions you should take when working on computer systems. The main points follow:

- Outer-surface cleaning can be accomplished with a simple soap-and-water solution, followed by a clear water rinse.
- A damp cloth is the best general-purpose cleaning tool for use with computer equipment.
- Socket-mounted devices should be reseated (that is, removed and reinstalled to establish a new electrical connection) as part of an anticorrosion effort. Doing this overcomes the chip-creep effect that thermal cycling has on socket-mounted devices.
- Computer equipment is susceptible to failures caused by dust buildup, rough handling, and extremes in temperature.
- Missing expansion slot covers adversely affect a system in two ways. First, a missing cover permits dust to accumulate in the system, forming an insulating blanket that causes components to overheat. Second, the heat problem is complicated further by the fact that the missing slot cover interrupts the designed airflow patterns inside the case, causing components to overheat due to lack of or inadequate airflow.
- If you use a vacuum for cleaning computer systems, you should use a static-free vacuum because normal vacuums are, by nature, static generators. A static-free vacuum has special grounding to remove the static buildup it generates. You should not use a normal vacuum to clean toner from a laser printer.
- You should check for sources of heat buildup around a computer and its peripherals, including direct sunlight from an outside window.
- Copies of the system backup should be stored in a convenient but secure place. In the case of secure system backups, such as those for client/server networks, backup copies should be stored where the network administrators can access them but others cannot (for example, in a locked file cabinet). Left unsecured, these copies could be used by someone without authority to gain access to the system or to its data.
- A keyboard's electronic circuitry is open to the atmosphere and should be vacuumed when you are cleaning around your computer area. Dust buildup on the keyboard circuitry can cause its ICs to fail due to overheating.
- A mouse's trackball should be removed and cleaned periodically. You should use a lint-free swab to clean the X and Y trackball rollers inside the mouse.
- Typical power supply variations fall into two categories: transients and sags. *Transients* are overvoltage conditions, and *sags* are undervoltage conditions. Transients can be classified as spikes (measured in nanoseconds) or as surges (measured in milliseconds). Sags can include voltage sags (which typically last only a few milliseconds) and brownouts (which can last for a protracted period of time).
- Inexpensive power line filters called *surge suppressers* are good for cleaning up dirty commercial power.
- In the case of a complete shutdown or a significant sag, the best protection against losing programs and data is a UPS.

- A battery-based UPS cannot keep a system running infinitely. For this reason, you should not connect nonessential, power-hungry peripheral devices such as laser printers to a UPS supply.
- Monitors, printers, scanners, and other peripheral devices should be stored in their original boxes, using their original packing foam and protective storage bags.
- Extremely high voltage levels (in excess of 25,000 volts) may be present inside the CRT housing, even up to a year after electrical power has been removed from the unit.
- In repair situations, the high voltage charge associated with video displays must be discharged. This is accomplished by creating a path from the tube's high-voltage anode to the chassis. With the monitor unplugged from the commercial power outlet, you clip one end of an insulated jumper wire to the chassis ground of the frame, and you clip the other end to a long, flat-blade screwdriver that has a well-insulated handle.
- In laser printers, the laser light is a hazard to eyesight, the fuser assembly is a burn hazard, and the power supply is a shock hazard.
- A potential burn hazard is the printhead mechanism of a dot-matrix printer.
- A Class C fire extinguisher should be present in the work area. Class C extinguishers are the type specified for use around electrical equipment.
- Laser printer toner cartridges can be refilled and recycled.
- For both batteries and printer cartridges, the desired method of disposal is recycling.
- ESD is the most severe form of EMI. The human body can build up static charges that range up to 25,000 volts. These buildups can discharge very rapidly into an electrically grounded body or device. A 25,000-volt surge can be damaging to any electronic device.
- The ability of the voltage associated with a video monitor to push current through the human body is significant (several amps), but the same ability associated with static is very low (micro-amps—that is, thousandths of an amp). Therefore, it is possible for a lower-voltage device with a higher current rating (such as a 110-volt AC power supply) to be much more dangerous than a higher-voltage source that has a lower current-producing capability (such as static).
- Some repair shops do not permit compressed air to be used for blowing dust out of keyboards and other computer equipment because it has erroneously been linked to creating ESD.
- ESD is most likely to occur during periods of low humidity. If the relative humidity is below 50%, static charges can accumulate easily. ESD generally does not occur when the humidity is above 50%. Normal air-conditioning works by removing moisture from the atmosphere, creating low-humidity conditions. Therefore, humidifiers are often used to correct this condition.
- You should never wear antistatic wrist or ankle straps while working on high-voltage components, such as monitors and power-supply units.
- Normal operating vibrations and temperature cycling can degrade the electrical connections between ICs and sockets over time. This gradual deterioration of electrical contact between chips and sockets is referred to as *chip creep*.
- Good grounding routes the induced EMI signals away from logic circuitry and toward ground potential, preventing the signals from disrupting normal operations. Unlike ESD effects, which are destructive, EMI effects can be corrected without damage.

