



Technical and Vocational Training Institute (TVTI)
Faculty of Electrical/Electronics & Information and Communication
Technology Department of Information Technology

Course Title: Computer Maintenance

Chapter – 1:

PC Technician Professional

Best Practices

Chapter 1.1:- Introduction to computer maintenance and peripherals

1. Introduction

- 1. Personal computer,**
- 2. Basic personal computer system**
- 3. Maintenance, Servicing**
- 4. Troubleshooting**
- 5. Electrical Safety**

2. PC component and Peripherals

1. PC opponent

- 1. Form factor, Cases**
- 2. Power Supply**
- 3. Connectors**
- 4. Motherboard**
- 5. Cooling System**
- 6. Memory and adapter cards**
- 7. Storage device**

2. Peripheral device

- 1. Input Devices**
- 2. Output device**

1. Personal Computer

- A computer can be defined as:

1. A person who makes calculations, especially with a calculating machine.
2. A programmable device that can store, retrieve, and process data.
3. An electronic device that can retrieve, store, process, and output data, typically in binary form, according to instructions given to it in a variable program.
4. A programmable electronic device designed to accept data, perform prescribed mathematical and logical operations, store data, and display results of these operations.
 - Mainframes, desktop and laptop computers, tablets, smartphones, smartwatches, and IoT devices are some of the different types of computers.

2. Basic Personal Computer System

- A computer system consists of hardware and software components.
 1. Hardware is the physical equipment such as the case, storage drives, keyboards, monitors, cables, speakers, and printers.
 2. Software is the operating system and programs.
 - The operating system instructs the computer how to operate.
 - Programs or applications perform different functions.



3. Maintenance, Servicing

- **Maintenance**

- Maintenance includes both hardware & software in it.
- Maintenance is a continuous process.
- Hardware maintenance includes cleaning dust, maintaining constant voltage, etc.
- Software maintenance includes reinstallation, upgradation & removal of different software's.

- **Servicing**

- Servicing is mainly associated with hardware equipment.
- Servicing includes checkups, repairs and updating of all physical components.
- Service provider should have proper knowledge about various components and their installation procedures.

Electrical Safety

- Electrical devices have certain power requirements.
- AC adapters are manufactured for specific laptops.
- Exchanging AC adapters with a different type of laptop or device may cause damage to both the AC adapter and the laptop.
- Some printer parts, such as power supplies, contain high voltage.

Check the printer manual for the location of high-voltage components.



**Follow electrical safety guidelines
to prevent electrical fires, injuries, and
fatalities.**

Electrical and ESD Safety

- Electrostatic discharge (ESD) can occur when there is a buildup of an electric charge that exists on a surface which comes into contact with another differently charged surface.
- ESD can cause damage to computer equipment if not discharged properly.
- At least 3,000 volts of static electricity must build up before a person can feel ESD
- Follow these recommendations to help prevent ESD damage:
 - Keep all components in **antistatic bags** until you are ready to install them.
 - Use **grounded mats** on workbenches.
 - Use **grounded floor mats** in work areas.
 - Use **antistatic wrist straps** when working inside computers. Wrist strap should make contact with the skin.



2. Computer components and Peripherals

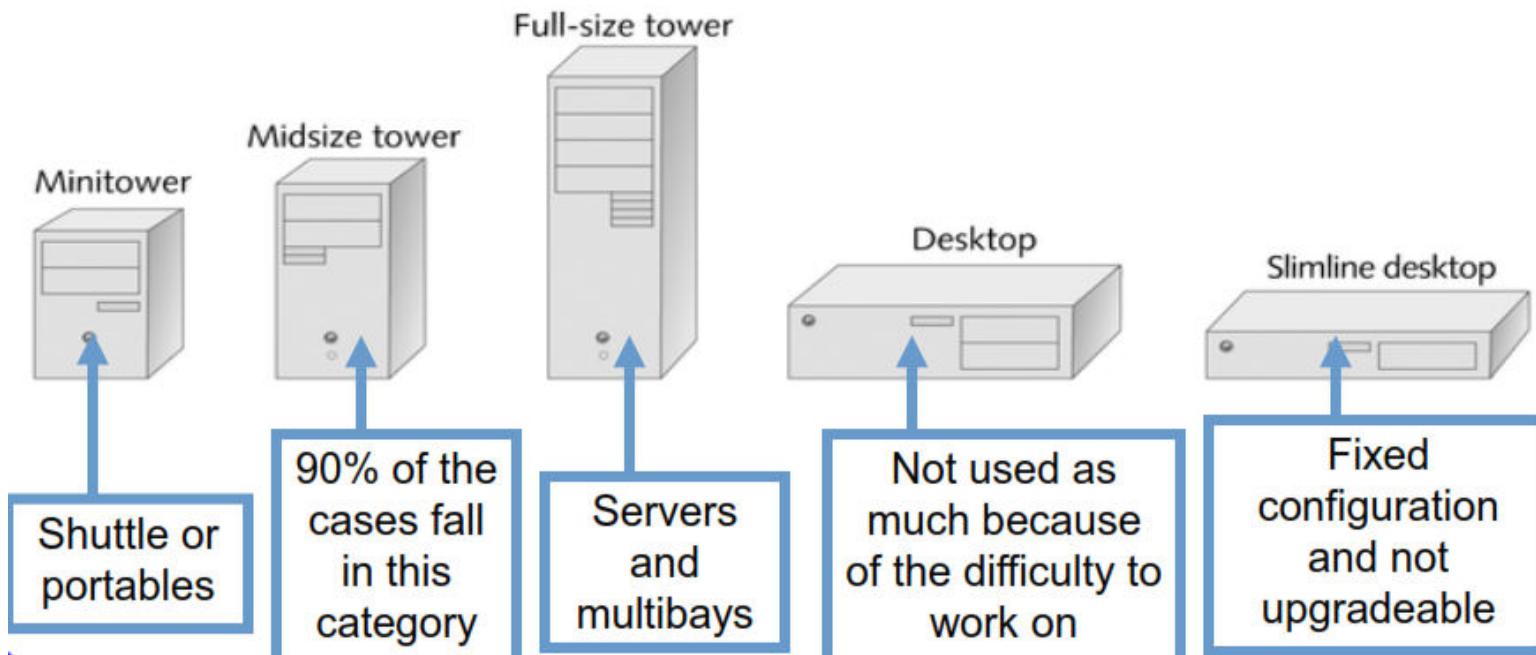
Form Factor

- It determines the specifications on how a Motherboard is built, from the size, shape, casing, power supply, mounting holes, and the overall layout.
- The size and layout of a case is called a **form factor**.
- Influences the motherboard and power supply form factor choice
- Must allow for good air flow
- Available in different sizes
- Provides protection and support for internal components.
- Should be durable, easy to service, and have enough room for expansion.
- NOTE: Select a case that matches the physical dimensions of the power supply motherboard.

2. PC Components/ Peripherals

Cases

- The case houses the internal components such as the power supply, motherboard, central processing unit (CPU), memory, disk drives, and assorted adapter cards.
- Many case manufacturers may have their own naming conventions, including super tower, Full tower, mid tower, mini tower, and more



2. PC Components/ Peripherals

Power Supplies

- Provides power to all computer components.
- Must be chosen based on current and future needs.
- Deliver different voltage levels to meet different internal component needs
- Converts **AC power** from the wall socket into low voltage
- Must provide enough power for the installed components and future additions.
- Input voltage selector on the back of the power supply.
- Power supplies are measured in
 - **Ohm's Law: $W = V \times A$**



2. PC Components/ Peripherals

Power Supplies

- Desktop computer power supply form factors include:
 - **Advanced Technology (AT)** – original power supply for legacy computer systems.
 - **AT Extended (ATX)** – updated version of the AT.
 - **ATX12V** – the most common power supply on the market today.
 - **EPS12V** – originally designed for network servers but commonly used in high-end desktop models.
 - (EPS12V refers to the 8-pin connector used for CPU power.)
 -



2. PC Components/ Peripherals

• Four Basic Units of Electricity

- **Voltage (V)** is a measure of the force required to push electrons through a circuit.
- Voltage is measured in **volts (V)**. A computer power supply usually produces several different voltages.
- **Current (I)** is a measure of the **amount of electrons going through a circuit**. Current is measured in **amperes**, or **amps (A)**. Computer power supplies deliver different amperages for each output voltage.
- **Power (P)** is **voltage** multiplied by **current**. The measurement is called **watts (W)**.
 - Watts is the work required to move electrons through a circuit multiplied by the number of electrons flowing through a circuit per second. Computer power supplies are rated in **watts**.
- **Resistance (R)** is the opposition to the flow of current in a circuit. Resistance is measured in **ohms (Ω)**. Lower resistance allows more current to flow through a circuit.

2. PC Components/ Peripherals

Ohm's Law

- There is a basic equation that expresses how three of the terms relate to each other.
- It states that **voltage** is equal to the **current** multiplied by the **resistance**. This is known as **Ohm's Law $V = IR$** .
- In an electrical system, **power (P)** is equal to the voltage multiplied by the current **$P= VI$** .
- power supply is rated (measured) in **watts** and is calculated by **$W = A \times V$**
- A power supply should support 20 to 25 percent more voltage than all the attached components required.

2. PC Components/ Peripherals

Connectors

- A power supply includes several different connectors. They are used to power
- various internal components such as the motherboard and disk drives.
- **The amount of connector vary based on the Some examples are:**
 - 20-pin or 24-pin main power connector
 - SATA keyed connector
 - Molex keyed connector
 - Berg keyed connector
 - 4-pin to 8-pin auxiliary power connector
 - 6/8-pin PCIe power connector



2. PC Components/ Peripherals

Motherboard

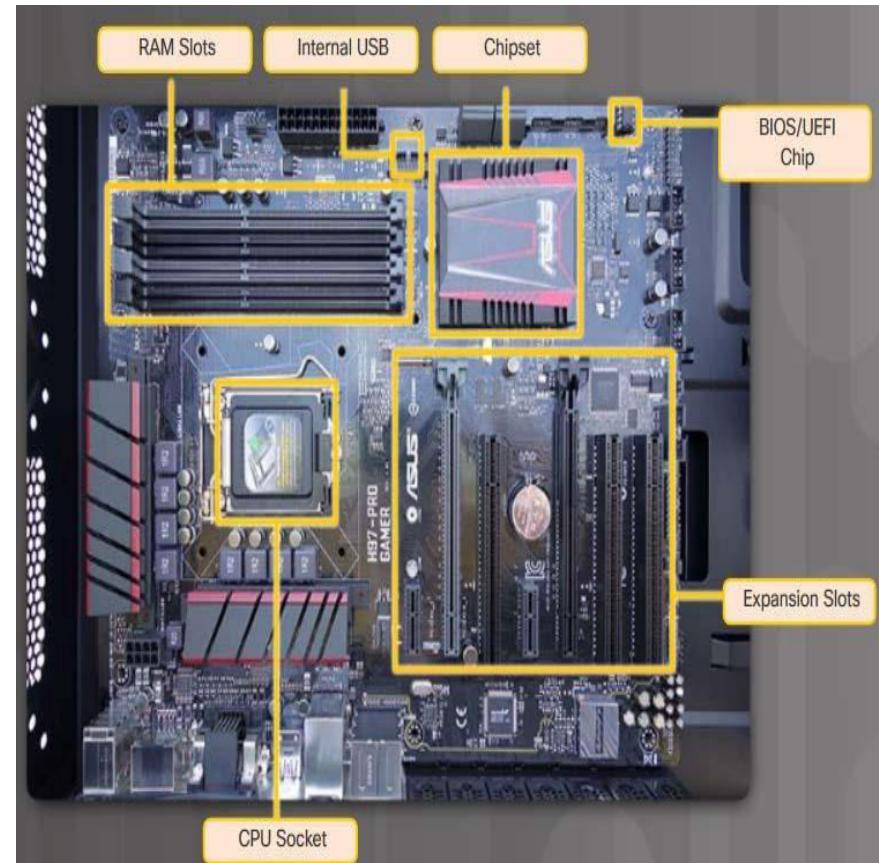
- Backbone of the computer.
- Interconnects computer components.
- The motherboard is the *main printed circuit board*.
- Contains the buses, or electrical pathways found in a computer.
- **Buses** allow data to travel among the various components.
- Accommodates *CPU, RAM, expansion slots, heat sink/fan assembly, BIOS chip, chip set, sockets, internal and external connectors, various ports*, and the *embedded wires* that interconnect the motherboard components.
- These components may be soldered directly to the motherboard, or added using *sockets, expansion slots, and ports*.
- Main power uses a *20 or 24-pin connector*.



2. PC Components/ Peripherals

Motherboard Components

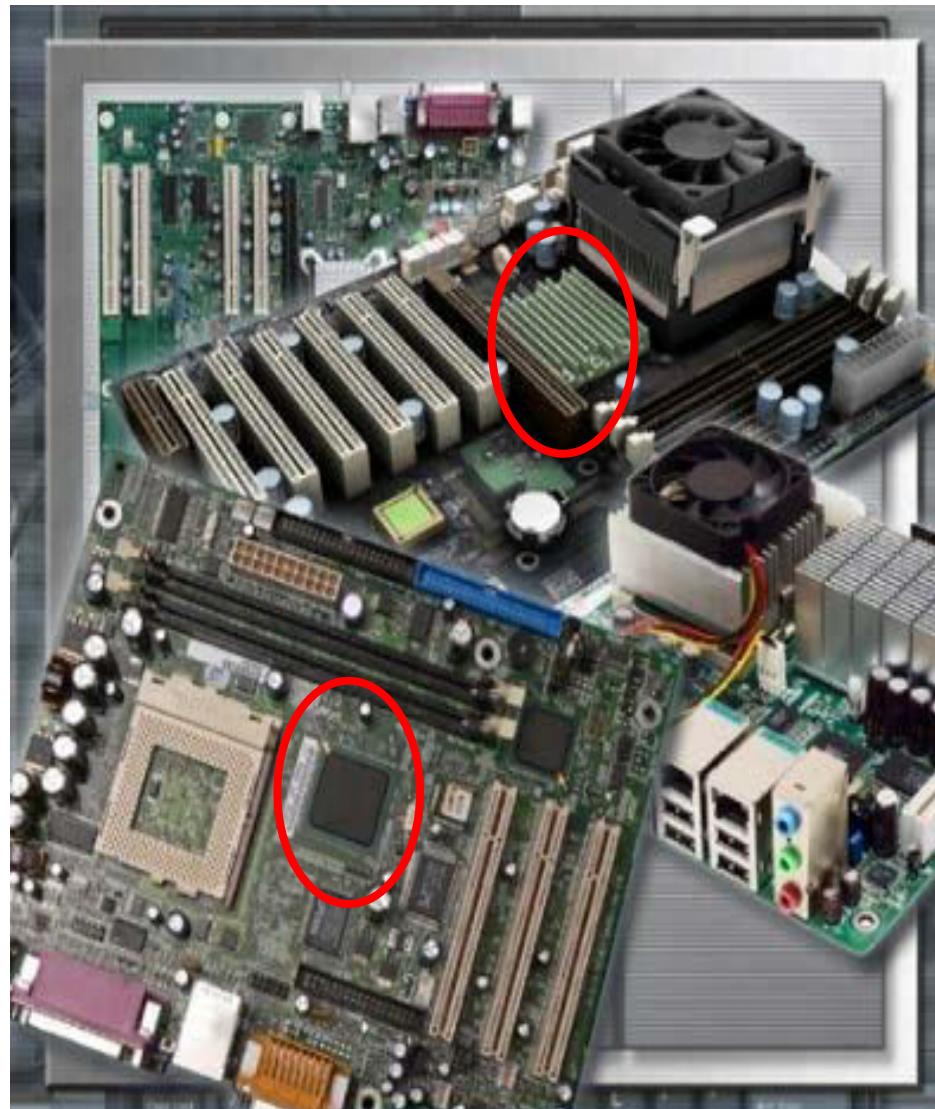
- Major components on a motherboard include:
 - Central Processing Unit (CPU)
 - Random Access Memory (RAM)
 - Expansion slots
 - Chipset
 - Basic input/output system (BIOS)
 - chip and Unified Extensible Firmware Interface (UEFI) chip
 - SATA connectors
 - Internal USB connector



2. PC Components/ Peripherals

Motherboard Chipset

- **Chipset** consists of the integrated circuits on the motherboard that control how system hardware interacts with the CPU and motherboard.
 - System performance
 - System limitations
 - How much memory can be added to a motherboard

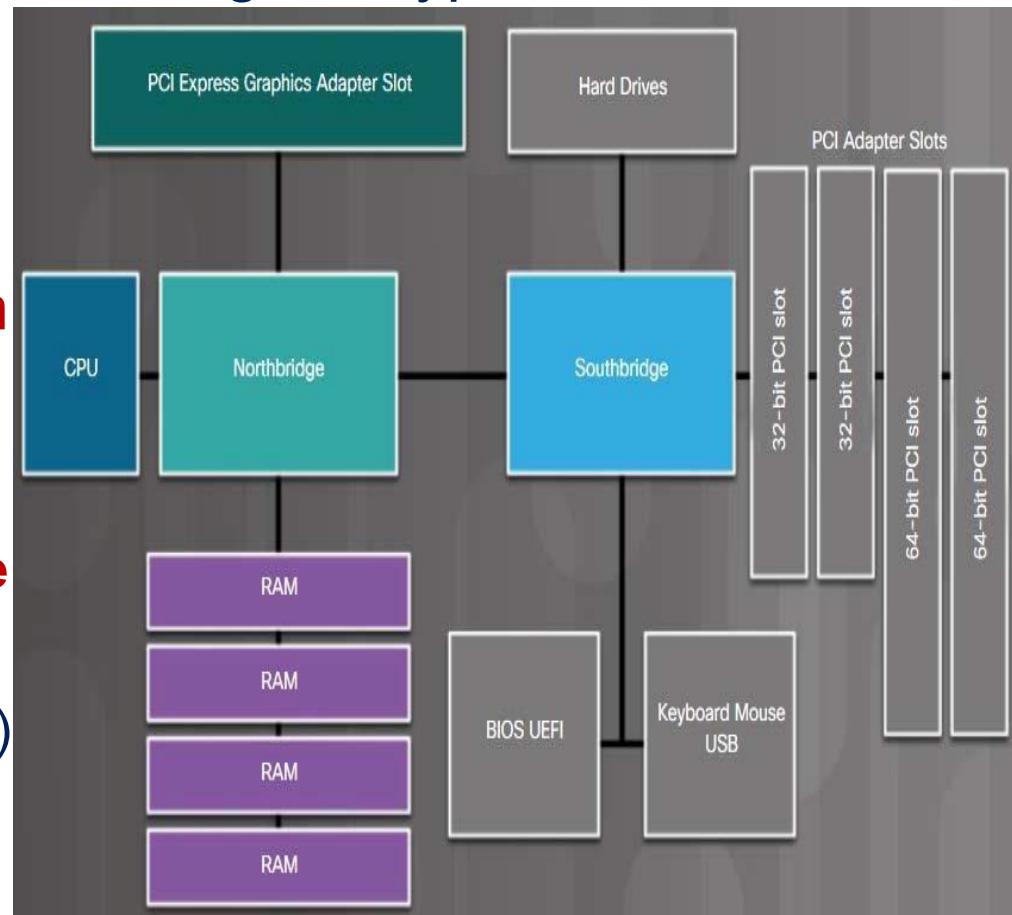


2. PC Components/ Peripherals

Motherboard Chipset

- Most chipsets consist of the following two types

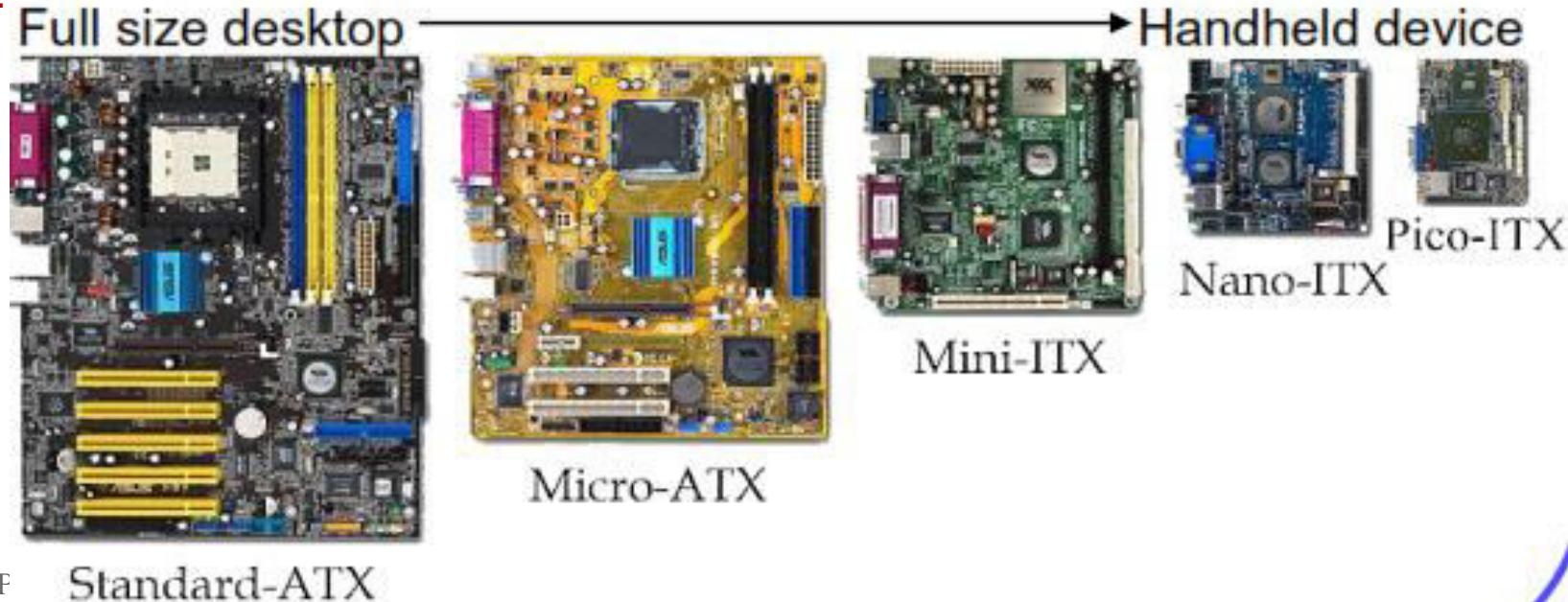
- **Northbridge controls**
 - Access to the RAM
 - Access to video card
 - Access to the CPU
 - The speed the CPU can communicate
- **Southbridge controls**
 - Communication between **the CPU and Expansion ports** (**Hard** drives, sound card, USB ports, and other I/O ports)



2. PC Components/ Peripherals

Motherboard Form Factors

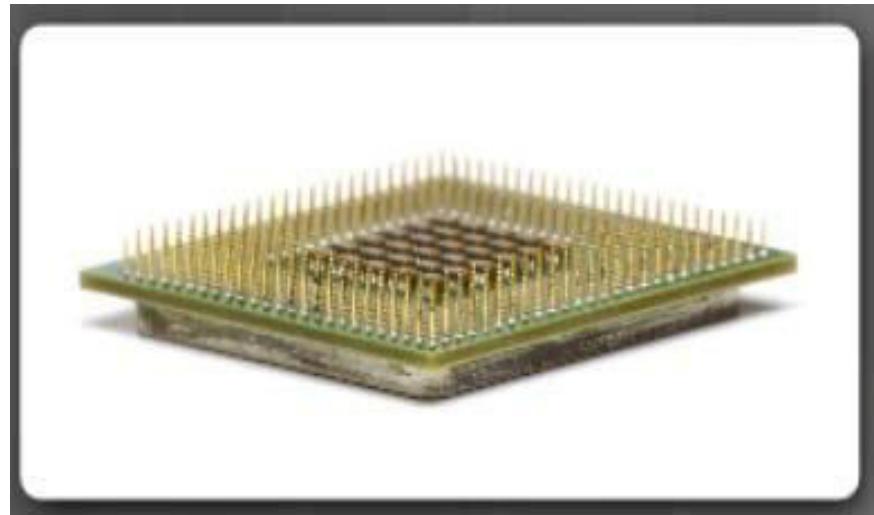
- The form factor of motherboards pertains to the ***size and shape of the board***.
- There are **three** common **motherboard form factors**:
 1. Advanced Technology eXtended (ATX),
 2. Micro-ATX and
 3. Information Technology eXtended (ITX).
- The choice of motherboard form factor determines how individual components attach to it, **the type of power supply required**, and **the shape of the computer case**.