- Because a computer system is connected to an actual earth ground, it should always be turned off and disconnected (along with its peripherals) from the power outlet during electrical storms.
- Technicians normally use antistatic grounding straps that may be placed around the wrist or ankle to ground them to the system they're working on. These straps release any static present on the technician's body and pass it harmlessly to ground potential.
- Antistatic straps should never be worn while working on higher-voltage components, such as monitors and power-supply units. Some technicians wrap a copper wire around their wrist or ankle and connect it to the ground side of an outlet. This practice is not safe because the resistive feature of a true wrist strap is missing.
- Most technicians' work areas include antistatic mats as an alternative to wrist or ankle straps; these mats are made out of rubber or other antistatic materials that the technicians stand on while working on the equipment. These mats are particularly helpful in carpeted work areas because carpeting can be a major source of ESD buildup. Some antistatic mats have ground connections that should be connected to the safety ground of an AC power outlet.
- A Pentium II processor includes all the multimedia enhancements from the MMX processor, and it retains the power of the Pentium Pro's dynamic execution and 512KB L2 cache features and employs a 66MHz or 100MHz system bus. The L1 cache is increased to 32K, and the L2 cache operates with a half-speed bus.
- The original Pentium III processor (code-named Katmai) was designed around the Pentium II core, but increased the L2 cache size to 512K. It also increased the speed of the processor to 600MHz, including a 100MHz front-side bus speed.
- Although the Intel Slot 1 design was originally developed for the Pentium II processor, it is also used in Celeron and Pentium III processor designs.
- AMD produced a reversed version of the Slot 1 specification for its Athlon processor by turning around the contacts of the Slot 1 design. AMD titled the new design Slot A. Although these two slot designs serve the same ends, the Slot A and Slot 1 microprocessor cartridges are not compatible.
- In older Pentium systems, the microprocessor's configuration settings are established largely through jumpers on the system board.
- The BIOS version must support the parameters of the microprocessor. If a microprocessor upgrade is performed and the BIOS code does not fully support the new processor, all the error types listed for manual configuration can occur.
- Whether RAM is made up of static or dynamic RAM devices, all RAM systems have the disadvantage of being volatile. This means that any data stored in RAM is lost if power to the computer is disrupted for any reason.

4.0 MOTHERBOARD/ PROCESSORS/MEMORY

The 4.0 domain requires knowledge of specific system board terminology and facts, along with ways and means of dealing with classifications, categories, and principles of motherboards, processors, and memory in computer systems. The main points follow:

- EDO is an advanced type of fast page-mode DRAM that is also referred to as *hyper page-mode DRAM*. The advantage of EDO DRAM is encountered when multiple sequential memory accesses are performed. Because the data pin is not turned off, each successive access after the first access is accomplished in two clock cycles rather than three.
- Special memory devices have been designed to optimize video memory–related activities. Among these devices are VRAM and WRAM.
- DRAM devices, which are commonly used for a system’s RAM, require periodic refreshing of their data. Some refreshing is performed by the system’s normal memory reading and writing cycles. However, additional circuitry must be used to ensure that every bit in all the memory registers is refreshed within the allotted time frame.
- The most popular form of error detection in PC compatibles is parity checking. With this methodology, an extra bit is added to each word in RAM and checked each time it is used. Parity checking is a simple self-test that is used to detect RAM read-back errors.
- When a parity error occurs, an NMI signal is generated in the system, causing the BIOS to execute its NMI handler routine, which normally places a parity error message onscreen, along with an option to shut down the system or to continue.
- Another possibility when a parity error occurs is that the system counts the memory, locks up, and reboots itself. If the memory error occurs high in the physical memory device, this situation can occur after the operating system and applications have been loaded and started running.
- ECC SDRAM is a type of SDRAM that includes a fault-detection/correction circuit that can detect and fix memory errors without shutting down the system.
- By using a parity memory scheme, a system can detect that a bit has flipped when the memory is read, but it can only display a `Parity Error` message and freeze up. Although this prevents the bad data from being used or written away in the system, it also erases all current data from RAM. An ECC memory module has the ability to detect and correct a single-bit error or to detect errors in 2 bits.
- A microprocessor’s internal first-level cache is also known as an *L1 cache*.
- The primary objective of the cache memory’s control system is to maximize the ratio of hits to total accesses (that is, the *hit rate*) so that the majority of memory accesses are performed without wait states. One way to do this is to make the cache memory area as large as possible (thus raising the possibility of the desired information being in the cache). However, the relative cost, energy consumption, and physical size of SRAM devices work against this technique. Practical sizes for cache memories run between 16KB and 512KB.
- SIMM modules were traditionally available in 30-pin and 72-pin versions; DIMMs are larger 168-pin boards.
- SIMMs and DIMMs come in 9-, 36-, and 72-bit versions that include parity-checking bits for each byte of storage (for example, a 36-bit SIMM provides 32 data bits and 4 parity bits—1 for each byte of data).
- Split-bank arrangements use a different specification for DIMM slot 1 than they do for DIMM slots 2 and 3. The odd slot is normally organized into one bank, and the other two slots combine to form the second bank. If you are not careful when populating these slots, you can create a situation in which the system’s memory controller cannot access all the installed RAM.

- It is important to install RAM that is compatible with the bus speed at which the system is running. Normally, installing RAM that is rated faster than the bus speed does not cause problems. However, installing slower RAM or mixing RAM speed ratings within a system may cause it not to start or to periodically lock up.
- A software-activated power switch can be implemented through the ATX power-connector specification. The PS-ON and 5VSB signals can be controlled by the operating system to perform automatic system shutdowns.
- The most common connectors used with PC keyboards are 6-pin PS/2 mini-DINs, 5-pin DINs, and RJ-11 jacks. PC-XT- and AT-compatible systems have historically used 5-pin DIN connectors, and ATX systems use 6-pin mini-DINs. Keyboards with USB interfaces and connectors are available and are becoming increasingly popular.
- Although the ISA bus originally ran at micro-processor-compatible speeds up to 10MHz or 12MHz turbo speeds, incompatibility with slower adapter cards caused manufacturers to settle for running them at 8MHz or 8.33MHz in newer designs.
- Due to industry moves away from anything related to ISA cards, the PCI bus has become the dominant force in system board designs. Current designs include three or four PCI slots and an AGP slot; they may include a single ISA connector for compatibility purposes or no ISA connector.
- The PCI bus specification uses multiplexed addresses and data lines to conserve the pins of the basic 124-pin PCI connector. Within this connector are signals for control, interruption, cache support, error reporting, and arbitration.
- Because the PnP process has no method for reconfiguring legacy devices during the resource assignment phase, it begins by assigning resources, such as IRQ assignments, to these devices before servicing the system's PnP devices.
- When the BIOS detects the presence of a new device during the detection phase, it disables the resource settings of its existing cards, checks to determine what resources are required and available, and then reallocates the system's resources as necessary.
- Newer Pentium systems include an advanced AGP interface for video graphics. The AGP interface is a variation of the PCI bus design that has been modified to handle the intense data throughput associated with three-dimensional graphics.
- There is some upward compatibility between PC-Bus, ISA, EISA, and VESA cards. Both the EISA and VESA slots can accommodate ISA cards.
- The USB specification provides *interrupt transfers*, which are small, spontaneous transfers from a device that are used to announce events, provide input coordinate information, or transfer characters.
- USB 2.0 devices are rated as full-speed (480Mbps) and low-speed (12Mbps) devices based on their communication capabilities. The length limit for a cable serving a full-speed device is 16 feet, 5 inches (5m). The length limit for cables used between low-speed devices is 9 feet, 10 inches (3m).
- The IDE host adapter portion of a chipset is normally capable of controlling up to four IDE hard disks, CD-ROM drives, or other IDE devices.
- The hierarchy of assigning logical drive designations in the IDE interface calls for primary partitions to be assigned sequentially from ID1 master, to ID1 slave, to ID2 master, to ID2 slave. Next, the system assigns drive letters to the

extended partitions for each drive in the same order.

- Two similar cables are used with IDE devices. The newer ATA 4/Ultra ATA-66 and Ultra ATA-100 IDE enhancements provide increased data throughput by doubling the number of conductors in the signal cable to 80.
- SCSI host adapters are typically available for use with ISA, EISA, and PCI bus interfaces.
- If the time is incorrect on a PC system, the easiest way to reset it is through the operating system. However, if the PC system continually fails to keep good time, you should ensure that corrosion has not built up on the battery contacts. You should clean the contacts with a pencil eraser and retry the battery. If that doesn't work, you can try replacing the battery. Next, you can try replacing the RTC module. If this does not correct the time-keeping problem, the electronic circuitry that recharges the battery may be defective; in this case, you need a new motherboard.
- For larger drives (more than 1,024 cylinders or 528MB), the Large and LBA modes are used. The Large option can be used with large drives that do not support LBA techniques. For drives that do support LBA techniques, the LBA mode should be selected. In LBA mode, the IDE controller converts the sector/head/cylinder address into a physical block address that improves data throughput.
- Care must be taken when changing the translation mode setting in CMOS because all data on the drive can be lost in the process.
- The BIOS antivirus utility should be enabled for normal operations. However, it should be turned off when you conduct an upgrade of the operating system. The built-in virus warning utility checks the drive's boot sector for changes. The changes that the new operating system attempts to make to the boot sector are interpreted as a virus, and the utility tries to prevent the upgrade from occurring.
- You use the Feature Setup screen to configure different boot-up options, including establishing the system's boot-up sequence. The sequence can be set so that the system checks the floppy drive for a boot sector first or so that it checks the hard drive without checking the floppy drive.
- You should enable the CD-ROM drive as one of the boot options in the sequence so that the operating system CD-ROM can be used to start the system when it will not boot to the hard drive.
- The BIOS stores the PnP information it collects from the devices in a special section of the CMOS RAM that is known as the *ESCD area*. This information is stored in the same manner in which standard BIOS settings are stored.
- The parallel printer port can be configured for normal PC-AT-compatible SPP operation; for extended bidirectional operation (that is, EPP operation); for fast, buffered bidirectional operation (that is, ECP operation); or for combined ECP+EPP operation. The normal CMOS setting should be selected unless both the port hardware and the driver software support EPP and/or ECP operation.
- The ECP mode provides a number of advantages over the SPP and EPP modes. In particular, it offers higher performance than either of the other modes.
- The ECP port is compatible with the standard LPT port and is used in the same manner as the LPT port when no ECP operations are called for. However, it also supports high-throughput DMA operations for both forward and reverse transfers.