2. PC Components/ Peripherals

What is CPU?

- The central processing unit (CPU) is responsible for interpreting and executing commands.
- The CPU is known as the brain of the computer.
- The CPU is a *small microchip* that resides within a CPU package.
- Two major CPU architectures related to instruction sets:
 - **Reduced Instruction Set Computer (RISC)**
 - **Complex Instruction Set Computer (CISC)**



2. PC Components/ Peripherals

Cooling Systems

- Computer components perform better when kept cool.
- A **case fan** makes the cooling process more efficient.
- A **heat sink** draws heat away from the core of the CPU. A fan on top of the heat sink moves the heat away from the CPU.
- Fans can be dedicated to cool the **Graphics-processing unit (GPU)**.
- Computers are kept cool using **active** and **passive** cooling solutions.
 - Active solutions require power while passive solutions do not.
 - Passive solutions for cooling usually involve reducing the speed at which a component is operating or adding heat sinks to computer chips.
 - A case fan is considered as active cooling.



Passive Cooling

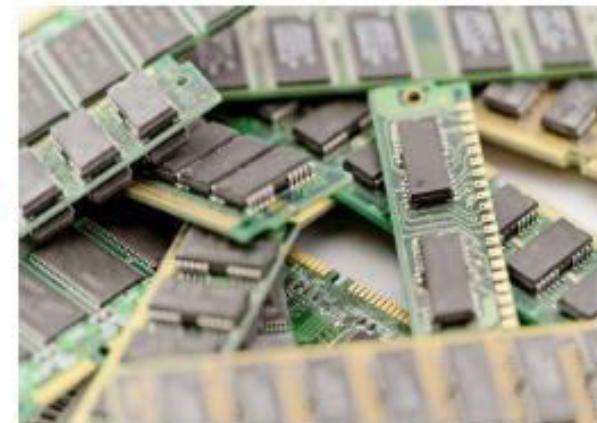


Active Cooling

2. PC Components/ Peripherals

Types of Memory

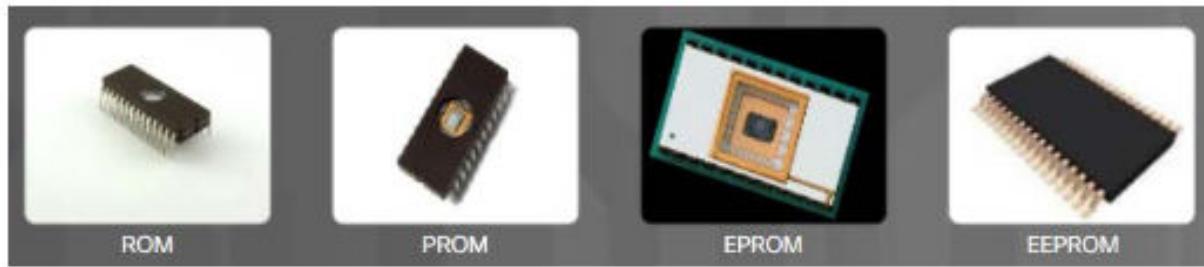
- A computer might use different types of memory chips.
- All memory chips store data in the form of bytes.
 - A byte is a block of eight bits stored as either 0 or 1 in the memory chip.
- **Read-Only Memory (ROM)**
 - Basic instructions for booting the computer and loading the operating system are stored in ROM.
 - ROM chips retain their contents even when the computer is powered down.
 - Can't be erased or rewritten.



2. PC Components/ Peripherals

Types of ROM

- Types of Read-only Memory include:
 - Read-Only Memory (**ROM**) chips – Programmed at factory and can't be erased or rewritten.
 - Programmable Read-Only Memory (**PROM**) chips – Manufactured blank and can be programmed only once.
 - Erasable Programmable Read-Only Memory (**EPROM**) chips – Can be erased by exposing it to strong ultraviolet light.
 - Electrically Erasable Programmable Read-Only Memory (**EEPROM**) chips – Can be reprogrammed while still in the computer.



2. PC Components/ Peripherals

Types of Memory

- **Random-access memory (RAM)**

- RAM is temporary storage for data and programs that are being accessed by the CPU.
- RAM is volatile memory, which means that the contents are erased when the computer is powered off.
- All data moving in or out of the processor must be loaded into RAM first.
- More RAM means more capacity to hold and process large programs and files, as well as enhance system performance.
- The maximum amount of RAM that can be installed is limited by the motherboard (chipset).



2. PC Components/ Peripherals

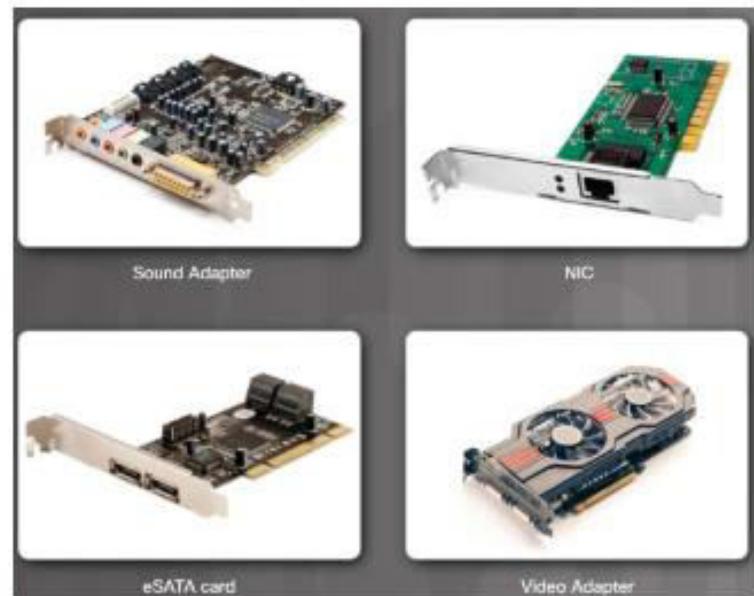
Memory Modules

- Memory modules are memory chips that have been soldered on to a special circuit board for easy installation and removal.
- The speed of memory has a direct impact on how much data a processor can process because faster memory improves the performance of the processor. As processor speed increases, memory speed must also increase.
 - **Dual Inline Package (DIP)** is an individual memory chip with dual rows of pins.
 - **Single Inline Memory Module (SIMM)** is a small circuit board that holds several memory chips. Comes in 30- and 72-pin configurations.
 - **Dual Inline Memory Module (DIMM)** is a circuit board that holds SDRAM, DDR SDRAM, and DDR2 SDRAM chips.
 - **RAM Bus Inline Memory Module (RIMM)** is a circuit board that holds RDRAM chips.
 - **Small Outline DIMM (SODIMM)** is a smaller, more condensed version of DIMM which provides random access data storage that is ideal for use in laptops, printers, and other devices where conserving space is desirable.

2. PC Components/ Peripherals

Adapter Cards

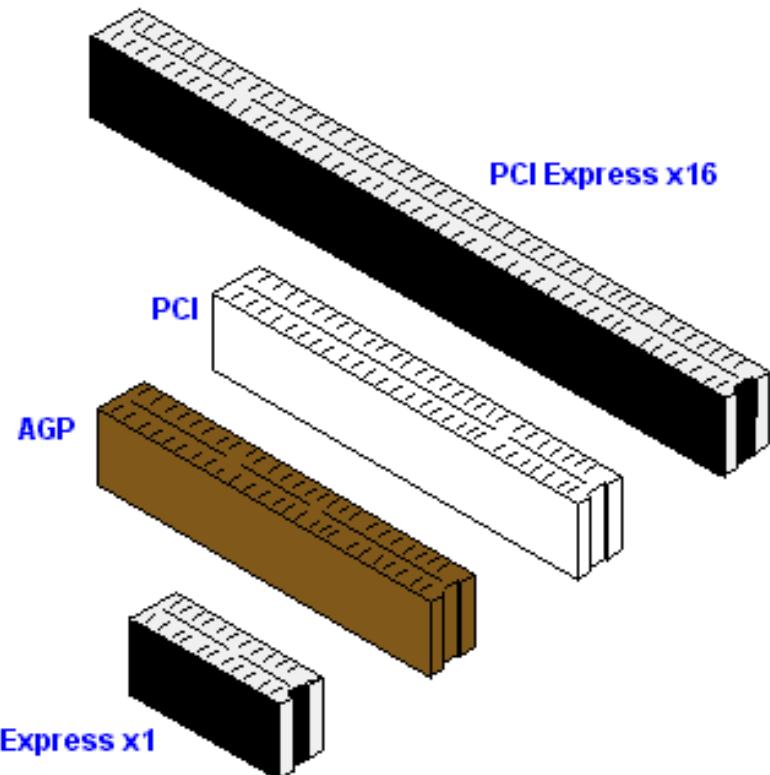
- Adapter cards increase the functionality of a computer by adding controllers for specific devices or by replacing malfunctioning ports.
- Common adapter cards include:
 - Sound adapter
 - Network Interface Card (NIC)
 - Wireless NIC
 - Video adapter or display adapter
 - Video capture card
 - TV tuner card
 - Universal Serial Bus (USB) controller card
 - eSATA card



2. PC Components/ Peripherals

Adapter Cards

- Computers have expansion slots on the motherboard to install adapter cards.
- The type of adapter card connector must match the expansion slot.
- Common expansion slots include:
- Peripheral Component Interconnect (PCI)
 - Mini-PCI
 - PCI eXtended (PCI-X)
 - PCI Express (PCIe)
 - Riser card
 - Accelerated Graphics Port (AGP)



2. PC Components/ Peripherals

Types of Storage Devices

- Data drives provide non-volatile storage of data.
- Designed to permanently store user data, user applications and the Operating System.
- Can be internal or external to the computer.
- Some drives have fixed media, and other drives have removable media.
- Data storage devices can be classified according to the media on which the data is stored:
 - **Magnetic – like hard disk drive and tape drive**
 - **Solid state – like solid state drive**
 - **Optical – like CD and DVD**



Hard Disk Drive



Optical Drive



Solid State Drive



Tape Drive

2. PC Components/ Peripherals

Storage Device Interfaces

- Storage devices inside a computer connect to the motherboard using Serial ATA Attachment (SATA) connections. The legacy interface is Parallel ATA (EIDE).
- The interface standards define the way that data is transferred, the transfer rates, and physical characteristics of the cables and connectors.
- There are three main versions of the SATA standard: SATA 1, SATA 2, & SATA 3.
- The cables and connectors are the same, but the data transfer speeds are different.

ATA	Parallel (PATA)	IDE	8.3 Mb/s
		EIDE	16.6 Mb/s
Serial (SATA)	Serial (SATA)	SATA 1	1.5 Gb/s
		SATA 2	3.0 Gb/s
		SATA 3	6.0 Gb/s

2. PC Components/ Peripherals

Magnetic Media Storage

- This type of storage represents binary values as magnetized or non-magnetized physical areas of magnetic media.
- Common types of magnetic media storage drives:
 - **Hard Disk Drive (HDD) – the traditional magnetic disk devices with storage capacity ranging from gigabytes (GBs) to terabytes (TBs).**
 - Magnetic hard drives have drive motors designed to spin magnetic platters and move the drive heads.
 - Speed is measured in revolutions per minute.
 - Common speeds are 5400rpm, 7200rpm, 10,000rpm



2. PC Components/ Peripherals

Semiconductor Storage

- Solid-state drives (SSD) store data as electrical charges in semiconductor flash memory. This results in faster access to data, improved performance, higher reliability, reduced power usage.
- SSDs have no moving parts, make no noise, are more energy efficient, not susceptible to vibrations, and produce less heat than HDDs.
- SSDs come in three form factors:
- Disc drive form factor – similar to an HDD
- Expansion cards – plugs directly into the motherboard and mounts in the computer case like other expansion cards
- mSata or M.2 modules – these packages may use a special socket.
 - M.2 is a standard for computer expansion cards



2. PC Components/ Peripherals

Types of Optical Storage Devices

- Optical drives are removable media storage devices that use lasers to read and write data on optical media.
- They were developed to overcome the storage capacity limitations of removable magnetic media such as floppy discs.
- There are three types of optical drives:
 - **Compact Disc (CD)** - audio and data
 - **Digital Versatile Disc (DVD)** - digital video and data
 - **Blu-ray Disc (BD)** - HD digital video and data



2. PC Components/ Peripherals

Ports and Cables

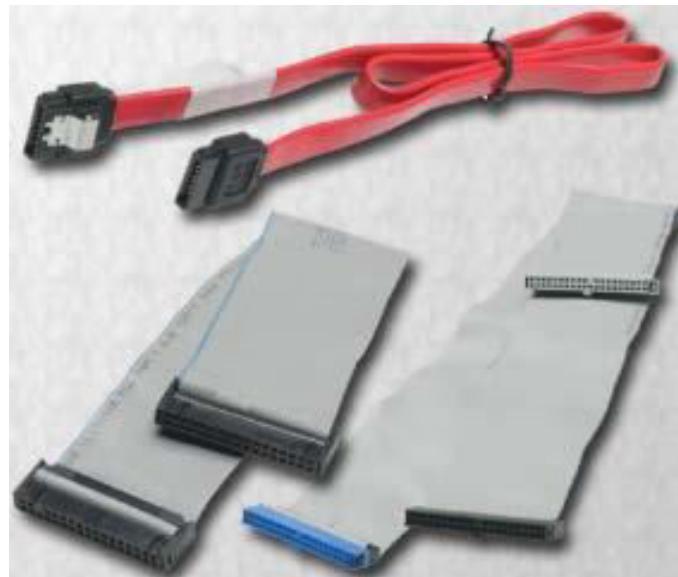
- Input/output (I/O) ports on a computer connect peripheral devices, such as printers, scanners, and portable drives.
- A computer may have other ports:
- Personal System 2 (PS/2)
- Audio and game port
- Network
- Parallel AT Attachment (PATA)
- Serial AT Attachment (SATA)
- External SATA (eSATA)
- Small Computer System Interface (SCSI)
- Universal Serial Bus (USB)
- Integrated Drive Electronics (IDE)
- Enhanced Integrated Drive Electronics (EIDE)



2. PC Components/ Peripherals

Internal Cables

- Power supply connectors- SATA, Molex, and Berg.
- Front panel cables connect the case buttons and lights to the motherboard.
- Data cables connect drives to the drive controller.
- Floppy disk drive (FDD) data cable
- PATA (IDE) data cable (40 conductor)
- PATA (EIDE) data cable (80 conductor)
- SATA data cable (internal)
- eSATA data cable (external)
- SCSI data cable



2. PC Components/ Peripherals

Ports and Cables

- Serial ports transmit one bit of data at a time.
- Uses a DB-9 or DB-25 connector.
- USB is a standard interface for connecting hot-swappable peripheral devices to a computer. Some devices can also be powered through the USB port.
- FireWire is a high-speed, hot-swappable interface that can support up to 63 devices. Some devices can also be powered through the FireWire port. (IEEE1394)
- A parallel cable is used to connect parallel devices, such as a printer or scanner, and can transmit 8 bits of data at one time.(IEEE-1284)



2. PC Components/ Peripherals

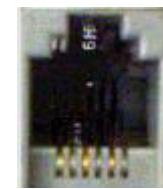
Ports and Cables

- A SCSI port can transmit data at rates in excess of 320 Mbps and can support up to 15 devices. SCSI devices must be terminated at the endpoints of the SCSI chain.
- A network port, also known as an RJ-45 port, connects a computer to a network. The maximum length of network cable is 328 ft (100 m).
- A telephone port (RJ11) is used to connect a modem to a telephone outlet.
- A BNC connects data networks over coaxial cable.
- A PS/2 port connects a keyboard or a mouse to a computer.

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The PS/2 port is a 6-pin mini-DIN female connector.

- An audio port connects audio devices to the computer.
- A video port connects a monitor cable to the computer.



2. PC Components/ Peripherals

Video Ports and Cables

- A video port connects a monitor to a computer using a cable.
- Video ports and monitor cables transfer analog signals, digital signals, or both.
- Video ports and cables include:
 - Digital Visual Interface (DVI)
 - DisplayPort
 - High-Definition Multimedia Interface (HDMI)
 - Thunderbolt 1 or 2
 - Thunderbolt 3
 - Video Graphics Array (VGA)
 - Radio Corporation of America (RCA)



2. PC Components/ Peripherals

Adapters and Converters

- There are many connection standards in use today. These components are called adapters and converters:

- ITE v7.0
- **Converter – performing the same function as an adapter but also translates the signals from one technology to the other.**
 - **Adapter – physically connecting one technology to another**

- Example of adapters include:
- DVI to VGA Adapter
- USB to Ethernet adapter
- USB to PS/2 adapter
- DVI to HDMI adapter
- Molex to SATA adapter
- HDMI to VGA converter



2. PC Components/ Peripherals

The Original Input Devices

- Input devices allow the user to communicate with a computer.
- Some of the first input devices include:
 - **Keyboard and Mouse – these are the two most commonly used input devices**
 - **ADF / Flatbed Scanner – these devices digitize an image or document**
 - **Joystick and Gamepad – these devices are used for playing games**
 - **KVM Switch – a hardware device that can be used to control more than one computer while using a single keyboard, video (monitor), and mouse**



Keyboard and Mouse



ADF / Flatbed Scanner



Joystick and Gamepad



KVM Switch

2. PC Components/ Peripherals

New Input Devices

- Some new input devices include:
- **Touch screen – input devices with touch or pressure sensitive screens**
- **Stylus – a type of digitizer that allows a designer or artist to create artwork by using a pen-like tool**
- **Magnetic strip reader – a device that reads information magnetically encoded on the back of plastic cards**
- **Barcode scanner – a device that reads the information contained in the barcodes affixed to products**



Touch screen



Stylus



Magnetic Stripe Reader



Barcode Scanner

2. PC Components/ Peripherals

More New Input Devices

- A few newer input devices:
- **Digital camera – devices that capture digital images and videos**
- **Webcams – video cameras that can be integrated into a computer**
- **Signature pad– a device that electronically captures a person's signature**
- **Smart card reader – a device used on a computer to authenticate the user.** A smart card may be the size of a credit card with an embedded microprocessor that is typically under a gold contact pad on one side of the card.
- **Microphone – a device that allows a user to speak into a computer and have their voice digitized**



Digital Camera



Webcam



Signature Pad



Smart Card Reader



Microphone

2. PC Components/ Peripherals

Most Recent Input Devices

- The newest input devices include:
 - **NFC devices and terminals – Near Field Communication (NFC) tap to pay devices**
 - **Biometer Devices:**
 - **Facial recognition scanners – devices identifying a user based on unique facial features**
 - **Fingerprint scanners – devices identifying a user based on unique fingerprint**
 - **Voice recognition scanners – devices identifying a user based on unique voice**



2. PC Components/ Peripherals

What are Output Devices?

- An output device takes binary information from the computer and converts it into a form that is easily understood by the user.
- Examples of output devices include monitors, projectors, printers, speakers, headphones, and VR headsets.