- Because both of the advanced parallel port modes operate in a bidirectional half-duplex manner, they require an IEEE-1284-compliant cable. Standard parallel cables designed for older SPP operations may not support these qualities.
- There is some danger that a user will forget his or her CMOS password. When this occurs, it is impossible for the user to gain access to the system unless you completely reset the contents of the CMOS RAM. On some system boards, you can do so by shorting a special pair of jumpers on the board. With other systems, you need to remove or short across the backup battery to reset the CMOS information.
- When you try to reset the contents of the CMOS RAM in ATX systems, you need to unplug the power from the commercial outlet to reduce the voltage to the CMOS registers. When the contents of the CMOS are reset, you must manually restore any nondefault CMOS settings being used by the system.
- The BIOS holds information about the system's resource allocations and supplies it to the operating system as required. The operating system must be PnP-compatible to achieve the full benefits of the PnP BIOS. In addition, you should configure the CMOS setting for a PnP operating system so that the BIOS routine knows that the PnP OS is available.

5.0 PRINTERS

The 5.0 domain requires knowledge of basic types of printers, basic printer concepts, printer components, the way printers work, the way printers print onto a page, the paper path, printer care and service techniques, and common printer problems. This domain has been expanded so that it now covers laser, ink-

dispersion, dot-matrix, solid-ink, thermal, and dye-sublimation printing technology. Likewise, interfaces covered in this domain include Parallel, Network, SCSI, USB, Infrared, Serial, IEEE 1394/FireWire, and Wireless connections.

The main points follow:

- Vector-based fonts store the outlines of the character styles and sizes as sets of mathematical formulas. Each character is composed of a set of reference points and connecting lines between the reference points. These types of fonts can be scaled up and down to achieve various sizes.
- Vector-based fonts require much less storage space to store a character set and all its variations than is necessary for an equivalent bitmapped character set. In addition, vector-based fonts can be scaled and rotated; bitmapped fonts typically cannot be scaled and rotated. Conversely, bitmapped characters can be printed out directly and quickly, but vector-based characters must be generated when called for.
- Tractor feeds are used with very heavy forms, such as multiple-part, continuous forms, and are most commonly found on dot-matrix printers.
- A typical printhead may contain 9, 18, or 24 print wires. The number of print wires used in the printhead is the major determining factor associated with a printer's character quality. A 9-pin printhead generally delivers draft-quality print, and 24-pin printheads approach letter-quality print.
- The components of a typical dot-matrix printer include a power-supply board, a main control board, a printhead assembly, a ribbon cartridge, a paper-feed motor (along with its mechanical drive gears), and a printhead positioning motor and mechanisms.

- A printer's interface may contain circuitry to handle serial data, parallel data, or a combination of the different interface types: Centronics parallel, RS-232 serial, SCSI, USB, or IrDA.
- Ink-jet printers produce characters by squirting a precisely controlled stream of ink drops onto paper. The drops must be controlled very precisely in terms of their aerodynamics, size, and shape; otherwise, the drop placement on the page becomes inexact, and the print quality falters.
- The six stages of operation in a laser printer are cleaning, conditioning, writing, developing, transferring, and fusing.
- A high voltage applied to the primary corona wire in a printer creates a highly charged negative field that conditions the drum to be written on, by applying a uniform negative charge (–600 volts) to it.
- Great care should be taken when installing a new drum unit in a laser printer. Exposing the drum to light for more than a few minutes may damage it. The drum should never be touched because touching it can ruin its surface. You should keep the unit away from dust, dirt, humidity, and high temperatures.
- The transfer corona wire (that is, transfer roller) is responsible for transferring toner from the drum to the paper.
- A thermal sensor in the fuser unit of a printer monitors the temperature of the unit. This information is applied to the control circuitry so that it can control the fuser temperature between 140°C and 230°C. If the temperature of the fuser is not controlled correctly, it may cause severe damage to the printer and may also present a potential fire hazard.
- In Hewlett-Packard printers, the main portion of the printing system is contained in the electrophotographic cartridge, which contains the toner supply, the corona wire, the drum assembly, and the developing roller.
- The most fundamental specification for paper is paper weight. Paper is specified in terms of its weight per 500 sheets of 22-inch×17-inch paper (for example, 500 sheets of 22-inch×17-inch 21-pound bond paper weighs 21 pounds).
- You should heed this caution concerning parallel printer cables: The IEEE has established specifications (IEEE 1284) for bidirectional parallel-printer cables. These cables affect the operation of EPP and ECP parallel devices. Using an older, noncompliant unidirectional cable with a bidirectional parallel device prevents the device from communicating properly with the system and may prevent it from operating.
- Not all serial cables are created equal. In the PC world, RS-232 serial cables can have several configurations. First, they may use either 9-pin or 25-pin D-shell connectors. The recommended signal cable lengths associated with parallel printers are 0 to 10 feet (0m to 3m), although some equipment manufacturers specify 6 feet (1.8m) maximums for their cables. You should believe these recommendations when you see them. The recommended signal cable lengths associated with RS-232 serial printers are 10 to 50 feet (3m to 15.25m). However, some references use 100 feet (30.5m) as the acceptable length of an RS-232C serial cable.
- The IrDA specification calls for communication ranges up to 6.5 feet (2m), but most implementations state 3 feet (1m) as the recommended range.
- Although some older network printers use coaxial cable connections, newer network printers feature RJ-45 jacks for connection to twisted-pair Ethernet networks. It is relatively easy to