2. PC Components/ Peripherals

Monitors and Projectors

- Most monitors use one of three types of technology:
- **Liquid Crystal Display (LCD)** is commonly used in laptops and some projectors. LCD comes in two forms, active matrix and passive matrix.
- A **Light-Emitting Diode (LED) display** is an LCD display that uses LED backlighting to light the display.
- An **Organic LED (OLED) display** uses a layer of organic material that responds to electrical stimulus to emit light.
- Several factors are involved in Monitor Resolution –Pixel, Dot Pitch, Contrast Ratio, Refresh rate, Interlace/Non-Interlace, Horizontal vertical color, Aspect ratio, Native resolution.
 - **Monitor Resolution** refers to the level of image detail that can be reproduced. Higher resolution settings produce better image quality.
 - **Contrast ratio** is the difference in the intensity of light between the brightest white and darkest black that can be displayed.

2. PC Components/ Peripherals

Monitors and Projectors

- **Plasma - Plasma displays are another type of flat panel monitor**
- Most video projectors use LCD or DLP technology.
- DLP stands for Digital Light Processing
- Different projectors have different numbers of lumens, which affects the level of brightness of the projected image.



Monitor



Projector

2. PC Components/ Peripherals

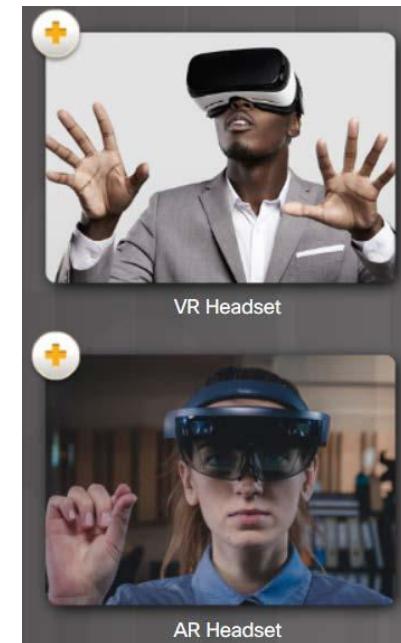
VR and AR Headsets

- Virtual reality headset – used with computer games, simulators, and training

applications with virtual reality functionalities.

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- **Virtual Reality (VR) uses computer technology to create a simulated, three-dimensional environment.**
- A VR headset completely encases the upper portion of users' faces, not allowing in any ambient light from their surroundings.
- **Augmented Reality (AR) uses similar technology but superimposes images and audio over the real world in real time.**
- AR can provide users with immediate access to information about their real surroundings.
- An AR headset usually does not close off ambient light to users, allowing them to see their real life surroundings.



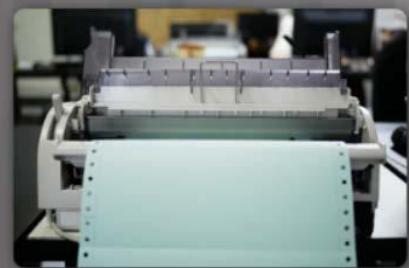
2. PC Components/ Peripherals

Printers

- Printers are output devices that create hard copies of files.
- A hard copy might be a on a sheet of paper. It could also be a plastic form created from a 3D printer.
- Different types of printers:
- Inkjet, impact, thermal, laser, and 3D printers
- Printers use wired or wireless connections
- All printers require printing material (such as ink, toner, liquid plastic, etc.)
- Printers use a driver to communicate with a computer



Inkjet Printer



Impact Printer



3D Printer



Thermal Printer

2. PC Components/ Peripherals

Speakers and Headphones

- **Speakers are a type of auditory output device.**
- Most computers and mobile devices have audio support either integrated into the motherboard or on an adapter card.
- **Headphones, earbuds, and the earphones found in headsets are all auditory output devices.**
- These may be wired or wireless. Some are Wi-Fi or Bluetooth-enabled.



Speakers

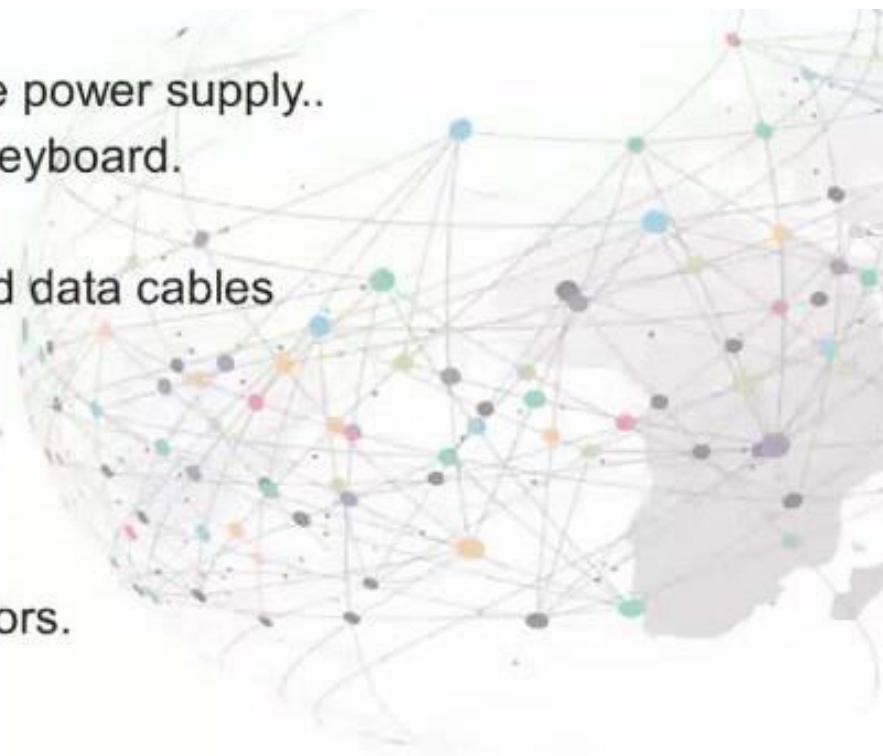


Headphones

1.3 Computer Disassembly

- **Demonstration Step for Computer Disassembly**

- **Step 1:** Power off and disconnect the power supply..
- **Step 2:** Disconnect the mouse and keyboard.
- **Step 3:** Remove the case screws.
- **Step 4:** Remove the SATA power and data cables
- **Step 5:** Remove the hard drive.
- **Step 6:** Remove the optical drive.
- **Step 7:** Remove the adapter card.
- **Step 8:** Remove the power supply.
- **Step 9:** Remove front panel connectors.
- **Step 10:** Remove the RAM.



1,3 Computer Disassembly

Lab – Disassemble a Computer

- Points to consider:
 - Use safe lab procedures
 - Use the proper tools
 - Use extreme care and follow all safety procedures
 - Familiarize yourself with the tools you will be using in this lab
 - Document how things come apart or go together
 - Place components in anti-static bags
 - Keep track of all screws and cables



Technical and Vocational Training Institute (TVTI)
Faculty of Electrical/Electronics & Information and Communication
Technology Department of Information Technology

Course Title: Computer Maintenance

Chapter – 1:

PC Technician Professional

Best Practices

1.1.2. Preventive Maintenance and Troubleshooting

Contents

1. Preventive Maintenance

- 1. Describe PC preventive maintenance**

2. Troubleshooting Process

- 1. Describe each step of the troubleshooting process.**
- 2. Identify common problems and solutions for PCs.**
- 3. Troubleshoot computer components and peripherals using the six-step troubleshooting process.**

3. PC Common Problems and Solutions

4. Safety and Electrical Safety, Environmental Safety and Materials Handling

1. Preventive Maintenance

Benefits to Preventive Maintenance

- Preventive maintenance plans are developed based on at least two factors:
 - **Computer location or environment - Dusty environments, such as** construction sites, requires more attention than an office environment.
 - **Computer use - High-traffic networks, such as a school network, might require** additional scanning and removal of malicious software and unwanted files.

1. Preventive Maintenance

Preventive Maintenance Tasks

- **Hardware Maintenance**
 - Check the condition of cables, components, and peripherals.
 - Repair or replace any components that show signs of excess wear.
 - Removing dust from inside the computer and fans should be part of every preventive maintenance plan.
 - Keep components clean to reduce the ***likelihood of overheating***.
 - Hold compressed air can upright while spraying
 - Don't spray directly into fans, they can be damaged

1. Preventive Maintenance

Preventive Maintenance – Dust

- Use a cloth or a duster to clean the outside of the computer case.
- Dust on the outside of a computer can travel through cooling fans to the inside.
- Accumulated dust prevents the flow of air and reduces the cooling of components.
- Hot computer components are more likely to break down.

1. Preventive Maintenance

Preventive Maintenance – Internal Components

- A basic checklist of components to inspect for dust and damage includes:
 - CPU heat sink and fan assembly
 - RAM modules
 - Storage devices
 - Adapter cards
 - Cables
 - Power devices
 - Keyboard and mouse



1. Preventive Maintenance

Preventive Maintenance – Environmental Concerns

- An optimal operating environment for a computer is
 - *clean*,
 - free of potential contaminants, and
 - within the temperature and humidity range specified by the manufacturer. (mot computer components can operate from 20 to 80% humidity, but, recommended is 45 to 50%),
- There are numerous things you can do to keep your PC cool, including:
 - Keep your PC well-ventilated.
 - Clear dust from vents and fans.
 - Give your computer time to cool down.
 - Consult the manufacturer's manual.

1. Preventive Maintenance

Preventive Maintenance – Software

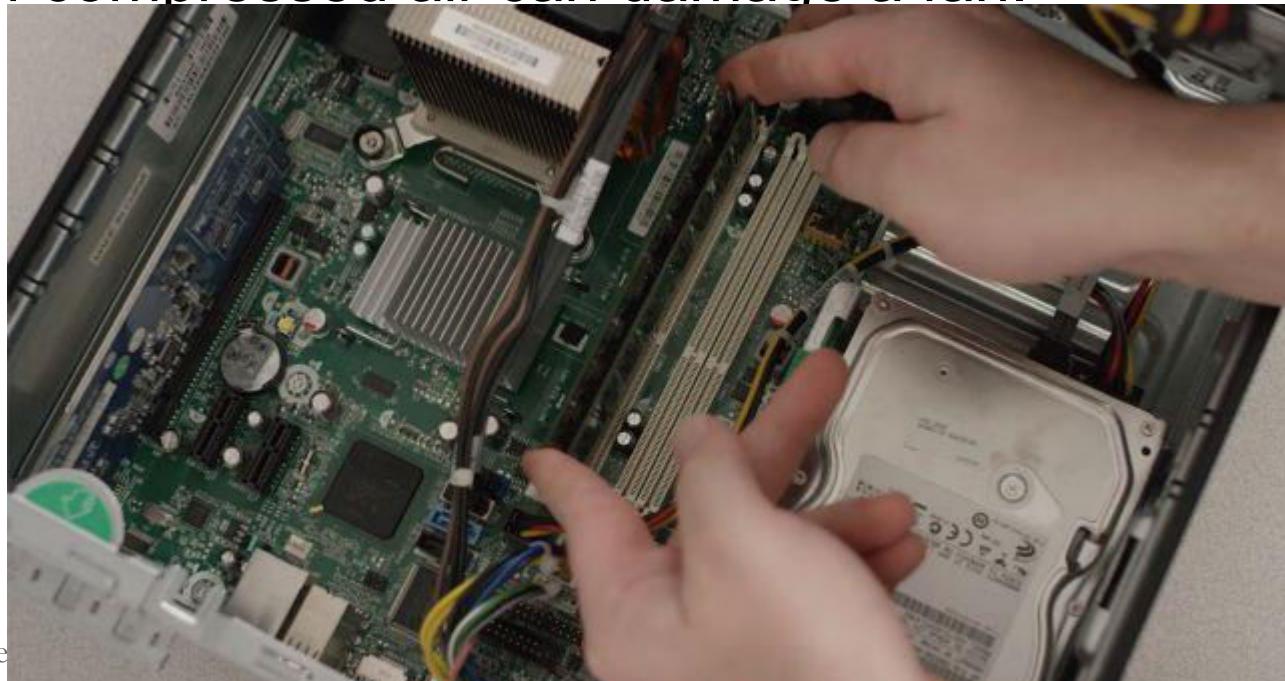
- Verify that installed software is current.
- Follow the policies of the organization when installing security updates, operating system, and program updates.
- Create a software maintenance schedule to:
 - Review and install the appropriate **security, software, and driver updates**.
 - Update the virus definition files and scan for viruses and **spyware**.
 - Remove unwanted or unused programs.
 - Scan hard drives for errors and defragment hard drives.

1. PC Preventive Maintenance Overview

- **Clean the Case and Internal Components**
 - Dust or dirt can accumulate inside the computer.
 - Accumulated dirt and dust block airflow inside the case.
 - Use a low-air-flow ESD vacuum cleaner
 - Make sure to keep the following internal components clean:
 - Heat sink and fan assembly, RAM, adapter cards, motherboard, fans, power supply and internal drives.

1. PC Preventive Maintenance Overview

- Inspect Internal Components
 - Examine the computer on a regular schedule.
 - The main components to inspect are: CPU heat sink and fan assembly, RAM, storage devices, adapter cards, screws, cables, power devices, keyboard and mouse.
 - A direct spray of compressed air can damage a fan.



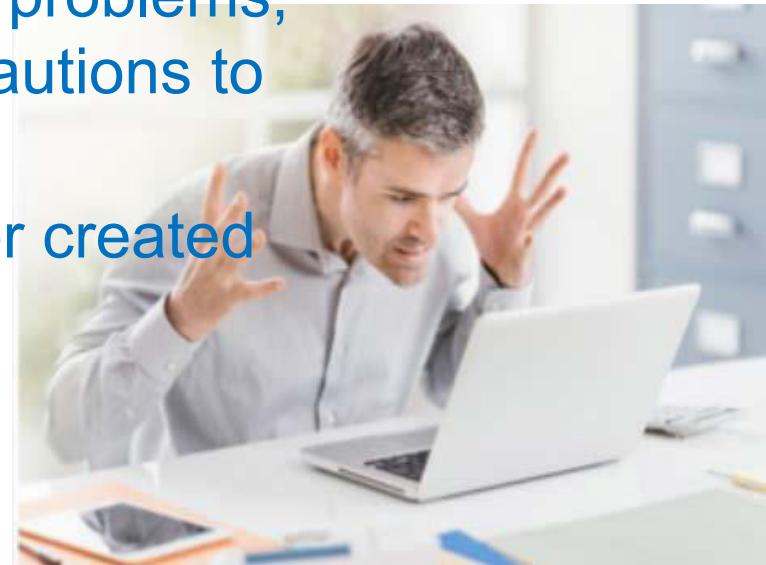
1. PC Preventive Maintenance Overview

- Environmental Concerns
 - Computers should not be operated in harsh environmental conditions.
 - Due to their mobile nature, laptops are subject to various environmental conditions.
- Guidelines to help ensure optimal computer operating performance include:
 - Do not obstruct vents or airflow to the internal components.
 - Keep the room temperature between 45 to 90 degrees Fahrenheit (7 to 32 degrees Celsius).
 - Keep the humidity level between 10 and 80 percent.

2 TROUBLESHOOTING PROCESS

- **Introduction to Troubleshooting**

- Troubleshooting requires an organized and logical approach to problems with computers and other components.
- Eliminates variables and identifies causes of problems in a systematic order.
- Troubleshooting is a skill refined over time.
- Before you begin troubleshooting problems, always follow the necessary precautions to protect data on a computer.
- Backup Internet favorites and user created documents.



2 TROUBLESHOOTING PROCESS

• The Troubleshooting Process

Step Troubleshooting Process

- 1 Identify the Problem
- 2 Establish a Theory of Probable Cause
- 3 Test the Theory to Determine Cause
- 4 Establish a Plan of Action to Resolve the Problem and Implement the Solution
- 5 Verify Full System Functionality and, if Applicable, Implement Preventive Measures
- 6 Document Findings, Actions, and Outcomes

- Follow an organized and logical procedure.
- Eliminate variables one at a time.
- Troubleshooting is a skill that is refined over time.
- The first and last steps involve effectively communicating with the customer.

2 TROUBLESHOOTING PROCESS

Data Protection

- Before troubleshooting problems, **always follow the necessary precautions to protect data on a computer.**
- **User Data**, like documents and favorites, should be *backed up to a removable drive* before starting any diagnostics or repairs.
- If unsure that a backup has been done, do not attempt any troubleshooting activities until the following are verified:
 - Date of the last backup
 - Contents of the backup
 - Data integrity of the backup
 - Availability of all backup media for data restore
- **If no backup can be created, ask customer to sign a release form.**



2 TROUBLESHOOTING PROCESS

Liability Release Form

- A Liability Release form should be signed by the customer before beginning work and should include:
 - a description of the work to be performed.
 - permission to work on the computer without a current backup available.
 - a release from liability if data is lost or corrupted.

RELEASE OF LIABILITY

To: Consulate General of Japan in Miami

I will not hold the Consulate General of Japan in Miami liable for any loss or damages of my documents while being transported to or from the Consulate by mailing services (USPS, UPS, FedEx, Courier Services etc.).

I take full responsibility for the transportation of these documents.

Print Name

Signature

Date

***Your signature here must be exactly the same as in your passport.*

2 Troubleshooting Process Steps

Step 1 - Identify the problem

- During the troubleshooting process, gather as much information from the customer as possible, but always be respectful.
- This information will be used to aid in solving the problem.
- Use the following strategy during this step:
 - Start by using open-ended questions to obtain general information.
 - Continue using closed-ended (yes/no) questions to get relevant information.
 - Document the responses in the work order and in the repair journal.
 - Verify the customer's description by gathering data from the computer using applications such as:

-
- **Event Viewer**
 - **Device Manager**
 - **Beep Codes**
 - **Diagnostic Tools**
 - **BIOS or UEFI Information**
 - **Event Viewer**
 - **Device Manager Task M**

Step 1: Identify the Problem.	
Customer Information	<ul style="list-style-type: none">• Company Name• Contact Name• Address• Phone Number
Computer Configuration	<ul style="list-style-type: none">• Manufacturer and Model• Operating System• Network Environment• Connection Type
Problem Description	<ul style="list-style-type: none">• Open-ended Questions• Closed-ended Questions
Error Messages	
Beep Sequences	
LEDs	
POST	

2 Troubleshooting Process Steps

Step 1 - Identify the problem

- Event Viewer
- BIOS or UEFI Information
- Device Manager
- Event Viewer
- Beep Codes
- Device Manager Task Manager
- Diagnostic Tools

Step 1: Identify the Problem.

Customer Information	<ul style="list-style-type: none">• Company Name• Contact Name• Address• Phone Number
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Problem Description	<ul style="list-style-type: none">• Open-ended Questions• Closed-ended Questions
Error Messages	
Beep Sequences	
LEDs	
POST	

2 Troubleshooting Process Steps

Step 2 - Establish a theory of probable cause

- Create a list of the most common reasons why the error would occur. The computer manual and the computer's repair history log can help establish a plan of action.
- List the easiest or most obvious causes at the top and more complex causes at the bottom.
 - Research the symptoms.
 - The computer manual
 - The computer repair history log.
 - Internet search.

Step 2. Establish a Theory of Probable Cause.

- Device is powered off.
- Power switch for an outlet is turned off.
- Surge protector is turned off.
- Loose external cable connections.
- Non-bootable disk in designated boot drive.
- Incorrect boot order in BIOS setup.

2 Troubleshooting Process Steps

Step 3 – Test the Theory to Determine cause

- Determine the exact cause by testing the theories of probable cause one at a time, starting with the easiest and most obvious first.
- After identifying an exact cause of the problem, determine the steps to resolve the problem.
- If the exact cause of the problem has not been determined after all theories have been tested, establish a new theory of probable causes and test it.
- Document each test tried that did not correct the problem.

Step 3. Test the Theory to Determine the Cause.

Common steps to determine cause

- Ensure the device is powered on.
- Ensure the power switch for an outlet is turned on.
- Ensure the surge protector is turned on.
- Ensure external cable connections are secure.
- Ensure that the designated boot drive is bootable.
- Verify the boot order in BIOS setup.

2 Troubleshooting Process Steps

Step 4 – Establish a Plan of Action to Resolve the Problem and Implement the solution

- After the exact cause of the problem is determined, establish a plan of action to resolve the problem and implement the solution.
- Sometimes quick procedures can determine the exact cause of the problem or even correct the problem.
- If a quick procedure does not correct the problem, further research is needed to establish the exact cause.
- Divide larger problems into smaller problems that can be analyzed and solved individually.

Step 4: Establish a Plan of Action to Resolve the Problem and Implement the Solution.

If no solution is achieved in the previous step, further research is needed to implement the solution.

- Helpdesk repair logs
- Other technicians
- Manufacturer FAQ websites
- Technical websites
- News groups
- Computer manuals
- Device manuals
- Online forums
- Internet search

2 Troubleshooting Process Steps

Step 5 – Verify Full System Functionality and, If Applicable, Implement Preventive Measures

- The troubleshooting process is not over until full system functionality is confirmed.
- Have the customer tryout the fixes you implemented.
- Ensure that you have not created another problem while repairing the computer.
- If the system is working properly, implement preventive measures if needed.

Step 5: Verify Full System Functionality and if Applicable Implement Preventive Measures.

- Reboot the computer.
- Ensure multiple applications work properly.
- Verify network and Internet connections.
- Print a document from one application.
- Ensure all attached devices work properly.
- Ensure no error messages are received.

2 Troubleshooting Process Steps

Step 6 – Document Findings, Actions, and Outcomes

- Discuss the solution with the customer, both verbally and in writing.
- Have the customer confirm that the problem has been solved.
- Document the entire process for future reference.
- Document the details and frequency of each maintenance task.
- Document the process:
 - Problem description
 - Steps to resolve the problem
 - Components used in the repair.

Step 6: Document Findings, Actions, and Outcomes

- Discuss the solution implemented with the customer.
- Have the customer verify that the problem has been solved.
- Provide the customer with all paperwork.
- Document the steps taken to solve the problem in the work order and in the technician's journal.
- Document any components used in the repair.
- Document the amount of time spent to resolve the problem.

3. PC Common Problems and Solutions

- Computer problems can be attributed to hardware, software, networks, or some combination of the three. These are some common hardware problems:
 - Storage Device - Storage device problems are often related to loose, or incorrect cable connections, incorrect drive and media formats, and incorrect jumper and BIOS settings.**
 - Motherboard and Internal Components - These problems are often caused by incorrect or loose cables, failed components, incorrect drivers, and corrupted updates.**
 - Power Supply - Power problems are often caused by a faulty power supply, loose connections, and inadequate wattage.**
 - CPU and Memory - Processor and memory problems are often caused by faulty installations, incorrect BIOS settings, inadequate cooling and ventilation, and compatibility issues.**
 - Displays – Display problems are often caused by incorrect settings, loose connections, and incorrect or corrupted drivers.**

3. PC Common Problems and Solutions

1. Common Problems and Solutions for Storage Devices

- Optical drive discs can be removed by inserting a pin or paper clip into the small hole on the front of the drive.
- Loose cables can cause front LEDs from working.

The computer does not recognize a storage device

Probable Causes	Possible Solutions
The power cable is loose.	Secure the power cable.
The data cable is loose.	Secure the data cable.
The jumpers are set incorrectly.	Reset the jumpers.
A storage device failed	Replace the storage device.
The storage device setting in BIOS are incorrect.	Reset the storage device settings in BIOS.

3. PC Common Problems and Solutions

2. Common Problems and Solutions for Motherboards and Internal Components

- Temperature can affect motherboards, CPUs, and hard drive.
- Can cause the PC to lock up.
- Loose screws, plugging in cables while the computer is on, and unseated cards can cause the motherboard to short-circuit.
- Longer boot time and incorrect system time can be caused by the CMOS battery.

The clock on the computer is no longer keeping the correct time or the BIOS settings are changing when the computer is rebooted

Probable Causes	Possible Solutions
The CMOS battery may be loose.	Secure the battery.
The CMOS battery may be drained.	Replace the battery.

3. PC Common Problems and Solutions

3. Common Problems and Solutions for Power Supplies

- Smell of burning electronics.
- Unexpected shutdown.

The computer will not turn on

Probable Causes	Possible Solutions
The computer is not plugged in to the AC outlet.	Plug the computer into a known good AC outlet.
The AC outlet is faulty.	Plug the computer into a known good AC outlet.
The power cord is faulty.	Use a known good power cord.
The power supply switch is not turned on.	Turn on the power supply switch.
The power supply switch is set to the incorrect voltage.	Set the power supply switch to the correct voltage setting.
The power button is not connected correctly to the front panel connector.	Correctly orient the power button to the front case panel connector and reconnect.
The power supply has failed.	Install a known good power supply.

3. PC Common Problems and Solutions

4. Common Problems and Solutions for CPUs and Memory

- Adding RAM can improve performance problems.
- Be sure RAM is installed correctly and firmly seated.
- Overheating can cause the computer to lockup or shutdown unexpectedly.
- Improperly seated RAM can cause the PC to not boot.

The computer will not boot or it locks up

Probable Causes	Possible Solutions
The CPU has overheated.	<p>Reinstall the CPU.</p> <ul style="list-style-type: none">• Replace the CPU fan.• Add fan(s) to the case.
The CPU fan is failing.	Replace the CPU fan.
The CPU has failed.	Replace the CPU.

3. PC Common Problems and Solutions

5. Common Problems and Solutions for Displays

- Video problems can be caused by setting in the BIOS.

Display has power but no image on the screen

Probable Causes	Possible Solutions
Video cable is loose or damaged.	Reconnect or replace video cable.
The computer is not sending a video signal to the external display.	Use the Fn key along with the multi-purpose key to toggle to the external display.

6. Common Problems and Solutions for Software

- Antivirus software is out of date or expired. Update or renew, then run a full virus scan.
- Event Viewer may show information about errors caused by the system, the user, or the software.

Preventive Maintenance & Troubleshooting Summary

- Preventive Maintenance
 - Explain why preventive maintenance must be performed on personal computers.
 - Describe PC preventive maintenance.
- Troubleshooting Process
- Troubleshoot problems with PC and Peripheral devices
 - ❖ Describe each step of the troubleshooting process.
 - ❖ Identify common problems and solutions for PCs.
 - ❖ Troubleshoot computer components and peripherals using the six-step troubleshooting process.

4. Safety and Electrical Safety, Environmental Safety and Materials Handling

Use Appropriate Safety Procedures

- **Occupational Safety and Health Administration (OSHA)**
 - Federal agency charged with the enforcement of safety and health legislation
 - OSHA requirements for a safe work environment:
 - Provide properly maintained tools and equipment
 - Keep records of accident reports
 - Display an OSHA poster in a prominent location

4. Safety and Electrical Safety, Environmental Safety and Materials Handling

Safety Rules

- 1. Familiarize yourself with your lab and the people that share it**
- 2. Familiarize yourself with the exits and the routes to them**
- 3. Stay alert and on the lookout for any condition that might pose a health and/or safety threat**
- 4. Notify the administrator immediately when you find a safety hazard or concern**
- 5. Always turn off the computer before moving it**

4. Safety and Electrical Safety, Environmental Safety and Materials Handling

Safety Rules

6. Do not remove or install components while the computer is on or plugged in
7. No food or drinks in the work area
8. Remove all jewelry and watches.
9. Keep the work area clean and orderly
10. Keep computer disks away from magnetic fields, heat, and cold
11. Do not touch any computer components with a magnetic screwdriver

4. Safety and Electrical Safety, Environmental Safety and Materials Handling

Safety Rules

- 12.** Do not use a pencil or metal tipped instrument to change DIP switches, jumpers, or touch components
- 13.** Cover sharp edges with tape when working inside the computer case
- 14.** Check all plugs and cords for wear damage prior to use
- 15.** Never open or work on a monitor or power supply (AMPS KILL)

4. Safety and Electrical Safety, Environmental Safety and Materials Handling

Safety Rules

16. Never look into a laser beam found in computer related equipment
17. Make sure that a fire extinguisher and first aid kit are available and you know where they are and how to use them
18. Read safety labels on all equipment in the lab, including the fire extinguish
19. Always use a grounding wrist strap
20. Allow 15 seconds to pass before touching any sensitive electronic components with bare hands

4. Safety and Electrical Safety, Environmental Safety and Materials Handling

Safety Rules

- 21. Do not allow anyone who is not properly grounded to touch or hand off computer components**
- 22. Work on a tile or concrete floor**
- 23. Hold cards by the edges**
- 24..Use anti-static bags to store and move computer components**
- 25.When laying components down put them on top of an anti-static bag or mat**

4. Safety and Electrical Safety, Environmental Safety and Materials Handling

Fire Extinguisher Ratings

- 1. Class A** – Ordinary materials (burning paper, lumber, cardboard, plastics)
- 2. Class B** – Flammable and combustible liquids (gasoline, kerosene, solvents)
- 3. Class C** – Electrical equipment (appliances, switches, panel boxes, power tools, and computers)
- 4. Class D** – Combustible metals (magnesium, titanium, potassium, and sodium)
- 5. Most general use fire extinguishers are rated “ABC”.**



4. Safety and Electrical Safety, Environmental Safety and Materials Handling

Material Safety Data Sheet (MSDS)

1. Form containing information about the properties of a particular substance
2. Intended to provide workers and emergency personnel with procedures and emergency phone numbers for handling or working with that substance in a safe manner
3. Included information:
 - A. Physical data
 - Storage
 - Disposal
 - Protective equipment
 - Spill handling procedures
 - B. Hazard rating
 - C. Toxicity
 - D. Health effects
 - E. First aid

4. Safety and Electrical Safety, Environmental Safety and Materials Handling

Hazardous Materials by National Fire Association (NFPA) color code

NFPA Rating Explanation Guide			
Rating Number	Health Hazard	Flammability Hazard	Instability Hazard
4	EXTREME – Highly Toxic – May be fatal on short-term exposure.	EXTREME – Extremely flammable gas or liquid. Flash Point below 73° F.	EXTREME – Explosive at room temperature.
3	SERIOUS – Toxic – Full protective suit and breathing apparatus should be worn	SERIOUS – Flammable. Flash Point 73° F to 100° F.	SERIOUS – May detonate if shocked or heated under confinement or mixed with water.
2	MODERATE – Breathing apparatus and face mask must be worn.	MODERATE – Combustible. Requires moderate heating to ignite. Flash Point below 200° F.	MODERATE – Unstable. May react with water.
1	SLIGHT – Breathing apparatus may be worn.	SLIGHT – Slightly combustible. Requires strong heating to ignite.	SLIGHT – May react if heated or mixed with water.
0	MINIMAL – No Precautions necessary.	MINIMAL – Will not burn under normal conditions.	MINIMAL – Normally stable. Does not react with water.



Rating Symbol	Special Hazard
ALK	Alkali
ACID	Acidic
COR	Corrosive
OXY	Oxidizer
W	Use No Water
RADIATION	Radiation

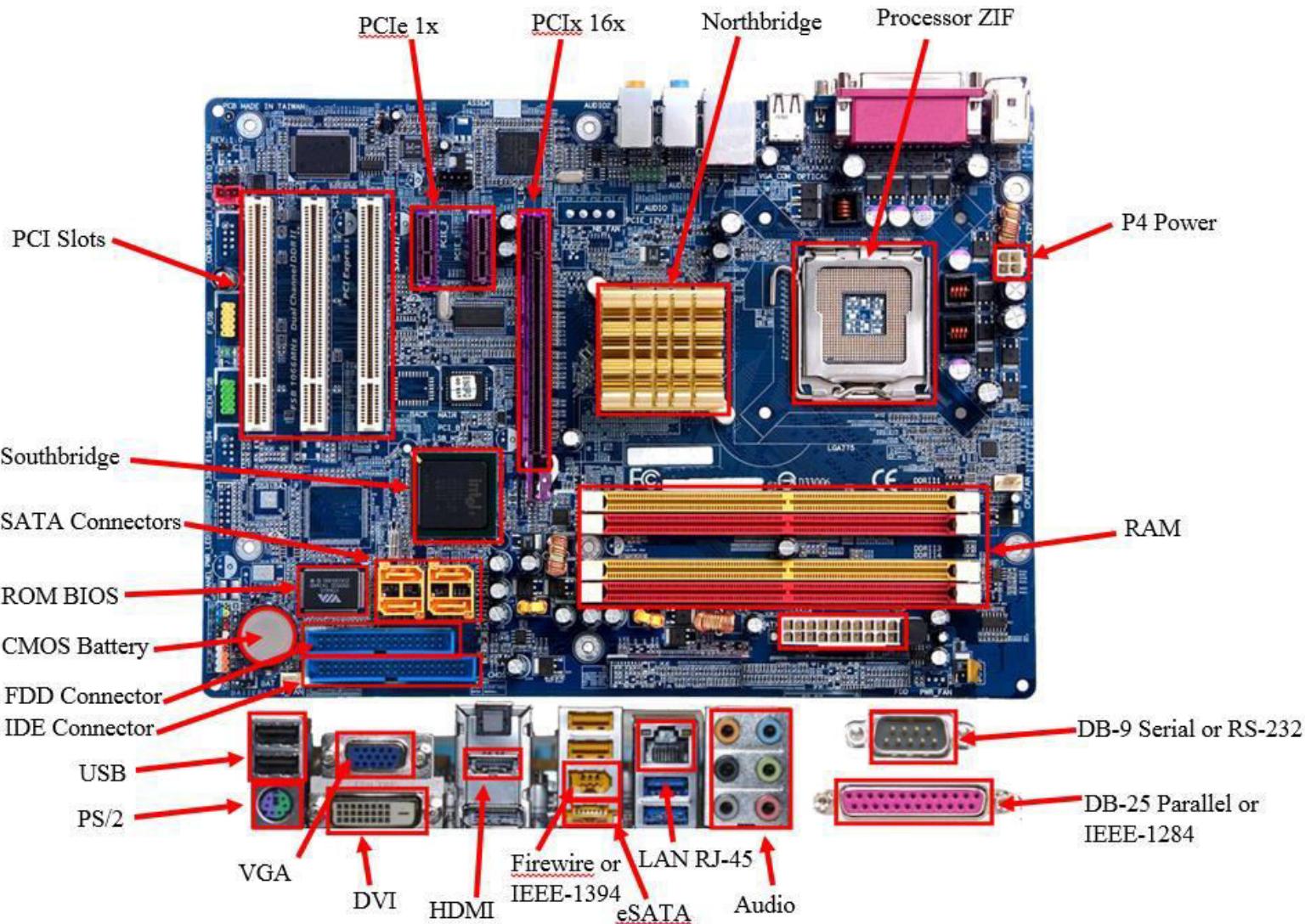
4. Safety and Electrical Safety, Environmental Safety and Materials Handling

Review Hardware Components

1. Differentiate form factors and cases
2. Choose an appropriate power supply
3. Differentiate between different bus structures
4. Differentiate between motherboard components, their purposes, and properties
5. Configure and apply BIOS settings
6. Differentiate among various CPU types and features
7. Select the appropriate cooling method
8. Compare and contrast RAM types and features
9. Install and configure storage devices and use appropriate media
10. Compare and contrast various connection interfaces and explain their purpose
11. Compare and contrast RAID types
12. Compare expansion devices
13. Evaluate video components and standards
14. Evaluate monitors
15. Evaluate peripheral devices
16. Evaluate and select appropriate components for a custom configuration, to meet customer specifications or needs

4. Safety and Electrical Safety, Environmental Safety and Materials Handling

Motherboard Parts and I/O Ports



End

Thank you

FFDRE TVTI Institute
Departments of Information Technology
Course Title: Computer Maintenance

Chapter -2 Software Maintenance:

Linux Practice Commands using Ubuntu

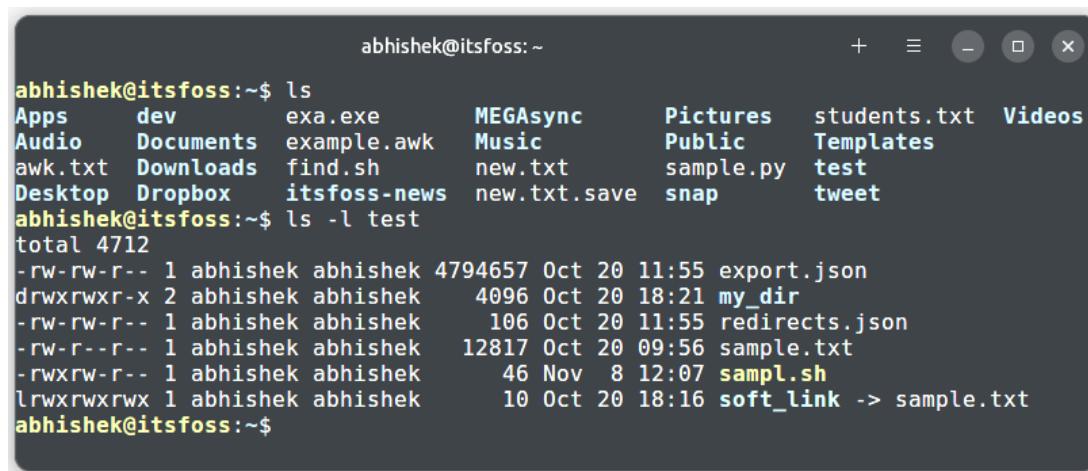
1. ls command: List the contents of a folder

/ls syntax → ls [option] [file | folder]

ls options

option	description
ls -la	list long format including hidden files
ls -lh	list long format with readable file size
ls -ls	list with long format with file size
ls -r	list in reverse order

Example



```
abhishek@itsfoss:~$ ls
Apps      dev      exa.exe      MEGASync      Pictures    students.txt  Videos
Audio     Documents example.awk  Music        Public      Templates
awk.txt   Downloads find.sh    new.txt     sample.py  test
Desktop   Dropbox  itsfoss-news new.txt.save snap       tweet
abhishek@itsfoss:~$ ls -l test
total 4712
-rw-rw-r-- 1 abhishek abhishek 4794657 Oct 20 11:55 export.json
drwxrwxr-x 2 abhishek abhishek   4096 Oct 20 18:21 my_dir
-rw-rw-r-- 1 abhishek abhishek    106 Oct 20 11:55 redirects.json
-rw-r--r-- 1 abhishek abhishek 12817 Oct 20 09:56 sample.txt
-rwxrwxr-x 1 abhishek abhishek     46 Nov  8 12:07 sampl.sh
lrwxrwxrwx 1 abhishek abhishek      10 Oct 20 18:16 soft_link -> sample.txt
abhishek@itsfoss:~$
```

2. cd command: Change the directory

The cd command stands for **change directory**; with this, you can change your location and move to another directory.

By default, you start in your home directory. You'll often require to change the directory and move to another one.

Syntax → cd <child directory name>
Switch to child directory

```
abhi@linux:~/parent$ ls
child 'child directory'
abhi@linux:~/parent$ cd child1
abhi@linux:~/parent/child1$ pwd      //to display the current working directory
```

```
/home/abhi/parent/child1  
abhi@linux:~/parent/child1$
```

Or

Example:

```
abhishek@itsfoss:~$ cd test  
abhishek@itsfoss:~/test$ ls  
export.json  my_dir  redirects.json  sample.txt  sampl.sh  soft_link  
abhishek@itsfoss:~/test$ cd my_dir/  
abhishek@itsfoss:~/test/my_dir$ cd ...  
abhishek@itsfoss:~$
```

3. cat command: Read a text file

You can also use the **cat command** to create new files or add more text to existing files.

The cat name stands for **catenate** as the primary job of that command is to *join several input files* by sequentially sending their content on standard output:

Syntax → **cat filename**

```
abhishek@itsfoss:~/test$ cat sampl.sh  
#!/bin/bash  
  
echo "Hello World"  
echo "XXYYZZ"  
abhishek@itsfoss:~/test$
```

Example:

```
# Let's obtain first some sample data files:  
curl -so - dict://dict.org/d:felidae:gcide' | unexpand -a -t 3 |  
    sed -Ee '/^151/,/^./!d;/^.[0-9]/s/.*/ / > felidae.txt  
curl -so - dict://dict.org/d:felis:gcide' | unexpand -a -t 3 |  
    sed -Ee '/^151/,/^./!d;/^.[0-9]/s/.*/ / > felis.txt  
  
# Catenate files  
Cattxtfile1.txt txtfile2.txt
```

If you want to store the result of that *concatenation* in a file, you have to use a shell redirection:
If you want to store the result of that concatenation in a file, you have to use a shell redirection:
(use the **cat command followed by the redirection symbol (>) and the name of the file you want to create.)**)

```
cat txtfile1.txt txtfile2.txt > result.txt  
cat result.txt
```

4. less command: Read a large text file

When used without any argument, the **cat command will read data from its standard input** and write them to its standard output—which is mostly useless ... unless you are using some option to transform the data.

When you open a file with less, it opens the file in pages. You can scroll/press down or space key move forward to look for text more and you can press the ***up key to move backward.***

Or

- ✓ To move forward by a page, press B.
- ✓ To move forward several lines, hit B, then type the number of lines.
- ✓ To move backward by a page, press D.
- ✓ To move backward by a number of lines, type D, then the number of lines you want to go back by.

The basic syntax of the less command is:

```
less [option] [name or location of the file]  
e.g., less /etc/sudo.conf
```

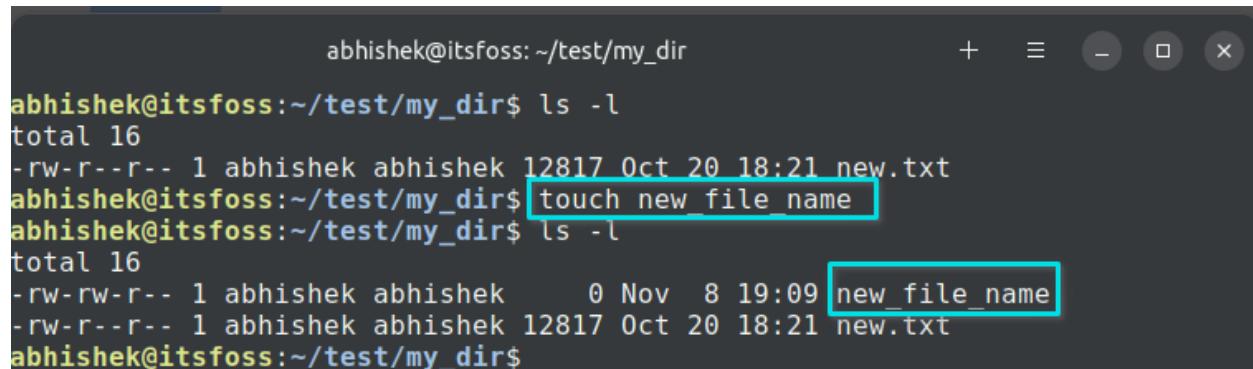
To show line number with less command, we have to add the **-N option the command.**

e.g., syntax: less -N /etc/sudo.conf

5. touch command: Create new files

There are multiple ways of creating new files in the Linux terminal. The cat command you saw above can also create new files. However, we can use **touch** also.

Syntax: → `touch [new_file_name]`



```
abhishek@itsfoss:~/test/my_dir$ ls -l
total 16
-rw-r--r-- 1 abhishek abhishek 12817 Oct 20 18:21 new.txt
abhishek@itsfoss:~/test/my_dir$ touch new_file_name
abhishek@itsfoss:~/test/my_dir$ ls -l
total 16
-rw-rw-r-- 1 abhishek abhishek      0 Nov  8 19:09 new_file_name
-rw-r--r-- 1 abhishek abhishek 12817 Oct 20 18:21 new.txt
abhishek@itsfoss:~/test/my_dir$
```

6. mkdir command: Make new folders

While there is no specific command for creating new files, there is a dedicated command for making new folders (or directories, as we call them in Linux).