determine whether a printer is networked by the presence of a coaxial or a twisted-pair network cable connected directly to the printer. The presence of the RJ-45 jacks on the back of the printer also indicates that the printer is network capable, even if it is not being used in that manner.

- Nearly every printer is equipped with a built-in self-test. The easiest way to determine whether a printer is at fault when problems arise is to run its self-test routine. If the self-test runs and prints clean pages, most of the printer has been eliminated as a possible source of problems. The problem could be in the computer, the cable, or the interface portion of the printer. If the printer fails the self-test, however, it is necessary to troubleshoot the printer's problem.
- The item in a dot-matrix printer that requires the most attention is the ribbon cartridge.
- As a dot-matrix printer's ribbon wears out, the printing becomes faint and uneven. When the print becomes noticeably faint, the cartridge should be replaced.
- If the tops of characters are missing, the printer's printhead is misaligned with the platen. It might need to be reseated in the printhead carriage, or the carriage assembly might need to be adjusted to the proper height and angle.
- If the output of a printer gets lighter as it moves from left to right across the page, you might need to adjust the spacing between the platen and the printhead carriage rod to obtain proper printing.
- To exchange a dot-matrix printhead assembly, you should make sure that it is cool enough to be handled. Printheads can get hot enough to cause serious burns.
- When paper does not advance in a printer, the output is normally one line of dark blocks across the page.
 - The item in an ink-jet printer that requires the most attention is the ink cartridge (or cartridges).
 - The density of the printout from an ink-jet printer can be adjusted through the printer's printing software. When the print becomes noticeably faint or the resolution becomes unacceptable, the cartridge needs to be replaced.
 - Using a solvent to clear blockages in the jets can dilute the ink, reduce its surface tension characteristics, and allow it to flow uncontrollably through the jet.
 - If a printhead assembly will not move at any time, check to see whether the printer is in Maintenance mode. In this mode, the printer typically keeps the printhead assembly in the home position. If no mode configuration problems are present, the printhead-positioning motor should be replaced.
 - If the printer's paper thickness selector is set improperly or the rollers in its paper-feed system become worn, paper can slip as it moves through the printer and cause disfigured graphics to be produced. You should check the printer's paper thickness settings. If they are correct and the print output is disfigured, you need to replace the paper-feed rollers.
 - Paper jams occur in all three main sections of the printer: the pickup area, the registration area, and the fuser area.
 - Using paper that is too heavy or too thick can result in jams, as can overloading paper trays. Similarly, using the wrong type of paper can defeat the separation pad and allow multiple pages to be drawn into the printer at one time.
 - If the high-voltage section of a laser printer's power supply fails, the transfer of toner to the drum and then to the paper cannot occur. In addition, the Contrast control is not operational.