Syntax: → `mkdir [new_dir]`

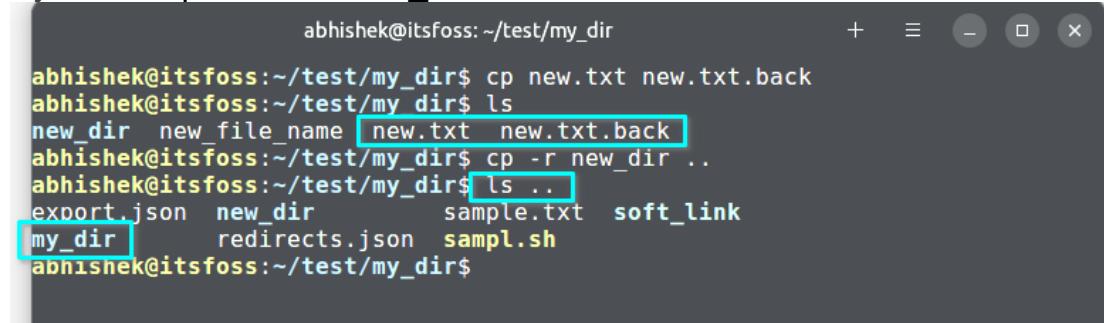
7. cp command: Copy files and folders

Copying files and folders in the command line is also one of the common tasks you will encounter. The **cp command**, short for **copy**, is used for this purpose. Imagine that you have to modify a configuration file. A smart move will be to copy the file with another name. This way, *you'll have a backup of the file.*

Syntax: → cp existing_file.txt existing_file.back

You can use the same **cp command for copying directories** as well. For that, you must specify the recursive option -r:

Syntax :→ cp -r dir another_location



```
abhishek@itsfoss:~/test/my_dir$ cp new.txt new.txt.back
abhishek@itsfoss:~/test/my_dir$ ls
new_dir new_file_name new.txt new.txt.back
abhishek@itsfoss:~/test/my_dir$ cp -r new_dir ..
abhishek@itsfoss:~/test/my_dir$ ls ..
export.json new_dir sample.txt soft_link
my_dir redirects.json sampl.sh
abhishek@itsfoss:~/test/my_dir$
```

e.g.1, If you want to copy a file, say texfile1.txt from Directory_1 to Directory_2, you will use the cp command like this:

`cp ./Directory_1/texfile1.txt ./Directory_2`

e.g.2 If you want to copy a directory in Directory_1 to Directory_2, we use as

`cp ./Directory_1/Filder/texfile1.txt ./Directory_2`

→ it copies Directory_1 with its directory and subdirectories to Directory_2

8. mv command: Cut-paste or rename files and folders

The mv command stands for '**move**'. When you copy a file to another location, it remains in its original place. The mv command moves the files and folders to the other location. You can think of it as a cut-paste operation.

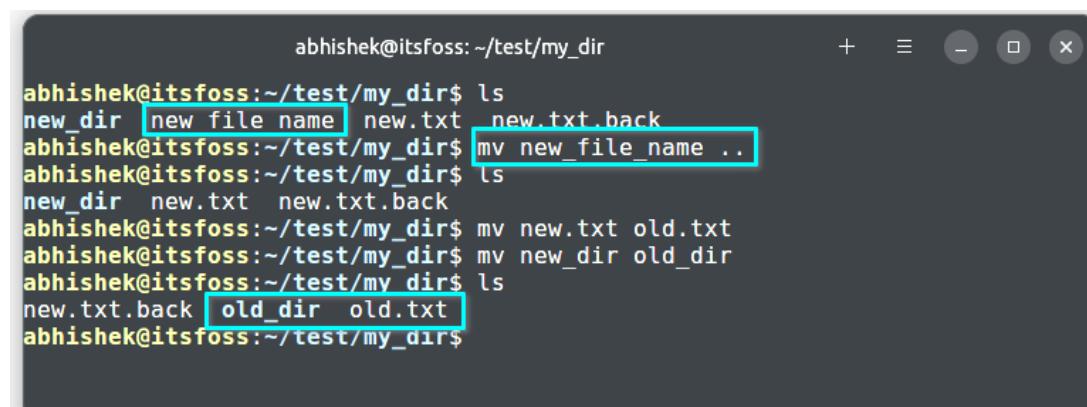
Syntax: → mv [options] source_file target_file_location

e.g. mv txtfile.txt my_dir

You can use the mv command to move multiple files to directory as well.

Syntax → mv txtfile.txt, new_txtfile.txt my_dir

The same mv command also moves or renames folders without any special options.



```
abhishek@itsfoss:~/test/my_dir$ ls
new_dir new_file_name new.txt new.txt.back
abhishek@itsfoss:~/test/my_dir$ mv new_file_name ..
abhishek@itsfoss:~/test/my_dir$ ls
new_dir new.txt new.txt.back
abhishek@itsfoss:~/test/my_dir$ mv new.txt old.txt
abhishek@itsfoss:~/test/my_dir$ mv new_dir old_dir
abhishek@itsfoss:~/test/my_dir$ ls
new.txt.back old_dir old.txt
abhishek@itsfoss:~/test/my_dir$
```

9. rm command: Remove files and folders

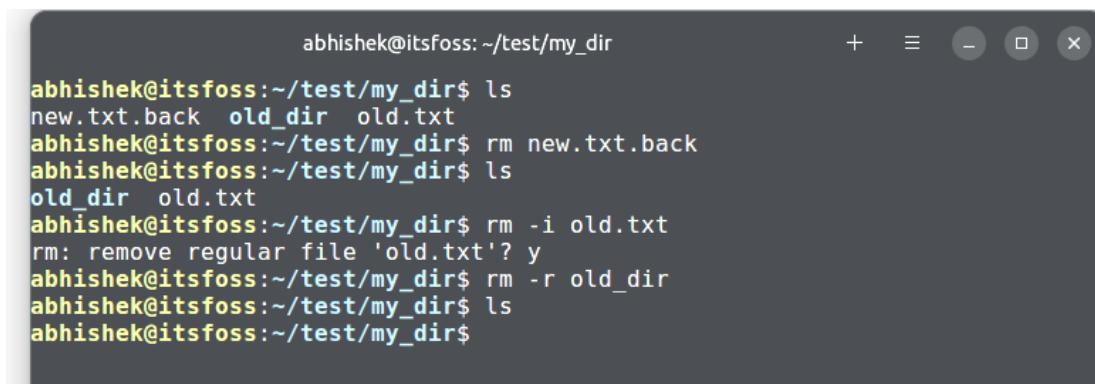
You use the **rm** (short for **remove**) command to delete files in the Linux terminal.

Syntax → **rm filename**

There is **no undo option** after you delete files in the command line. This is why you should be extremely careful while deleting files. If you are afraid of deleting the wrong file, use the **interactive** mode with **option -i**, which gives you an **additional prompt to confirm** the action.

Syntax → **rm -i filename**

With the recursive option **-r**, you can also use the same rm command to delete folders.



```
abhishek@itsfoss:~/test/my_dir
abhishek@itsfoss:~/test/my_dir$ ls
new.txt.back old_dir old.txt
abhishek@itsfoss:~/test/my_dir$ rm new.txt.back
abhishek@itsfoss:~/test/my_dir$ ls
old_dir old.txt
abhishek@itsfoss:~/test/my_dir$ rm -i old.txt
rm: remove regular file 'old.txt'? y
abhishek@itsfoss:~/test/my_dir$ rm -r old_dir
abhishek@itsfoss:~/test/my_dir$ ls
abhishek@itsfoss:~/test/my_dir$
```

10. nano: Edit files

There are command line-based text editors for this purpose. Ubuntu comes with **Nano editor preinstalled**, and it is relatively easier to use than Vim, Emacs, etc.

Easier to use doesn't mean the same comfort as a GUI-based text editor. You will have to use the keyboard shortcuts for moving around, making changes, saving, and exiting files.

- ✓ To open a new, unnamed file with nano, use:

Syntax → **nano**

- ✓ To edit an existing file in Nano, use:

Syntax → **nano filename**

In both cases, you should see an interface like this.

The screenshot shows a terminal window titled 'abhishek@itsfoss: ~/test/my_dir'. It displays the text 'Hello World' and the status 'new *'. The bottom of the screen shows the nano editor's command bar with various keyboard shortcuts:

- ^G Help
- ^O Write Out
- [New File]
- ^W Where Is
- ^R Read File
- ^A Replace
- ^K Cut
- ^U Paste
- ^T Execute
- ^J Justify
- ^X Exit

How to Use Nano Text Editor

1. Press **CTRL + O** to save the changes made in the file and continue editing.
2. To save and exit from the editor, press **CTRL + X**. If there are changes, it will ask you whether to save them or not. Input Y for Yes, or N for No, then press Enter.

11. clear: Clear terminal screen

Nano feels like a complicated one, right? Let me share a simple command.

The clear command clears the terminal.

Syntax →**clear**

And why do you need to do that? Well, if your terminal screen is flooded with random stuff and you want to do something new. Cleaning the terminal is like cleaning the board or opening a new page in your notebook.

12. ps: Check and handle processes

The **ps** command is for handling the processes running on your system. Each process has an associated *ID* called **PID**, which can be used for various purposes, such as **terminating a process**.

```
abhishek@itsfoss:~$ ps
  PID TTY      TIME CMD
 15358 ?    00:00:00 bash
 15404 ?    00:00:00 ps
```

Here,

- **PID:** Process ID
- **TTY:** Controlling terminal associated with the process (Not that important these days)
- **TIME:** Total CPU usage time
- **CMD:** Name of command that runs the process

But a system cannot run just 2-3 processes, To see all the processes running by all users, use:

Syntax →**ps aux**

Common ps commands

Commands	Description
ps -A or ps -e	To view all the running processes,

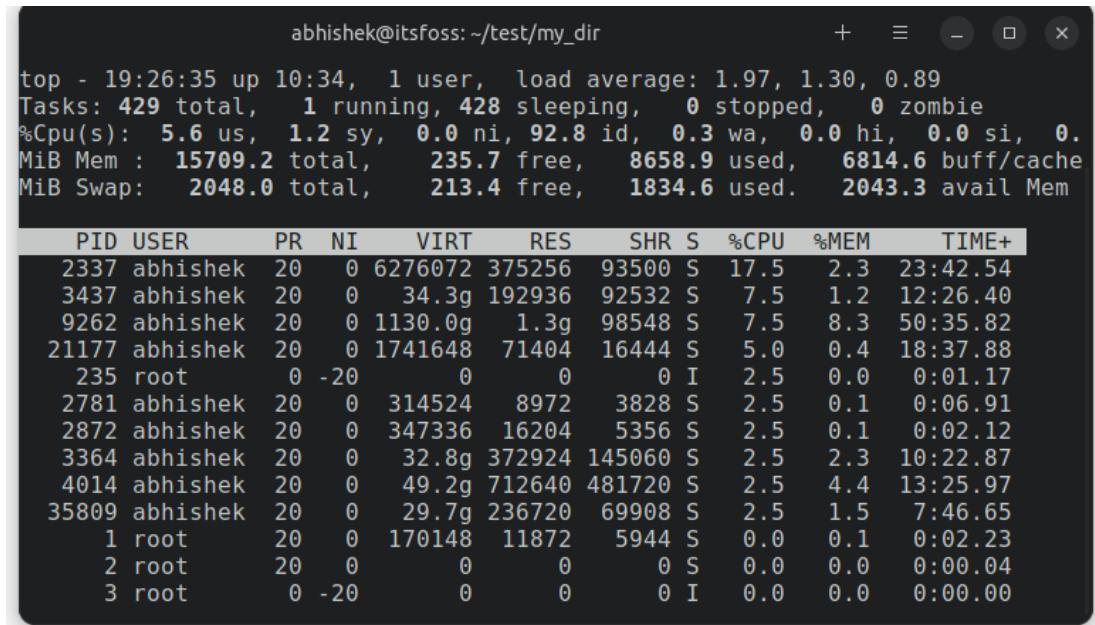
<code>ps -T</code>	To view processes associated with the terminal
<code>ps -ax</code>	To view all current processes execute (-a flag stands for all processes -x will display all processes even those not associated with the current tty)
<code>ps -ef</code>	To view a full format listing run
<code>ps -u user e.g ps -u jemis</code>	Filter process according the user. If you wish to list processes associated with a specific user, use the -u flag as shown
<code>ps -L 4264</code>	Filter process by thread process /thread shares the memory with the parent process and other threads within the process./ If you wish to know the thread of a particular process, make use of the -Lflag followed by the PID For example
<code>ps -U root -u root</code>	To reveal all processes run by the root user
<code>ps -fp PID</code>	You can display processes by their PID as shown

13. top: System monitor

While the **`ps` command** gives you all the running processes, the `top` command gives you a real-time view of the processes and the system resource consumption.

Consider it like the terminal variant of the task manager in Linux. You'll see a lot of interesting details with the `top` command.

The `top` command to check which process takes too much CPU or RAM. There are better `top` alternatives if you are interested in experimenting.



```
abhishek@itsfoss: ~/test/my_dir
+ - ×
top - 19:26:35 up 10:34, 1 user, load average: 1.97, 1.30, 0.89
Tasks: 429 total, 1 running, 428 sleeping, 0 stopped, 0 zombie
%Cpu(s): 5.6 us, 1.2 sy, 0.0 ni, 92.8 id, 0.3 wa, 0.0 hi, 0.0 si, 0.
MiB Mem : 15709.2 total, 235.7 free, 8658.9 used, 6814.6 buff/cache
MiB Swap: 2048.0 total, 213.4 free, 1834.6 used, 2043.3 avail Mem

      PID USER      PR  NI    VIRT    RES    SHR S %CPU %MEM TIME+
2337 abhishek  20   0 6276072 375256 93500 S 17.5  2.3 23:42.54
3437 abhishek  20   0   34.3g 192936 92532 S  7.5  1.2 12:26.40
9262 abhishek  20   0 1130.0g  1.3g 98548 S  7.5  8.3 50:35.82
21177 abhishek 20   0 1741648 71404 16444 S  5.0  0.4 18:37.88
  235 root      0 -20     0     0     0 I  2.5  0.0  0:01.17
  2781 abhishek 20   0 314524  8972 3828 S  2.5  0.1  0:06.91
  2872 abhishek 20   0 347336 16204 5356 S  2.5  0.1  0:02.12
  3364 abhishek 20   0 32.8g 372924 145060 S  2.5  2.3 10:22.87
  4014 abhishek 20   0 49.2g 712640 481720 S  2.5  4.4 13:25.97
  35809 abhishek 20   0 29.7g 236720 69908 S  2.5  1.5  7:46.65
    1 root      20   0 170148 11872 5944 S  0.0  0.1  0:02.23
    2 root      20   0     0     0     0 S  0.0  0.0  0:00.04
    3 root      0 -20     0     0     0 I  0.0  0.0  0:00.00
```

14. lsblk: List disks and partitions

The **`lsblk`** command lists all the block devices on your system. In really simple (and not entirely technically accurate) terms, it displays the disks and partitions.

```
root@learnubuntu:~# lsblk
NAME  MAJ:MIN RM SIZE RO TYPE MOUNTPOINTS
loop0  7:0    0 79.9M 1 loop /snap/lxd/22923
```

```
loop1  7:1  0 103M 1 loop /snap/lxd/23541
loop2  7:2  0 63.2M 1 loop /snap/core20/1623
loop3  7:3  0 48M 1 loop /snap/snapd/17336
loop4  7:4  0 48M 1 loop /snap/snapd/17029
loop6  7:6  0 63.2M 1 loop /snap/core20/1634
vda   252:0 0 25G 0 disk
└─vda1 252:1 0 24.9G 0 part /
  └─vda14 252:14 0 4M 0 part
    └─vda15 252:15 0 106M 0 part /boot/efi
vdb   252:16 0 466K 1 disk
root@learnubuntu:~#
```

15. fdisk: List and manage disks and partitions

Another similar but better command is the **fdisk** command. It lets you manipulate the disk partitions. This means you can create new partitions and delete and resize existing ones with this command.

You can also use it to list all the block devices, including loop devices, on your system.

```
sudo fdisk -l
```

The output could be huge if you have many partitions, disks, and loop devices (created by snap applications). I am showing a relevant part of the output here:

```
Disk /dev/vda: 25 GiB, 26843545600 bytes, 52428800 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: gpt
Disk identifier: 0B7C796D-51CD-4DD4-962A-7D94B31690E2
```

Device	Start	End	Sectors	Size	Type
/dev/vda1	227328	52428766	52201439	24.9G	Linux filesystem
/dev/vda14	2048	10239	8192	4M	BIOS boot
/dev/vda15	10240	227327	217088	106M	EFI System

16. find: Search for files

Even as a desktop user, you'll encounter cases where you may have to search for files in the Linux command line.

The **find** command is an extensive and versatile command for this purpose. It has more than fifty options, and you will probably never need all of them.

Here's an example of the **find** command that will give you all the files that end with **.txt** extension in the current directory.

```
find . -type f -name "*.txt"
```

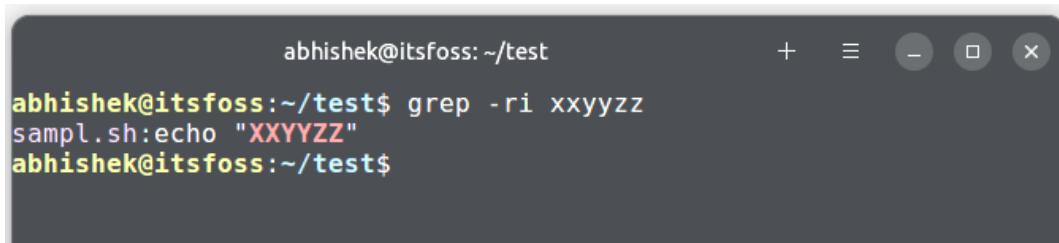
Other common examples include finding files by size, modified time, etc. You can combine **find** with **exec** or **xargs** to take actions on the result of the **find** command. For example, you can look for all the **.txt** files and choose to delete them.

17. grep: Search in file content

The find command search for files based on their name and type. If you want to search based on the content of the files, you use the grep command.

So, instead of looking for all files ending with .txt, you look for all files containing the text ‘foss’ with grep.

```
grep -ri search_term
```



A terminal window titled 'abhishek@itsfoss: ~/test'. The command 'grep -ri xxxyz' is run, and it finds a match in 'sampl.sh' at line 1. The match 'XXYYZZ' is highlighted in red. The terminal prompt 'abhishek@itsfoss:~/test\$' appears again.

```
abhishek@itsfoss:~/test$ grep -ri xxxyz
sampl.sh:echo "XXYYZZ"
abhishek@itsfoss:~/test$
```

18. kill: Terminate processes

Violence is not the answer ... it's the solution.

Just kidding!

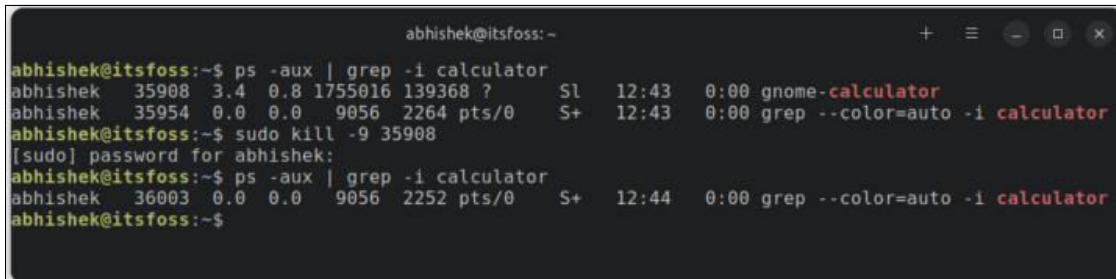
If you have a misbehaving process that takes too many system resources, you can find it and then terminate it using the kill command.

```
sudo kill -9 process_ID_or_Name
```

As you can see in the above command, you need to know the process ID (PID) or the name to terminate it. You can use the ps or the top command to get the PID or exact process name.

```
ps aux | grep -i "name of your desired program"
```

Did you notice the use of grep command? You are already utilizing the commands mentioned in this list.



A terminal window titled 'abhishek@itsfoss:~'. It shows the output of 'ps aux | grep -i calculator', which lists two processes: 'gnome-calculator' and 'grep --color=auto -i calculator'. The user then runs 'sudo kill -9 35908' to terminate the first process. A password prompt follows. Finally, another 'ps aux | grep -i calculator' command is run, showing that the process has been successfully terminated.

```
abhishek@itsfoss:~$ ps aux | grep -i calculator
abhishek 35908 3.4 0.8 1755016 139368 ? Sl 12:43 0:00 gnome-calculator
abhishek 35954 0.0 0.0 9056 2264 pts/0 S+ 12:43 0:00 grep --color=auto -i calculator
abhishek@itsfoss:~$ sudo kill -9 35908
[sudo] password for abhishek:
abhishek@itsfoss:~$ ps aux | grep -i calculator
abhishek 36003 0.0 0.0 9056 2252 pts/0 S+ 12:44 0:00 grep --color=auto -i calculator
abhishek@itsfoss:~$
```

Finding and terminating process

19. chmod: Change file permissions

It is highly recommend reading about Linux file permissions at this stage. That will help you understand things better than just running the chmod command blindly.

The chmod (change mode) command is used to change a file's permissions.

The most common use of this command is when you want to make a file executable. Got a shell script? Make it executable like this:

```
chmod u+x file executable
```

Many more use cases make chmod a must-know command for Ubuntu users.

Fun fact: The parent company of **It's FOSS** is **chmod777 Media Tech**. chmod 777 command gives all the permissions to all the users. This represents our motto of '*knowledge access to everyone*'.

20. Ishw: Get the hardware details

There are tons of command line tools to get the hardware details and other system information in Linux.

The one that probably comes preinstalled on Ubuntu is **Ishw** (short for list hardware).

Now, by default, it displays a vast output with details about all the hardware components and trust me, that's not very easy to understand.

```
Ishw
```

You may feel the temptation of using grep here, but there is no need for that. The output of Ishw is divided into classes and you can use that to show the details for a class of hardware.

```
Ishw -C network
```

```
abhishek@itsfoss:~$ lshw -C network
WARNING: you should run this program as super-user.
*-network
    description: Wireless interface
    product: Wi-Fi 6 AX201
    vendor: Intel Corporation
    physical id: 14.3
    bus info: pci@0000:00:14.3
    logical name: wlp0s20f3
    version: 20
    serial: dc:41:a9:fb:7a:c0
    width: 64 bits
    clock: 33MHz
    capabilities: bus_master cap_list ethernet physical wireless
    configuration: broadcast=yes driver=iwlwifi driverversion=5.19.0-23-generic firmware=71.058653f6.0 Q
uZ-a0-hr-b0-71.u ip=192.168.1.42 latency=0 link=yes multicast=yes wireless=IEEE 802.11
    resources: iomemory:600-5ff irq:16 memory:60552dc000-60552dffff
*-network
    description: Ethernet interface
    physical id: 18
    bus info: usb@6:2.4
    logical name: enx747827c86d70
    serial: 74:78:27:c8:6d:70
    size: 10Mbit/s
    capacity: 1Gbit/s
    capabilities: ethernet physical tp mii 10bt 10bt-fd 100bt 100bt-fd 1000bt 1000bt-fd autonegotiation
    configuration: autonegotiation=on broadcast=yes driver=r8152 driverversion=v1.12.13 duplex=half firm
ware=rtl8153b-2 v1 10/23/19 link=no multicast=yes port=MII speed=10Mbit/s
WARNING: output may be incomplete or inaccurate, you should run this program as super-user.
abhishek@itsfoss:~$
```

21. sudo: Run commands with root privileges

You must have noticed that I used **sudo** as a prefix for some commands I discussed previously.

By default, in Ubuntu, **sudo** is configured in a way that it allows you (to the default admin user) to run any command with root privileges.

You are asked to enter a password, and it's your user account password. When you enter the password, nothing is displayed on the screen. New users get baffled by it, but it's the expected behavior in UNIX/Linux. You type the password and press enter.

```
abhishek@itsfoss:~$ apt update ←
Reading package lists... Done
E: Could not open lock file /var/lib/apt/lists/lock - open (13: Permission denied)
E: Unable to lock directory /var/lib/apt/lists/
W: Problem unlinking the file /var/cache/apt/pkgcache.bin - RemoveCaches (13: Permission denied)
W: Problem unlinking the file /var/cache/apt/srcpkgcache.bin - RemoveCaches (13: Permission denied)
abhishek@itsfoss:~$ abhishek@itsfoss:~$ sudo apt update ←
[sudo] password for abhishek:
Hit:1 https://brave-browser-apt-release.s3.brave.com stable InRelease
Ign:2 https://repo.vivaldi.com/stable/deb stable InRelease
Hit:3 https://repo.vivaldi.com/stable/deb stable Release
Hit:4 https://dl.google.com/linux/chrome/deb stable InRelease
Hit:6 http://repository.spotify.com stable InRelease
Hit:7 http://us.archive.ubuntu.com/ubuntu kinetic InRelease
Get:8 http://security.ubuntu.com/ubuntu kinetic-security InRelease [109 kB]
Get:10 http://us.archive.ubuntu.com/ubuntu kinetic-updates InRelease [99.8 kB]
Get:11 https://mega.nz/linux/repo/xUbuntu_22.04 ./ InRelease [2,961 B]
Hit:12 http://us.archive.ubuntu.com/ubuntu kinetic-backports InRelease
Hit:9 https://packagecloud.io/slacktechnologies/slack/debian jessie InRelease
```

22. apt: Install, remove and manage .deb packages

The **apt** command is used for managing packages in Ubuntu. You'll have to use it with sudo as these are administrative tasks.

To install a package, use:

```
sudo apt install package_name
```

To delete an installed software, use:

```
sudo apt remove package_name
```

To update your Ubuntu system with all upgradable packages at once:

```
sudo apt update && sudo apt upgrade
```

The difference between apt update and upgrade is that an update refreshes the package cache and the upgrade actually installs the update.

23. exit: Close the terminal

The list of essential Linux commands is ending. So let's talk about exiting the terminal. It's quite simple. Just enter:

```
exit
```

If you are using another user or shell, you'll be logged out from that.

You may also use **Ctrl+D** keys to exit the terminal.

31. shutdown: Turn off or reboot the system

```
shutdown
```

The above command schedules a shutdown in one minute. You can make it turn off immediately with:

```
shutdown -now
```

You can use the same shutdown command for rebooting your Ubuntu system as well:

```
shutdown -r now
```



Technical and Vocational Training Institute (TVTI)
Faculty of Electrical/Electronics & Information and Communication
Technology Department of Information Technology

Course Title: Computer Maintenance

Chapter – 2: Part-II

Software Maintenance

Chapter 2 – Contents (Continued)

- 1. Introduction to Linux, macOS, Mobile OS**
 - 1. Basics of Linux**
 - 2. Basics of macOS**
 - 3. Basics Mobile OS**
- 2. File System Management and System Management Tools for Maintenance (preventive)**
- 3. Application Software Troubleshooting**
- 4. Anti - Malware**

1. Introduction to Linux, macOS, Mobile OS

- 1. Basics of Linux**
- 2. Basics of macOS**
- 3. Basics Mobile OS**

1. Basics of Linux

- **Operating System**
 - An OS is a software that communicates with the hardware and other programs to run
- **Features of Operating system**
 - Task Scheduling
 - Memory management
 - Network Communication Handling
 - Data and Security

1. Basics of Linux

- **Definition & Naming of Linux Operating System**
 - The Linux open source operating system or Linux OS, is
 - freely distributable,
 - Cross-Platform operating system based on Unix that can be installed on PCs, Laptops, Notebooks, Mobiles, and Tablet devices, Video game controllers, Servers, Supercomputers and more others.
 - It was developed by Linus Torvalds.
 - Linus Torvalds had wanted to call his invention “Freak” i.e. Free + X as an allusion to Unix.
 - In this project his partner Mr. A.L. Torvalds did not think it's a good name. so they finally decided named their project name as “Linux”

1. Basics of Linux

■ History of Linux OS

- Linux is a free and open source operating system.
- At its core, the Linux operating system is derived from the Unix OS.
 - **Unix** was created in the 1960s by Dennis Ritchie and Ken Thompson, both of them **also invented the C programming language**.
- Linux was initially named **GNU** and was developed by Richard Stallman
- **Linux** was the name of the kernel created in 1991 by Linux Torvalds, a student at the University of Helsinki.
- People started calling the GNU OS, Linux – because of the name of the kernel



Kenneth L. Thompson

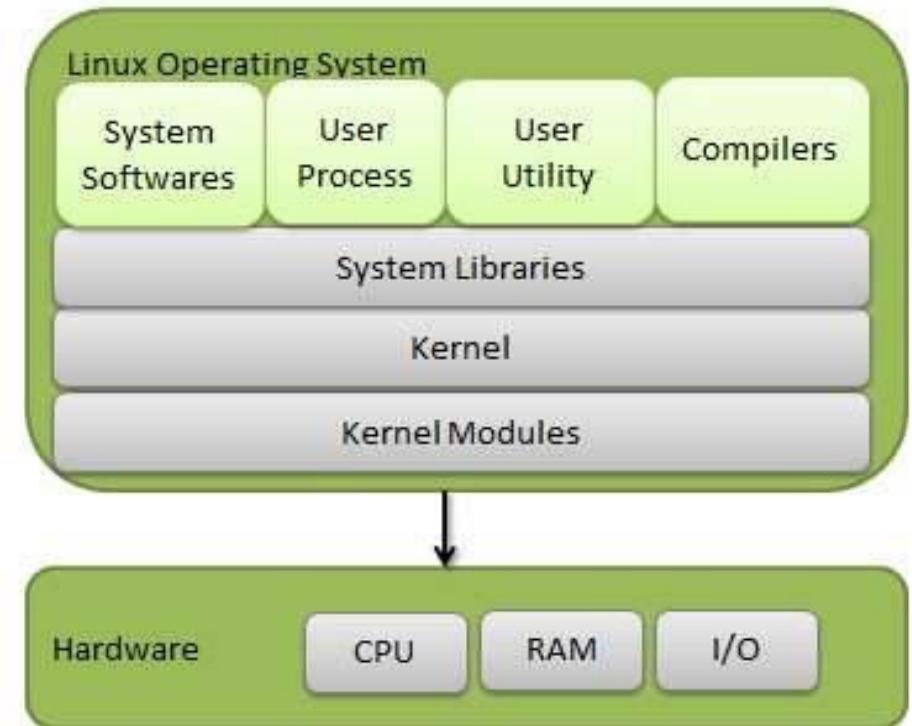
Dennis M. Ritchie



1. Basics of Linux

■ Components of Linux System

- **Kernel** – It the core of Linux. The Kernel is responsible for all major activities of the operating system.
- **System Library** – system libraries are special functions or programs using which application programs or system utilities access kernel's features.
- **System Utility** –
system utility programs are responsible to do specialized, individual levels tasks.



1. Basics of Linux

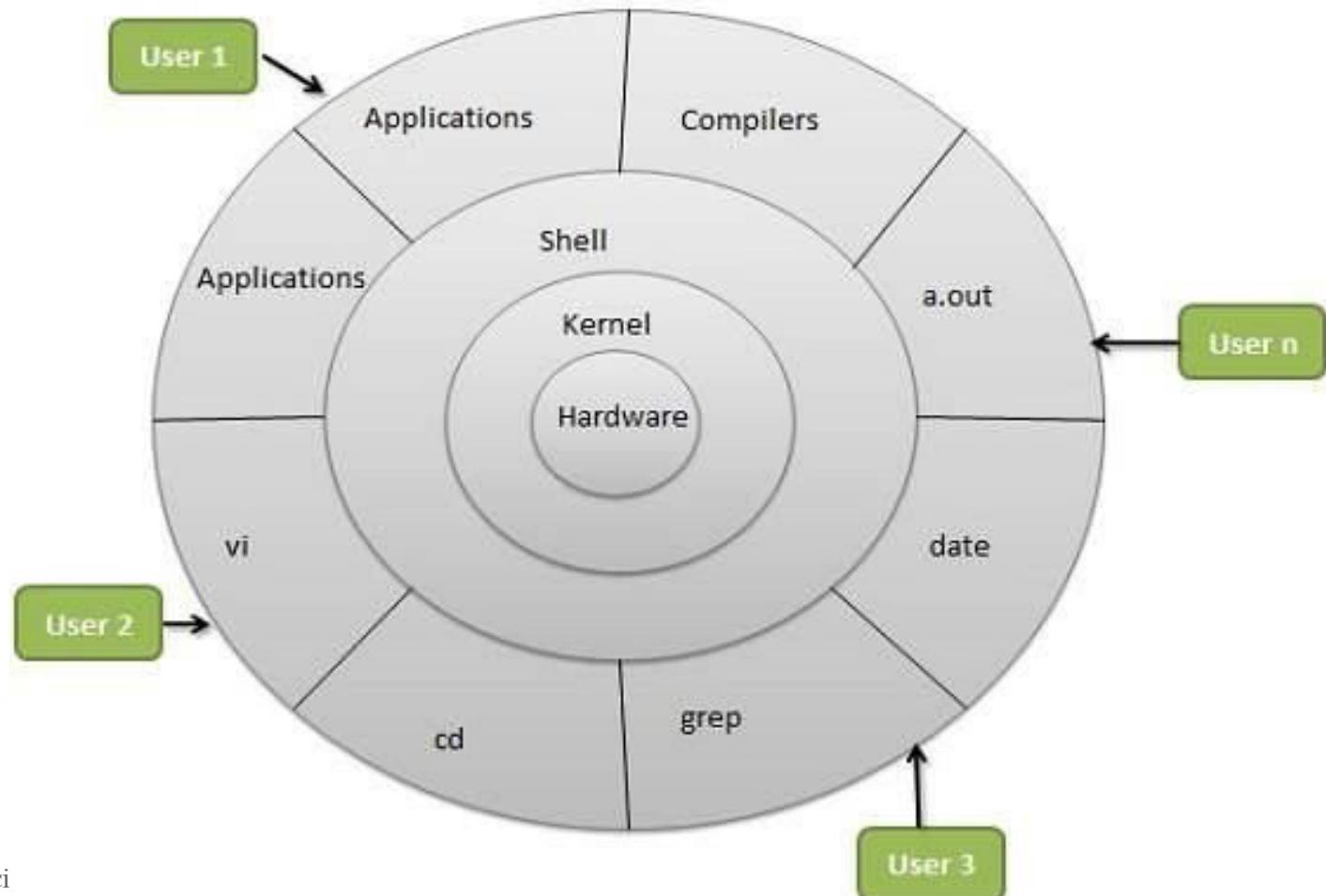
▪ Basic Features of Linux

- **Portable** – Portability means, software can work on different types of hardware in same way.
- **Open Source** – Linux Source code is freely available and it is community based development project.
- **Multi-User** – Linux is a multiuser system means multiple users can access system resources like memory/ ram/ application programs at same time
- **Multiprogramming** – Linux is a multiprogramming system means, multiple application can run at same time.
- **Hierarchical File System** – Linux provides a standard file structure in which system files/ user files are arranged.
- **Shell** – Linux provides a special interpreter program which can be used to execute commands of the operating system. It can be used to do various types of operations, call application programs. etc.
- **Security** – Linux provides user security using authentication feature like password protection /controlled access to specific files/ encryption of data.

1. Basics of Linux

■ Architecture of Linux OS

- The architecture of a Linux System consists of the following layers —



1. Basics of Linux

- **Architecture of Linux OS**
 - The architecture of a Linux System consists of the following layers –
 - **Hardware layer** – Hardware consists of all peripheral devices (RAM/ HDD/ CPU etc).
 - **Kernel** – It is the core component of Operating System, interacts directly with hardware, provides low level services to upper layer components.
 - **Shell** – An interface to kernel, hiding complexity of kernel's functions from users. The shell takes commands from the user and executes kernel's functions.
 - **Utilities** – Utility programs that provide the user most of the functionalities of an operating systems.

1. Basics of Linux

■ **Architecture of Linux OS**

■ About Kernel

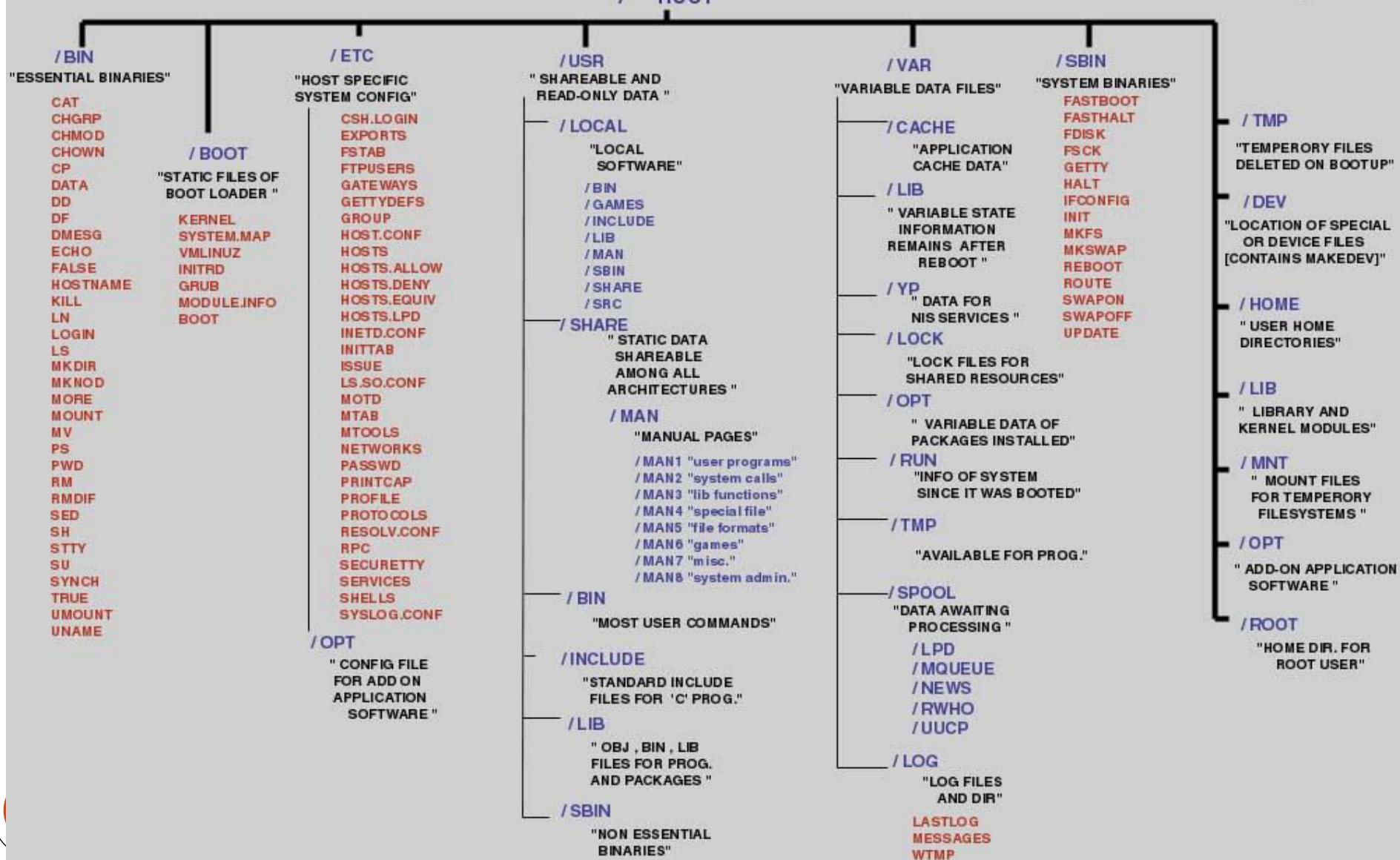
- It interacts with the actual hardware in machine language
- It is the monarch who has over all control of everything
- It has various functions such as file management, data transfer between file system and hardware, memory management, scheduling of various programs in the memory, interrupts issues.

Understanding UNIX/Linux File Systems (continued)

- UNIX/Linux systems support many file systems
 - Examples: UNIX file system (ufs), extended file system (ext or ext fs)
- **ufs**: original native UNIX file system
 - Expandable, supports large amounts of storage, provides excellent security, reliable
 - Supports **journaling**
 - Supports **hot fixes**
- In Linux, the native file system is **ext**
 - Installed by default
 - Modeled after ufs
 - First version contained some bugs
 - Newer versions of Linux use ext2, ext3, or ext4
 - ext4 enables the use of **extents**

Typical Unix/Linux Hierarchical Structure/Directory

© skill2die4@yahoo.com



Typical File System of UNIX/Linux File

File System	Description
Extended file system(ext or ext fs) & the newer version as second extended system (ext2 or ext2 fs)	Come with UNIX/Linux by default(compatible with Linux and FreeBSD); ext3 offer journaling, w/c is important for reliability and recovery when a system goes unexpectedly; ext4 adds larger volume size
High-Performance file system (HPFS)	Developed for use with OS/2 operating system (used by IBM and ATMs), it supports long file system
ISO (iso9660 in Linux, ntfs in Solaris, cd9660 in FreeBSD)	Developed for CD and DVD use; does not support long file names
Journaled File System (JFS)	Fast performance for processing larger files, dynamic inode allocation for better use of free space, and specialized approaches for organizing either small or large directory structure
Msdos	Offer compatibility with FAT 32 & FAT 16 (does not support long file names), typically installed to enable UNIX to read floppy disks made in MS-DOS or windows

Typical File System of UNIX/Linux File

File System	Network
Network File System (NFS)	Developed by Sun Microsystem for UNIX system to support network access and downloading, support by on all Linux version and other operating system
NT File System (NTFS)	Used by Windows OS, and Windows NOS
Proc File System	Present information about the Kernel status and the use of memory (not truly a physical file system, but logical file system)
Swap file system	File system for swap space:, Disk space used extensively to store spillover information from memory when memory is full (called Virtual Memory)
Universal Disk Format (UDF)	Developed for CD and DVD use and broadly replicating iso9660
uMS/DOS	Compatible with extended FAT16 as used by windows OS
Unix file system (ufs,)	Original file system for UNIX, compatible with virtually all Linux system

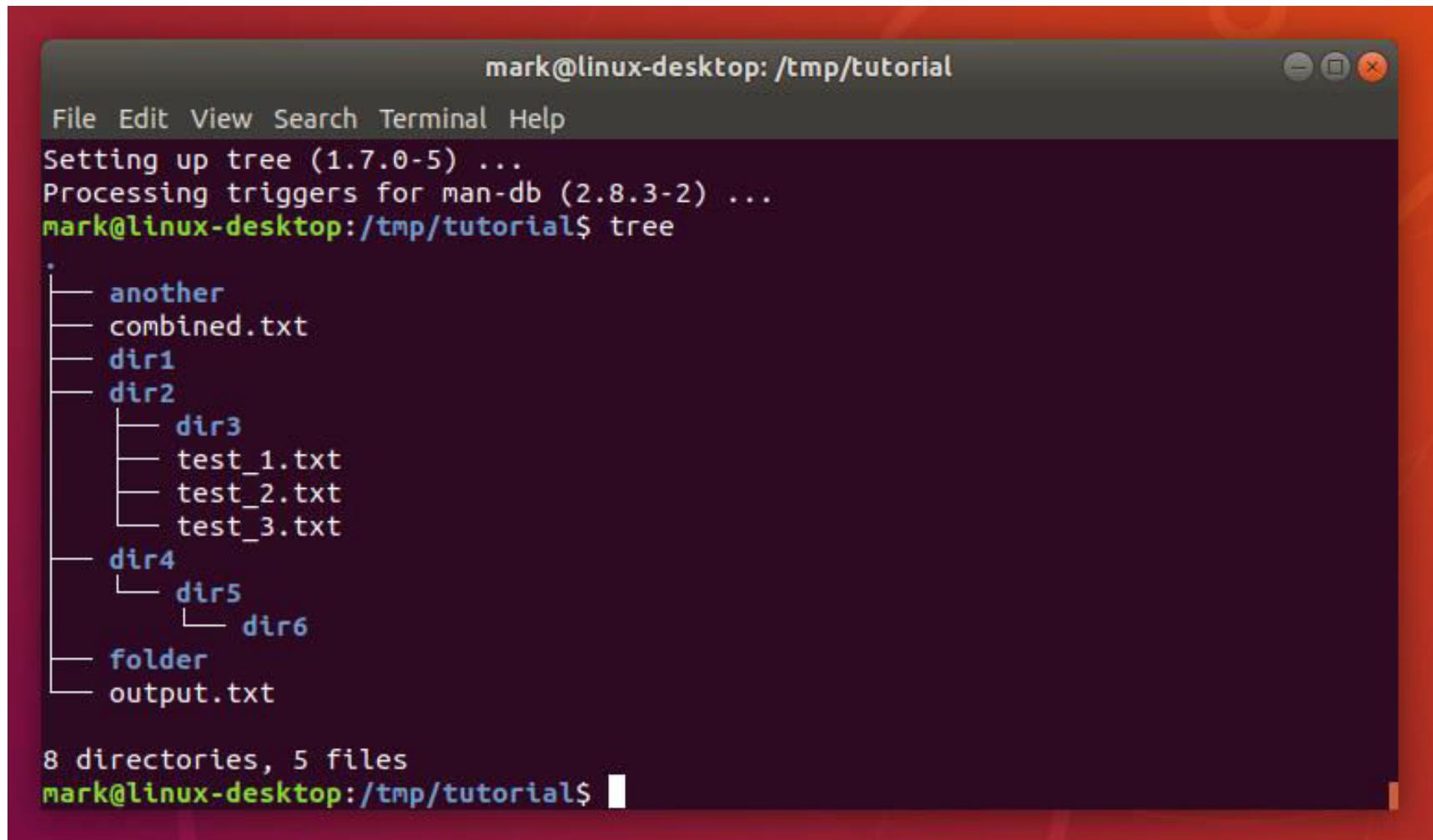
1. Basics of Linux

■ User interface of Linux OS

- The user interface is either a command line interface(CLI), a graphical user interface (GUI), or through controls are associated with hardware.
- CLI shells are text based user interfaces, which use text for both input and output.
- On the desktop system, the most popular user interface are the GUI shells.
- Most popular user interfaces are based on the X windows system, often simply called “X”.