- If you are having printer problems, you should check to see whether the printer is connected to the system through a print-sharing device. If it is, you should connect the printer directly to the system and test it. It is not a good practice to use laser printers with print-sharing devices.
- A black page indicates that toner has been attracted to the entire page. This condition could be caused by a failure of the primary corona, the laser-scanning module, or the main control board.
- A white, or blank, page indicates that no information is being written on the drum. This condition involves the laser-scanning module, the control board, and the power supply. Another white-page fault occurs when the corona wire becomes broken, contaminated, or corroded, so that the attracting charge between the drum and paper is severely reduced.
- Specks and stains on a page may be caused by a worn cleaning pad or by a defective corona wire. If the cleaning pad is worn, the pad cannot remove excess toner from the page during the fusing process. If the corona wire's grid does not regulate the charge level on the drum, dark spots appear in the print.
- Faint print from a laser printer can be caused by a number of different situations. If the contrast control is set too low or the toner level in the cartridge is low, empty, or poorly distributed, the print quality can appear washed out.
- If toner does not come out of a laser printer toner cartridge uniformly, areas of missing print can be created. A damaged or worn drum can also be a cause of repeated missing print. If areas of the drum do not hold the charge properly, toner is not transferred to it or to the page correctly.
- Smudged print is normally a sign of a failure in the fusing section. If the fuser roller's temperature or pressure is not sufficient to bond the toner to the page, the print smudges when it is touched.
- If paper feeds into a printer but jams after the process has begun, you should troubleshoot the particular section of the printer where the jam is occurring—pickup, registration, fuser area, and output devices (that is, collators and duplexers).
- Often, a paper jam error indication remains even after the paper has been removed from the laser printer. This problem is typically caused by a safety interlock error. Simply opening and closing the printer's main access door should clear the error.
- You should vacuum or replace a printer's ozone filter as a normal step in its preventive maintenance schedule.
- Thermal printing techniques are very old and at one point had nearly vanished. However, they continue to remain in use with specialized peripherals such as credit-card receipt printers. Thermal wax printing is used to produce near photographic reproductions of images.
- A direct-transfer thermal printer works in much the same manner as an ink-cartridge dot-matrix printer. The major difference between the two technologies is that the print wires are heated in the thermal printer so that they can burn dot patterns into special thermal paper. Early facsimile (fax) machine technology was based on this type of thermal printing. Even now, thermal printers are widely used for bar code printing, battery-powered hand-held printing devices, and credit-card receipt printers.
- Thermal-wax transfer printers employ a thermal printhead, which melts dots of wax-based ink from the transfer ribbon onto the paper. When the wax cools, it is permanently attached to the page. Unlike the direct-transfer thermal printer, thermal-

wax transfer printers do not require special paper for printing.

- A special variety of ink-jet printers referred to as solid ink-jet printers (also called *wax-jet printers*) combines thermal printer technology with ink-jet type operations to produce brilliantly colored pictures and images. Instead of working with inks, these printers melt dyed waxes and then spray them on the page using ink-jet–like dispersal methods. The wax base used for the printing process produces exceptionally bright colors on all types of paper. However, because these printers are slow and relatively expensive, they are typically found only in professional reproduction and advertising settings.
- Professional graphics companies use dye-sublimation printing to produce high-quality reproductions of photographic images. However, smaller versions designed for the consumer market have been introduced to provide personal printing capabilities for digital camera users.
- In a dye-sublimation printer, sheets of special paper or transparencies are fastened securely to a print drum. Clamping the paper to the drum ensures good registration between the different colors that will be printed on the paper in successive color passes. The drum with the paper is rotated in conjunction with a continuous roll of plastic film containing successive CYMK color sheets that have the same dimensions as the page. At the point where the paper and film come together, a heating element strip heats the color substance on the film so that it vaporizes (sublimates) and is absorbed into the paper.
- Many laser printers ship with something less than their maximum amount of RAM installed. However, they also provide the optional hardware to permit you to upgrade the memory if desired.

Many high-speed laser printers require additional RAM to be installed to handle printing of complex documents, such as desktop-published documents containing large graphic files.

- Newer printers follow the ROM technologies used in computers and have installed ROM devices that can be flashed. For a given printer type and model, the manufacturer’s service center can provide information about the availability of replacement parts.

6.0 BASIC NETWORKING

The 6.0 domain requires knowledge of basic networking concepts and terminology, ability to determine whether a computer is networked, knowledge of procedures for swapping and configuring NICs, and knowledge of the ramifications of repairs when a computer is networked. This domain has been expanded to also include common types of network cables, their characteristics and connectors, and common technologies available for establishing Internet connectivity and their characteristics. The main points follow:

- Be aware that under CompTIA’s definition, a LAN can be composed of only two computers. If only two units are connected, point-to-point communications software and a simple null modem can be used.
- In a peer-to-peer network arrangement, the users connected to the network can decide to share access to different network resources, such as hard drives and printers.
- A common definition of a peer-to-peer network is one in which all the nodes can act as both clients and servers of the other nodes under different conditions.