1. Basics of Linux

▪ CLI view of Linux OS



The screenshot shows a terminal window titled "mark@linux-desktop: /tmp/tutorial". The window has a standard Linux-style title bar with icons for minimize, maximize, and close. Below the title bar is a menu bar with "File", "Edit", "View", "Search", "Terminal", and "Help". The main area of the terminal displays the output of the "tree" command. The output shows a directory tree starting from the current working directory, which is "/tmp/tutorial". The tree structure is as follows:

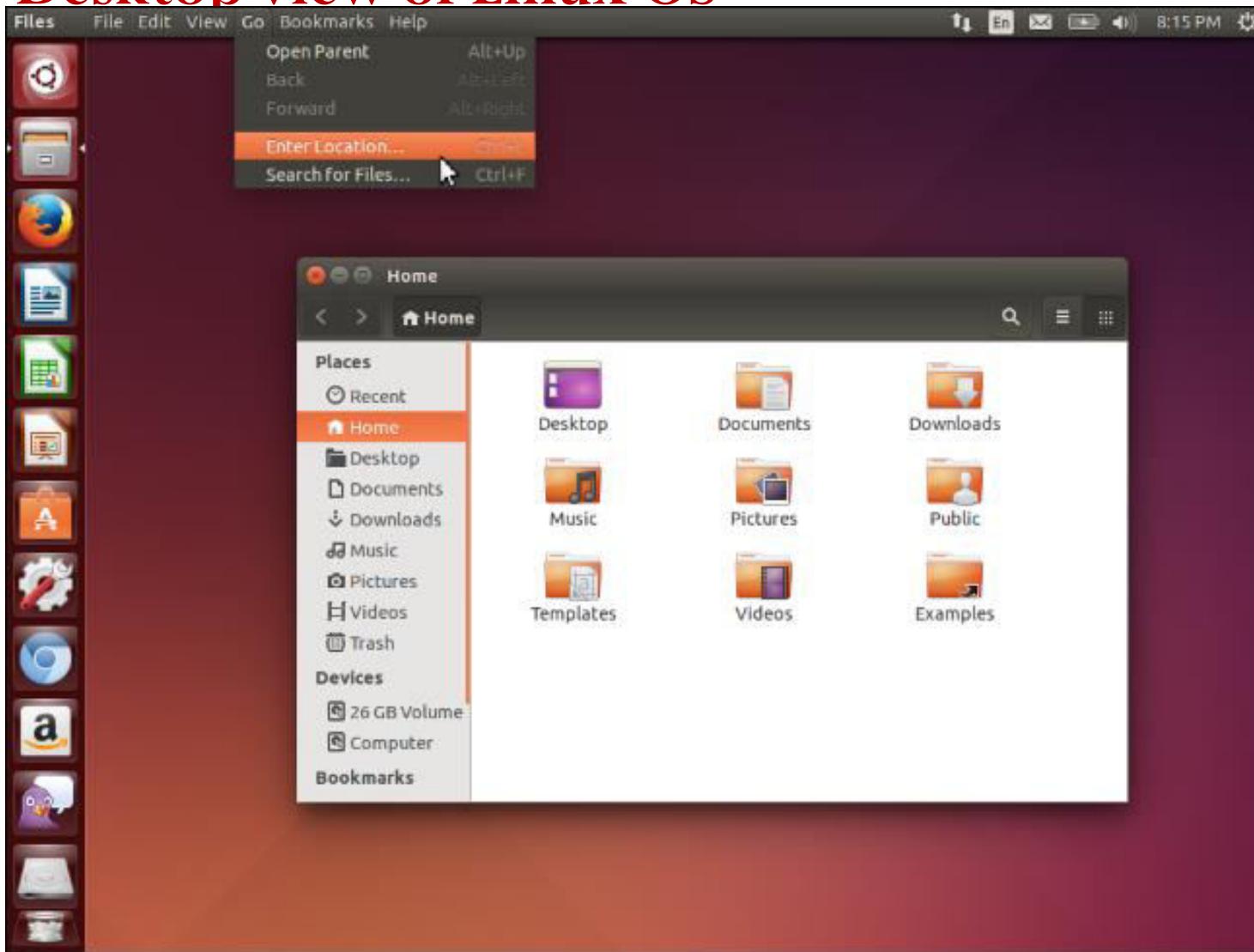
```
mark@linux-desktop:/tmp/tutorial$ tree
.
├── another
├── combined.txt
├── dir1
├── dir2
│   ├── dir3
│   ├── test_1.txt
│   ├── test_2.txt
│   └── test_3.txt
├── dir4
│   └── dir5
│       └── dir6
└── folder
    └── output.txt

8 directories, 5 files
```

The terminal prompt "mark@linux-desktop:/tmp/tutorial\$" is visible at the bottom of the window.

1. Basics of Linux

■ Desktop view of Linux OS



1. Basics of Linux

▪ Distributions of Linux OS

Distribution	Why To Use
Ubuntu	It works like Mac OS and easy to use.
Linux mint	It works like windows and should be use by new comers.
Debian	It provides stability but not recommended to a new user.
Fedora	If you want to use red hat and latest software.
Red hat enterprise	To be used commercially.
CentOS	If you want to use red hat but without its trademark.
OpenSUSE	It works same as Fedora but slightly older and more stable.
Arch Linux	It is not for the beginners because every package has to be installed by you

1. Basics of Linux

- **Distributions of Linux OS (Common)**
- Red Hat: <http://fedoraproject.org>
- CentOS : <http://www.centos.org/>
- Ubuntu: <http://www.ubuntu.com>
- Mandrake: <http://www.linux-mandrake.org>
- Debian: <http://www.debian.org>
- Knoppix: <http://www.knoppix.net/>

1. Basics of Linux

■ **Hardware Requirements to install Linux OS**

- The recommended processor type, memory, and disk space requirements to install Linux OS includes

System Characteristic	Recommended
Processor	64-bit Opteron, EM64T
RAM	1 GB or greater
Swap space	1 GB or greater
Hard Disk space	4 GB or greater

Swap space is a space on a hard disk that is a substitute for physical memory

1. Basics of Linux

- **Common Application Software for Linux**
 - **OpenOffice**: Word Processing, Spreadsheet, drawing
 - **Adobe Acrobat reader**
 - **Konqueror**: The KDE File Manager and Web Browser
 - **TV, Video, Radio and Webcam**, and
 - Other more....
- **There are different text editors in Linux**
 - Vi/Vm editor
 - Gedit editor
 - Namo editor
 - GNU Emacs editor
 - Kate/Kwrite editor
 - Lime text editor and
 - Other many more

1.2 Comparison of Linux with Other Operating System

■ Linux Vs. Windows

- Linux is freely available or online downloadable, for windows companies have pay for their license**
- Windows need up to date time to time, its updating process is slower than Linux**
- Linux supports backward compatibility unlike to the windows**
- Most of the software made on the windows are need to be licensed but all of them are freely available.**
- Window is Closed source software, but Linux is Open source software**

1.2 Comparison of Linux with Other Operating System

■ Linux Vs. IOS

■ Hardware Requirement:

- IOS has restrictive hardware requirement (applied in Apple product only), while Linux does not

■ Compatibility:

- IOS keeps restriction in the arrangement of your data or display whereas Linux can make it simpler as you want.

■ Security:

- Both are highly secured, they didn't give permission to their system administrator.

1.3 Commands of Linux

- There are some commands in linux which gives direct accessories to the files by using retminal.
- Some of them are
 - **sudo command:** perform tasks that require administrative or root permissions
 - **pwd command:** to find the path of your current working directory
 - **cd command:** To navigate through the Linux files and directories
 - **ls command:** lists files and directories within a system
 - **cat command:** It lists, combines, and writes file content to the standard output
 - **cp command:** To copy files or directories and their content
 - **mv command:** To move and rename files and directories
 - **mkdir command:** To create one or multiple directories at once and set permissions for each of them
 - **rmdir command:** To permanently delete an empty directory
 - **rm command:** To delete files within a directory
 - **find command:** To create an empty file or generate and modify a timestamp

Why we use Linux

- Open Source. i.e. its source code is easily available for everyone
- Security:- more secure in comparison to other operating systems such as Windows
- Revive older computer systems:-
- Software Updates:-
- Customization:-
- Various Distributions:-
- Free to use (Low Cost):-
- Large Community Support:-

Merits/quality and Demerits of Linux

- It can be easily accessible to the old computers
- It cannot be made for gaming purpose
- It is not easy to understand for those who are new to Linux
- It is mostly used by the programmers
- It is used for both commercial and Personals, but for home purpose, windows is mostly preferred.

Use of Linux in various fields

- Linux is used as an embedded OS for a variety of applications, including
 - Household appliances,
 - Automotive entertainment systems and
 - Network file system appliances.

Commercial use of Linux Operating System

- Adoption of Linux in production environments, rather than being used only by hobbyists, its widely started in the mid-off 1990, for supercomputing purpose.
- Today, Linux systems are used throughout computing, from embedded systems to supercomputers and provide

2. Basics of macOS

- **What is Mac?**

- ‘Mac’ is a simple abbreviation for Macintosh, the line of personal computers designed, manufactured, marketed, and sold by Apple Inc.
- The current Macintosh models are targeted towards home, education, and profession users.
- Macs are known for their elegant design, ease of use, and user experience. Macs continue elegance, power and style.
- Mac OS X is a completely Redesigned implementation of the Macintosh OS based on the BSD UNIX operating system. UNIX is an advanced multi-platform operating system that offers advanced features such as enhanced networking, high performance and security.

2. Basics of macOS

- **Models of Mac OS**

- ‘Apple current Mac product line consists of the following models:
 - Mac mini
 - iMac
 - Mac Oro
 - MacBook
 - MacBook Pro
 - MacBook Air
 - Xserve

2. Basics of macOS

- **Mac OS Version**

- Version 10.0: “Cheetah”
- Version 10.1: “Puma”
- Version 10.2: “Jaguar”
- Version 10.3: “Panther”
- Version 10.4: “Tiger”
- Version 10.5: “Leopard”
- Version 10.6: ”Snow Leopard”
- Version 10.7: ”Lion”
- Version 10.8: “Mountain Lion”

2. Basics of macOS

- Why Mac OS?
 - Apple is not supporting Mac OS 9 anymore. OS X is the future of Apple.
 - Protective Memory
 - When an OS 9 application crashes, the operating system may become usable, and you may need to reboot the computer.
 - In OS X, when an application crashes, just that application crashes. All your other application that running are still ok.
 - Multi-user

2. Basics of macOS

- **Why Mac OS?**
 - The current Macintosh models are powered by processors(CPU) from Intel.
 - In the past, Apple relied on other firms to provide the chips for Macs as Apple historically used competing processors such as the PowerPC.
 - In June 2005, Apple CEO Steve Jobs announced that Apple would transition the Macintosh line from PowerPC processor to Intel Processor
 - The transition was completed on Aug 7, 2006.

2. Basics of macOS

- **Mac Vs. Window (Differences)**
 - **Mouse button**
 - The Mac mouse has single button whereas a Windows has two bottoms. To display contextual menu in a Mac environment, control, + click the on an object, Unless your system has an “Apple Mouse“, in which case you have a right – option.
 - **Keyboard shortcut.**
 - Most keyboard shortcuts are the same on the Mac as in Windows. However, substitute the Command key [clover leaf] for the Ctrl key, and option key for Alt key.
 - **Menu bars**:- there is one menu bar across the top of the screen in Mac. In Windows, there's separate menus in every top of windows.
 - **Force quit**:- If PC freezes up, you will see the turning rainbow pinwheel . 1st try to quite currently working application. To do this, click anywhere on the desktop and choose → Force Quit.

2. Basics of macOS

- **Common Mac Desktop Icons**

Your desktop by default should have a panel on the bottom of the screen called the Dock.

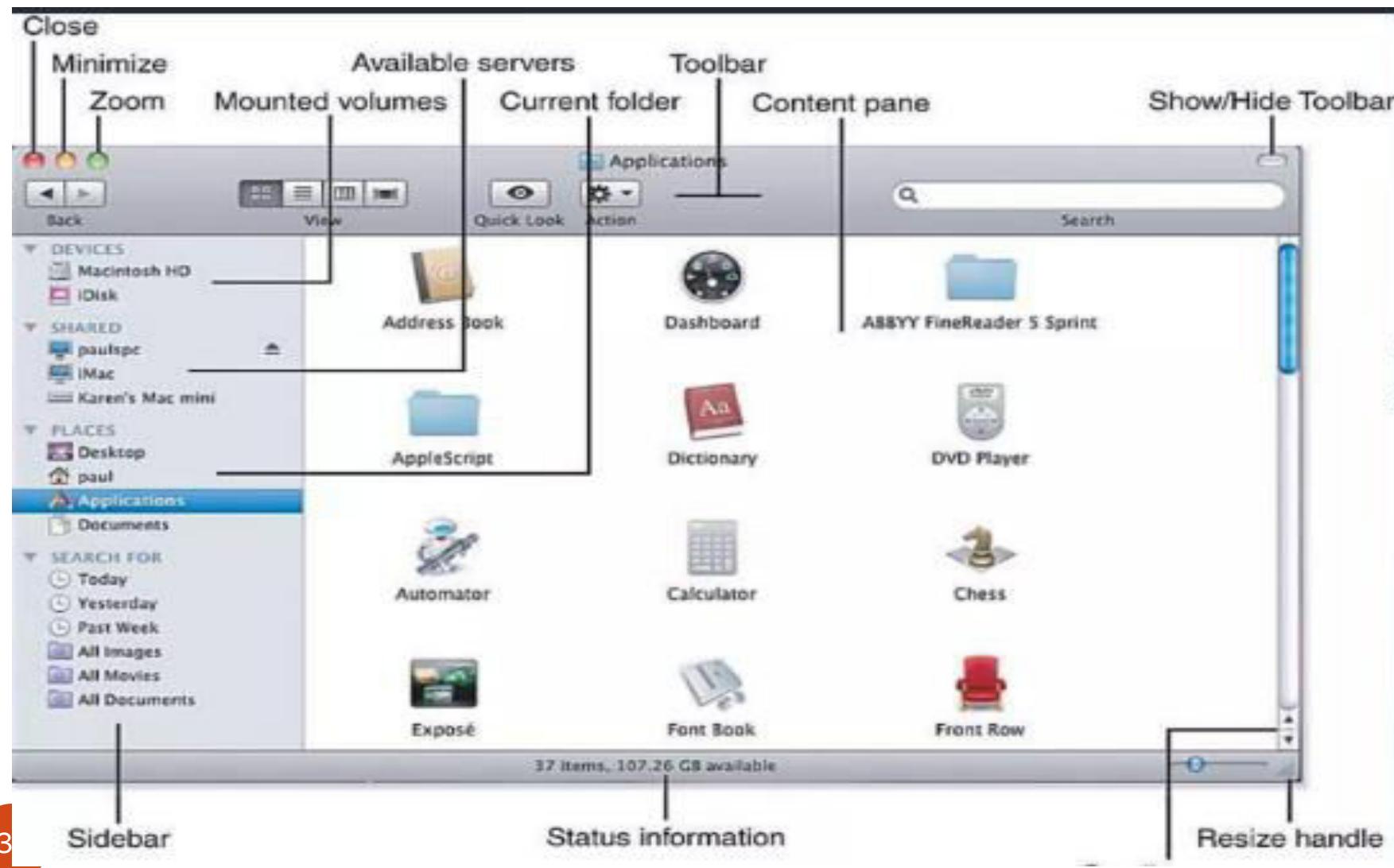


The icons in the Dock represent the different software packages on the computer.

- Roll over each icon to reveal its name.
- Click on an icon to launch a program.
- You know that an application is active or “running” if there is a white dot below the application’s icon.

2. Basics of macOS

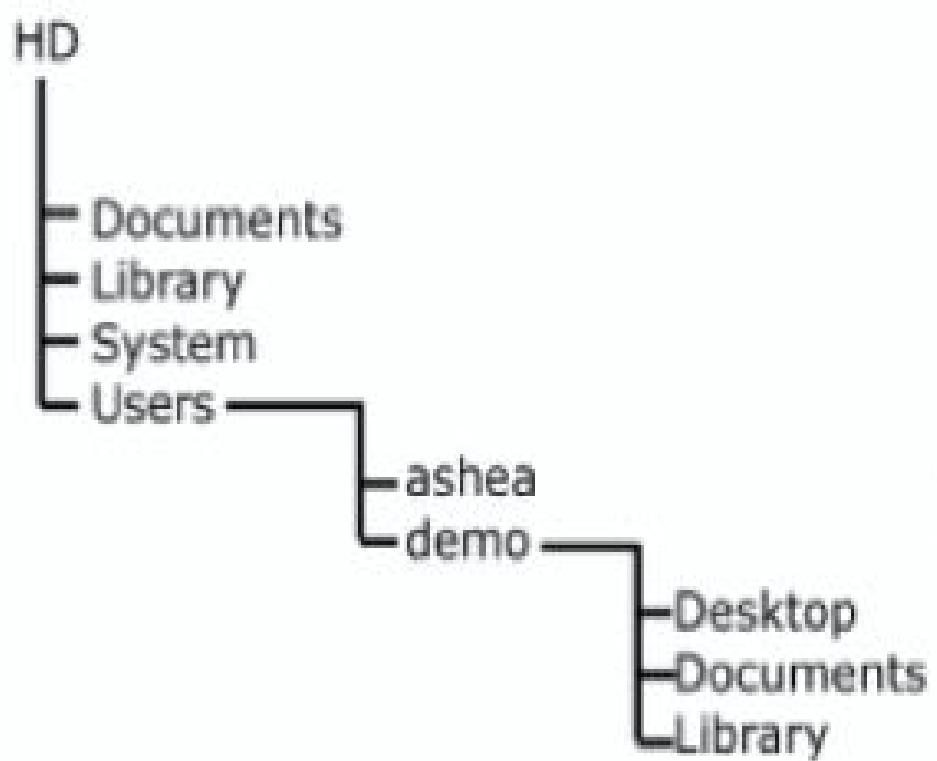
- Windows interface and Desktop Icons of Mac



2. Basics of macOS

- **File and Folders in Mac**

- File should be stored in your user folder
- Folders include in your user folder includes, Desktop, Documents, Library



2. Basics of macOS

- Application that come with OS X

- iTunes:
 - Convert CD tracks into MP3 file to store in your computer
 - To listen internet radio stations
 - To Purchase album
- iMovies:
 - Capture digital video from a camcorder
 - Video editing
- iPhotot:
 - Create slideshows, picture albums
- iDVD
 - Create DVDs (requires a Mac with a DVD-R / CD-RW SuperDrive)
- Safari

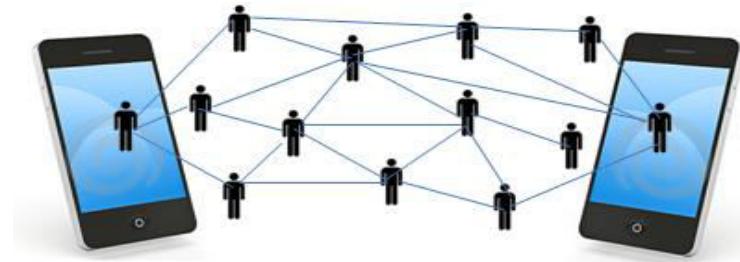
3. Basics of Mobile OS

• **Mobile Software**

- Mobile Software is the software program which is developed specifically to be run on mobile hardware. This is usually the operating system in mobile devices.
- These operating systems provide features such as touchscreen, cellular connectivity, Bluetooth, Wi-Fi, GPS mobile navigation, camera, video camera, speech recognition, voice recorder, music player, near field communication and sensors. The device sensors and other hardware components can be accessed via the OS.