- The major advantages of the client/server networking arrangement include centralized administration and data and resource security.
- The IEEE's XXBASE-YY nomenclature provides three pieces of information about the LAN. For example, 10BASE-5 designates that the LAN has a maximum data rate of 10Mbps, that it is a baseband LAN (versus broadband), and that its maximum segment length is 500m.
- The cables used in a TX network can be Category 5 UTP or STP. The 100BASE-FX Fast Ethernet designation indicates that the network is using fiber-optic cable.
- The recommended maximum length of a 10/100BASE-T segment is 330 feet (100m).
- UTP LAN connections are made through modular RJ-45 jacks and plugs.
- The three important pieces of information required to configure a LAN adapter card for use are the IRQ setting (which the adapter uses to communicate with the system), the I/O port address (which the adapter uses to exchange information with the system), and the base memory address (which the adapter uses as a starting point in memory for DMA transfers).
- LAN adapter cards must have connectors that are compatible with the type of LAN cabling being used. Many older Ethernet LAN cards came with both an RJ-45 and a BNC connector, so the cards can be used in any type of Ethernet configuration.
- RG-6 is the preferred type of coaxial cable for residential structured wiring. It is widely used for video distribution and also for connecting satellite-receiving antenna systems to standard, digital, and high-definition television (HDTV) receivers.
- RG-6 cable has an impedance of 75 ohms and uses 18-gauge wire. This type of coaxial cable connects to equipment through a threaded "F" connector.
- Referred to as thicknet coax cabling, RG-8 cable was widely used in 10BASE-5 Ethernet networking. It has an impedance of 50 ohms and uses 19/10-gauge wire centers. The thicknet cable does not actually connect to the network adapter in the computer. Instead, a device called a Medium Attachment Unit (MAU) is inserted in line with the cable. An interface cable referred to as an Attachment Unit Interface (AUI) connects the MAU to the network adapter card through a 15-pin AUI cable.
- RG-58 cable is thinnet Ethernet cabling used for 10BASE-2 networks. It has an impedance of 52 ohms and uses 24-gauge wire centers. These cables attach to equipment through British Naval Connectors (BNCs). In 10BASE-2 LANs, the node's LAN adapter card is usually connected directly to the LAN cabling, using a T-connector for peer-to-peer networks or a BNC connector in client/server LANs.
- RG-59 cable is widely used for CATV and video services. It is similar in appearance to RG-58 cabling.
- The original 10BASE-5 connection scheme required that special transceiver units be clamped to the cable. A pin in the transceiver pierced the cable to establish electrical contact with its conductor. An additional length of cable, called the drop cable, ran between the LAN adapter card and the transceiver on the bus.
- Terminators are energy-absorbing devices placed at the ends of buses and cables to absorb signal energy at the end of the bus or cable. They are used to prevent the signals from being reflected back into the cabling and causing signal interference with information on the bus.

- A standard method for terminating telecommunications wiring is to route all the data/ telecommunications wiring to a connection block that employs an Insulation Displacement Connector (IDC). This connection method offers faster installation and more reliable connections.
- The two most common styles of IDC are the type-66 and type-110 termination blocks. Older type-66 blocks are insulation displacement systems designed to wire up telephones and similar communications systems. They usually contain 200 metal slots (for interfacing 50 pairs from two sources) and come in various formats for those pins.
- Newer type-110 IDC blocks occupy less space than type-66 blocks for an equal number of connections. These blocks are more likely to be rated for CAT5 wire than type-66 blocks and often have RJ-11 or RJ-45 connectors already attached to them.
- The Universal Data Connector (UDC) device was developed as a part of IBM's token-ring networking standard to provide highly dependable connections even under adverse conditions.
- Fiber-optic cabling offers the prospect of very high performance links for LAN implementation. It can handle much higher data-transfer rates than copper conductors, and can handle longer distances between stations before signal deterioration (attenuation) becomes a problem. In addition, fiber-optic cable offers a high degree of security for data communications.
- Plenum-rated cables are suitable for use in ducts, plenums, and other spaces used for environmental air because they have adequate fire-resistant and low smoke-producing characteristics. When the protective insulation placed around cabling burns, it gives off toxic gases. If these cables are located in a plenum area, the dangerous gases are spread throughout the facility as part of the air circulation system.
- The Infrared Data Association (IrDA) infrared transmission specification makes provisions for multiple IrDA devices to be attached to a computer so that it can have multiple, simultaneous links to multiple IrDA devices.
- The IEEE 802.11b (also known as 802.11 High Rate or Wi-Fi) wireless standard has gained wide acceptance as the preferred wireless networking technology for both business and home network applications. Most current wireless LANs are based on this specification and operate at transfer rates in the range of 11Mbps, with fallback operations at 5.5, 2, and 1Mbps.
- To minimize the risk of security compromise on a wireless LAN, the IEEE 802.11b standard provides a security feature called Wired Equivalent Privacy (WEP). This standard provides a method for encrypting data transmissions and authenticating each computer on the network.
- Wireless LAN (WLAN) adapters for PCs are typically available in the form of plug-in PCI and PCMCIA cards or as attachable USB devices. Wireless network computers are also able to communicate with wired network computers on an Ethernet LAN using the access point as the connection between the two networks.
- To minimize the risk of security compromise on a wireless LAN, the IEEE 802.11b standard provides a security feature called Wired Equivalent Privacy (WEP). This standard provides a method for encrypting data transmissions and authenticating each computer on the network.
- In a network environment, no unit really functions alone. Unlike on a standalone unit, the steps performed on a network computer may affect the operation of other units on the network.

- A bad cable or connector can cause a condition in which the user cannot see any other computers on the network. As a matter of fact, the majority of all network failures involve bad cable, connectors, and connections.
- Even if a unit does not need to be removed from a network, diagnostic efforts and tests run across the network can use a lot of the network's bandwidth. This reduced bandwidth causes the operation of all the units on the network to slow down, due to the added usage of the network.
- Many newer network cards possess PnP capabilities. With non-PnP network cards, such as most ISA NICs, you need to configure the cards manually through hardware jumpers or through logical configuration settings in the BIOS Extension EPROM.
- You should check the activity light on the back plate of a LAN card (if available) to determine whether the network is recognizing the network adapter card. If the lights are active, the connection is alive.
- With UTP cable, you can unplug a cable from an adapter card and plug it into a tester. With coaxial cable, you must unplug both ends of the cable from the network, install a terminating resistor at one end of the cable, and plug the other end of the cable into the tester. The tester performs the tests required to analyze the cable and connection.
- Cable is one of the biggest problems encountered in a network installation. Is the cable correctly connected? Are all the connections good? Is the cable type correct? Has there been any cable termination, and if so, has it been done correctly?
- Most users connect to the Internet and other wide area networks via standard telephone lines, using dial-up modems. Dial-up connections are generally the slowest way to connect to a network, but they are inexpensive to establish and use.
- A proxy server is a computer used to perform services locally; it then forwards requests for services that it cannot fulfill to an appropriate server.
- Caching improves network performance by reducing the load placed on the bandwidth capabilities of the link between the company and the Internet. If the requested page is not in the proxy cache, the server forwards the request to the Internet for resolution.
- A firewall is a combination of hardware and software components that provide a protective barrier between networks with different security levels (for example, the LAN and the Internet). Rules for transmitting and receiving information to and from the other network can be established for the firewall so that specific types of items or addresses are not allowed to pass between the networks.
- A network protocol is a set of rules that govern how communications are conducted across a network. These protocols operate at the Network and Transport layers of the OSI model.
- NetBIOS Extended User Interface (NETBEUI) is a fast, efficient protocol, suitable for use on smaller Microsoft networks. It doesn't require any configuration to implement and is very simple to administer.
- NWLink is Microsoft's version of the Internetwork Packet Exchange/Sequenced Packet Exchange (IPX/SPX) network protocol used in Novell NetWare environments. Although NetWare has used IPX/SPX for the majority of its networking functions, with the release of NetWare 5.0, Novell changed its primary protocol from IPX/SPX to TCP/IP.
- AppleTalk is used to communicate with Apple Macintosh computers. Historically, Apple has

used AppleTalk for the majority of the functions in its networking environment. However, Apple now supports TCP/IP as well.

- ▶ The Transmission Control Protocol/Internet Protocol (TCP/IP) is the most popular network protocol currently in use due largely to the fact that the Internet is based on it. However, TCP/IP has rapidly become the protocol of choice for corporate networks because most operating systems support it.
- ▶ ISDN service offers high-speed access to the public telephone system. However, ISDN service requires digital modems (also referred to as terminal adapters, or TAs). Not only does the end user require a digital modem, but the telephone company's switchgear equipment also must be updated to handle digital switching.
- ▶ Digital Subscriber Line (DSL) technology provides high-speed communication links by using the existing telephone lines to generate bandwidths ranging up to 9Mbps or more. However, distance limitations and line-quality conditions can reduce the actual throughput that can be achieved with these connections.
- ▶ DSL communications require a special DSL modem, also known as an ADSL Terminal Unit (ATU), to provide the interface between the computer (or the computer network) and the DSL phone line.
- ▶ SDSL is referred to as symmetric because it supports the same data rates for upstream and downstream traffic. Conversely, ADSL (also known as rate-adaptive DSL) supports different data-transfer rates when receiving data (referred to as the downstream rate) and transmitting data (known as the upstream rate). The ADSL transmitting rate is significantly slower than the receiving rate.
- ▶ SDSL supports data-transfer rates up to 3Mbps in both directions, whereas ADSL supports data-transfer rates of from 1.5 to 9Mbps downstream and from 16 to 640Kbps upstream.
- ▶ Asymmetric DSL (ADSL) works by splitting the phone line into two frequency ranges. The frequencies below 4KHz are reserved for voice, and the range above that is used for data. This makes it possible to use the line for phone calls and data network access at the same time.
- ▶ As with ADSL, there are several varieties of Symmetric DSL. These versions include SHDSL, HDSL, HDSL-2, and IDSL.
- ▶ The equal upstream and downstream speeds make Symmetric DSL versions useful for LAN access, videoconferencing, and locations that host their own Web sites.
- ▶ The local cable television service companies act as ISPs and provide Internet access through their existing broadband cable television networks. To accomplish this, they offer special cable modems that attach the computer to an existing cable TV (CATV) network connection in the home.
- ▶ Satellite companies have taken on the cable distribution companies by providing Internet access via satellite link. These services have been provided using two methods: two-way satellite link and separate uplink and downlink channels using satellite and dial-up telephone lines.
- ▶ In most satellite systems, the dish has no up-link capabilities, so it cannot send data to retrieve information from the Web. This function must be supplied through the telephone connection.
- ▶ In other satellite systems, the dish is equipped with multiple transceivers that provide both up- and down-links through the satellite link.