Contd.



• **Communication**

- Mobile Communication refers to the exchange of data and voice using existing wireless networks.
- The data being transferred are the applications including File Transfer (FT), the interconnection between Wide-Area-Networks (WAN), facsimile (fax), electronic mail, access to the internet and the World Wide Web.
- The wireless networks utilized in communication are IR, Bluetooth, W-LANs, Cellular, W-Packet Data networks and satellite communication system.
- It is the mobile communication infrastructure which takes care of seamless and reliable communication between mobile devices.

Wireless Communication Networks

- **personal area network (PAN)**

A wireless telecommunications network for device-to-device connections within a very short range

- **Bluetooth**

A set of telecommunications standards that enables wireless devices to communicate with each other over short distances

Contd.

- **Wireless Local Area Networks and Wi-fi**

- **wireless local area network (WLAN)**

A telecommunications network that enables users to make short-range wireless connections to the Internet or another network

- **Wi-Fi (wireless fidelity)**

The common name used to describe the IEEE 802.11 standard used on most WLANs

- **wireless access point**

An antenna that connects a mobile device to a wired LAN

- **hotspot**

An area or point where a wireless device can make a connection to a wireless local area network (using Wi-Fi)

Contd.

- **WWAN (wireless wide area network) communication bandwidths**
 - **1G** - The first generation of wireless technology, which was analog based
 - **2G** - The second generation of digital wireless technology; accommodates voice and text
 - **2.5G** - An interim wireless technology that can accommodate voice, text, and limited graphics
 - **3G** - The third generation of digital wireless technology; supports rich media such as video
 - **3.5G** - This generation was inserted into the ranks of cell phone generations; it refers to the packet-switched technologies used to achieve higher transmission speeds
 - **4G** - It provides faster display of multimedia
 - **5G** - 5G networks are the next generation of mobile internet connectivity, offering faster speeds and more reliable connections on smartphones and other devices than ever before. Combining cutting-edge network technology and the very latest research, 5G should offer connections that are multitudes faster than current connections, with average download speeds of around 1GBps expected to soon be the norm.

Applications of Mobile Technology

- **Emergencies Services**
- **In companies**
- **Stock Information Collection/Control**
- **Credit Card Verification**
- **Taxi/Truck Dispatch**
- **Electronic Mail/Paging**
- **Mobile Commerce**
- **Banking and Financial Services**
- **Wireless Electronic Payment Systems**
- ▶ Location based Services
- ▶ Mobile Shopping
- ▶ Mobile Entertainment
 - ▶ Mobile games and
 - ▶ Hands-free driving
- ▶ Wireless Telemedicine
- ▶ Other Mobile Computing Services for Consumers
- ▶ Non–Internet Mobile Applications for Consumers

Advantages

- No location constraint: Mobile computing frees the user from being tied to a location and increased bandwidth and speed of transmission makes it possible to work on the move.
- It saves time and enhances productivity with a better return on investment (RoI)
- It provides entertainment, news and information on the move with streaming data, video and audio
- Streamlining of business processes: Mobility has enabled streamlining of business processes, cumbersome emails, paper processing, delays in communication and transmission.
- Newer job opportunities for IT professionals have emerged and IT businesses now have an added service in their portfolio which only will keep growing as per indicative mobile computing trends.

Challenges

- Disconnection
- Low bandwidth
- High bandwidth variability
- Low power and resources
- Security risks
- Wide variety terminals and devices with different capabilities
- Device attributes
- Fit more functionality into single, smaller device

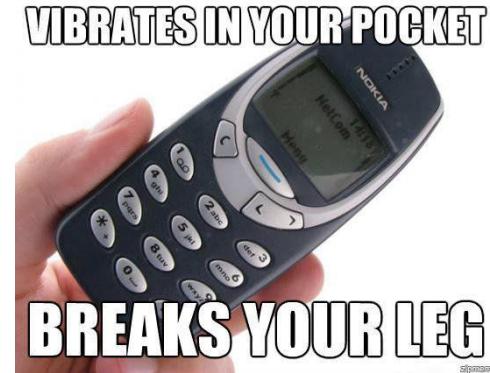
Mobile OS

- A mobile operating system (OS) is software that allows smartphones, tablet PCs and other devices to run applications and programs.
- A mobile OS typically starts up when a device powers on, presenting a screen with icons or tiles that present information and provide application access.
- Mobile operating systems also manage cellular and wireless network connectivity, as well as phone access.
 - Apple iOS
 - Google Android
 - BlackBerry OS
 - Nokia's Symbian
 - Hewlett-Packard's webOS (formerly Palm OS)
 - Microsoft's Windows Phone OS

Traditional Trends

- Relevant to older mobile systems
- Made use of older mobile operating systems such as:
 - Palm OS
 - Psion OS
 - Symbian OS
- Technologies used: Specific to the above operating systems such as C/C++, Java mobile edition, WML etc.

VIBRATES IN YOUR POCKET



BREAKS YOUR LEG

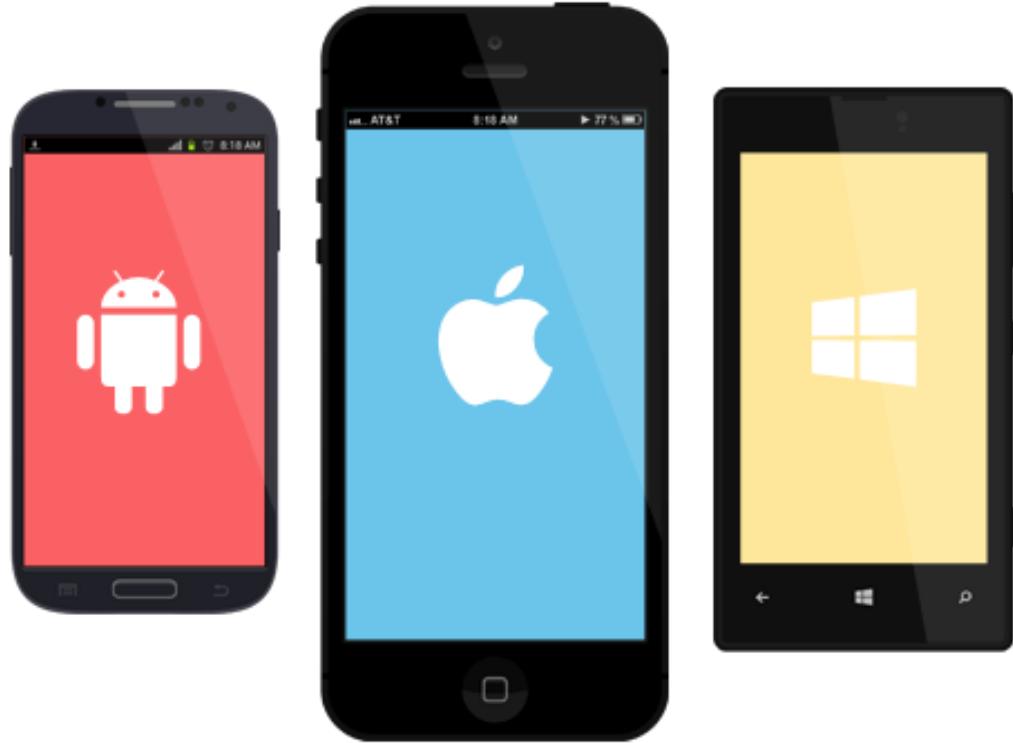


OH Please, I'm
Tsunami Resistant!



Current Trends of Mobile OS

- iOS
- Android
- Windows Phone



Current Trends (Contd..)

- **Android**

- Developed by Google Inc.
- Free and open source
- Uses Linux operating system
- Manufacturer: Oppo, Nokia, Samsung, Huawei, Vivo, Motorola etc.



Current Trends (Contd..)

- **iOS**

- Developed by Apple in June 2007.
- Device Manufacturer: Apple



- **Windows Phone**

- Developed by Microsoft.
- Uses Windows operating system (Windows 8 and above).
- Device Manufacturer: Nokia (formerly), Microsoft



Current Trends (Contd..)

Mobile Apps Platform	Pros	Cons
iOS	<ul style="list-style-type: none">• New features are usually available very quickly.• Less fragmentation arising from upgrades• Excellent graphics	<ul style="list-style-type: none">• Closed platform• Development only on Mac• Duplicating core iOS features is prohibited.• Publishing apps is expensive.
Android	<ul style="list-style-type: none">• Free and open source• Major share of mobile market (81%)• Open content sharing• Publishing apps is easy (only 25\$ fee once)• Development on any platform	<ul style="list-style-type: none">• Fragmentation between different versions of the OS• Graphics are often slower.• Delay in upgrades
Windows Phone	<ul style="list-style-type: none">• Develop once publish anywhere (phone, tablet or laptop).	<ul style="list-style-type: none">• Low take-up of windows phone• Publishing apps is less flexible• Development only on Windows 8 or above.

Current Trends (Contd..)

Mobile Apps Platform	Development Technology
iOS	<ul style="list-style-type: none">• System: MAC• Programming language: Objective C• Development software: Xcode
Android	<ul style="list-style-type: none">• System: Any system• Programming language: Java/ Kotlin• Development software: Android studio
Windows Phone	<ul style="list-style-type: none">• System: Windows• Programming language: C# or C++/ Javascript• Development software: Visual studio
Hybrid (3 into 1)	<ul style="list-style-type: none">• System: Any system• Programming language: Javascript, C#• Development software: PhoneGap, Xamarin

2. File System Management and System Management Tools for Maintenance (preventive)

Objectives

After reading this chapter and completing the exercises you will be able to:

- Explain file system maintenance techniques for different operating systems
- Perform regular file system maintenance by finding and deleting unused files and directories
- Perform disk maintenance that includes defragmenting, relocating files and folders, running disk and file repair utilities, and selecting RAID options
- Set up and perform disk, directory and file backups
- Explain how to install software for best performance
- Tune operating systems for optimal performance

File System Maintenance

- File system maintenance
 - linked to the file structure on a computer
- Basic rules for creating a file structure:
 - manageable number of directories in the root directory
 - OS files in the default directories
- Basic rules for creating a file structure:
 - Different versions of software in their own directories
 - Data files in directories on the basis of their functions
 - Design home directories to match the functions of users in an organization
 - Group files with similar security needs

File System Maintenance (continued)

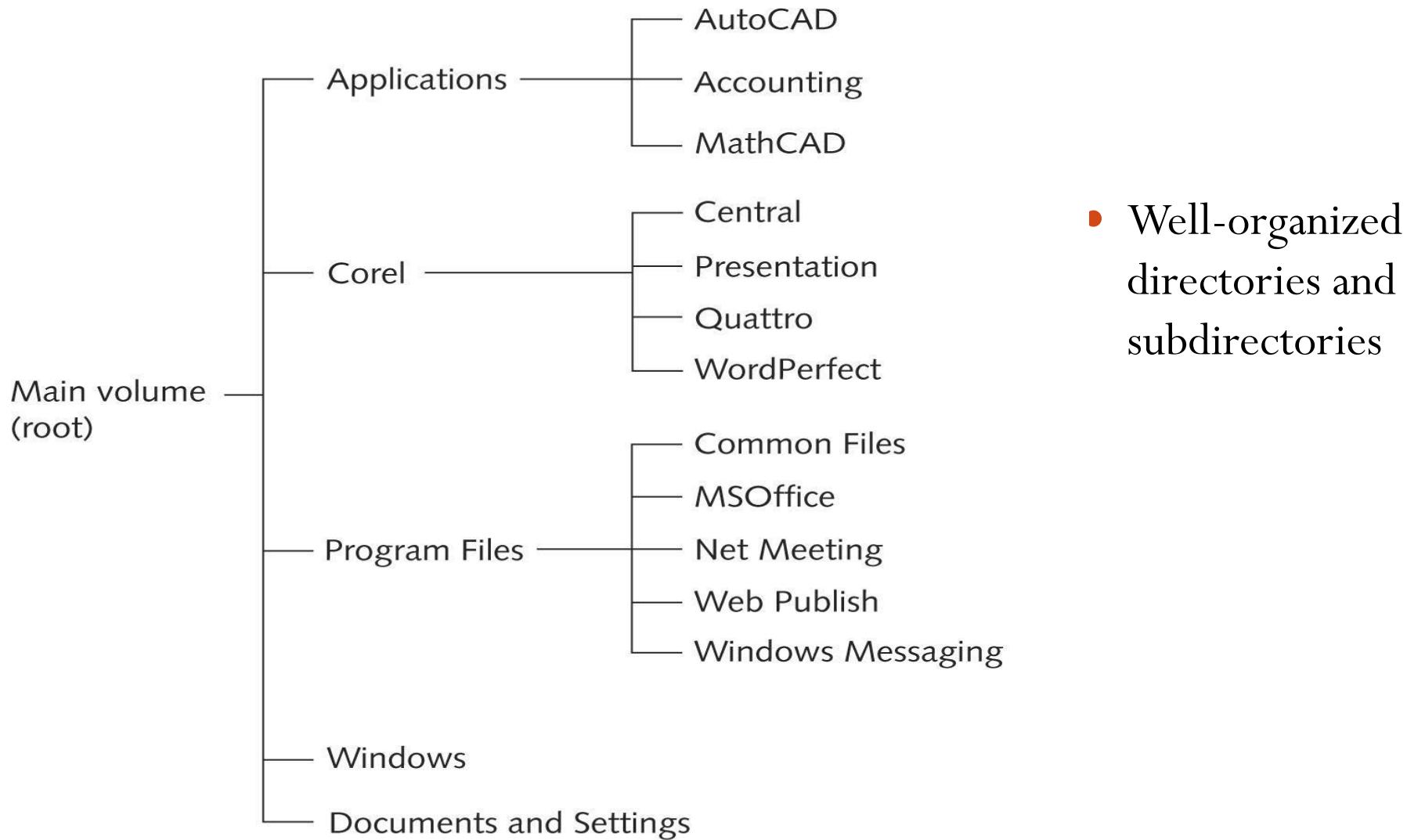


Figure 10-1 Example applications directories and subdirectories

File System Maintenance (continued)

- Example directories: created by the OS,
 - *bin* for user programs and utilities (binary files)
 - *lib* for libraries
 - *usr* for user's files and user programs
 - *var* for files in which the content often varies
 - *tmp* for files used only temporarily
 - *dev* for devices
 - *mnt* for floppy drive, cd-rom drives, etc..

File System Maintenance (continued)

- *etc* for system and configuration files
- *sbin* for user programs and utilities (system binary files)
- *home* for users' home directories
- *proc* for system resource tracking

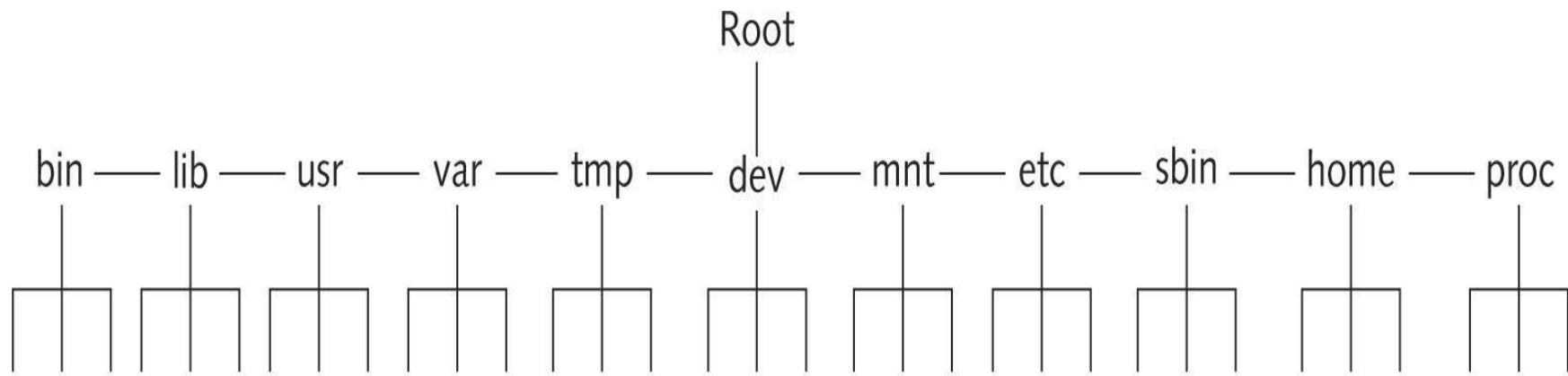


Figure 10-2 A typical UNIX/Linux root directory structure

File System Maintenance (continued)

- Folders in a Mac OS X system:
 - *Applications*
 - *Documents*
 - *Library*
 - *System*
 - *Users*

File System Maintenance (continued)

- User accounts in Mac OS X may contain:
 - *Music*
 - *Movies*
 - *Pictures*
 - *Public*

File System Maintenance (continued)

- OS directories
are usually in
the root

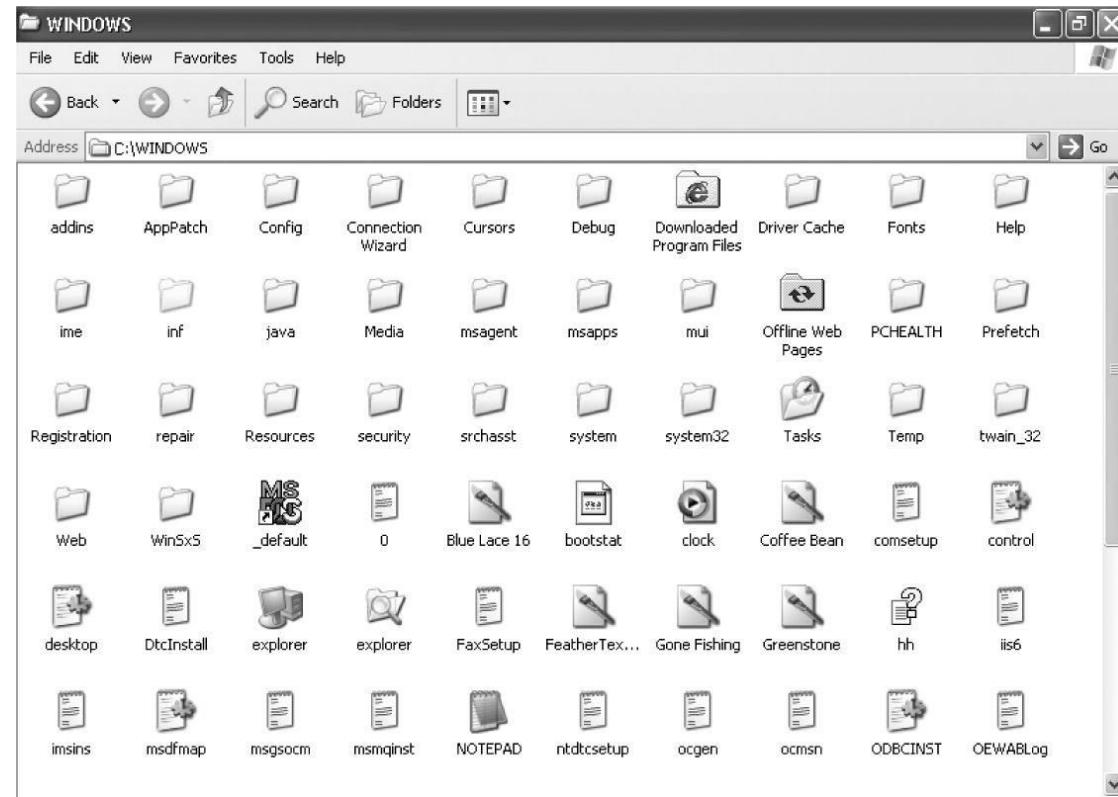


Figure 10-3 Windows XP operating system files in the Windows folder

File System Maintenance (continued)

Table 10-1 Operating System Directory

Operating System	System Directory or Directories from the Root
Mac OS	System (in Mac OS X the system folder contains the system file, and the system folder contains Mac OS 9.x system files for running the classic environment)
NewWare (it's discontinued computer network operating system developed by Novell, Inc)	System
UNIX/Linux	Bin, etc and sbin
Windows 2000 professional and server	winnt
Windows Server 2003	Windows
Windows XP, Home and Professional	Windows
Windows Vista, win-7, 8,10 and 11	Windows

File System Maintenance (continued)

- Advantages to leaving OS files in original directories:
 - easier for others to help with computer problems
 - many operating systems expect OS files to be in default locations

File System Maintenance (continued)

Table 10-2 Examples of Windows-based application software components

File Type	File Extension	File Type	File Extension
Application	.exe	Initialization	.ini
ActiveX Control	.ocx	Installation	.inf
Backup	.bak	Microsoft Common Console Document	.mcs
Bitmap image	.bmp	Microsoft Office Settings File	.pip
Compiled HTML help file	.chm	OLE common control	.ocx
Control Panel extension	.cpl	Precompiled setup information	.pnf
Configuration	.cfg	Screen saver	.scr
Data	.dat	Security catalog	.cat
Device driver	.drv	Temporary file	.tmp
Dynamic link library	.dll	Text	.txt
Help	.hlp	TrueType font	.ttf
Help context	.cnt	Virtual device driver	.vxd

File System Maintenance (continued)

- Vital files are kept in the operating system folder and subfolders
- Home directories on a server often reflect the organizational structure

Finding and Deleting Files

- Solid file structure makes it easier to find and delete unneeded files
- Temporary directory
 - temporary files are not always completely deleted
 - web browsers leave Internet files in this directory

Deleting Temporary Files in Windows

- Temporary files accumulate
 - can be deleted using utilities
 - typically \Temp, \Winnt\System32, and \Winnt\Temp folders for Windows 2000
 - \Temp, \Windows\Temp, and \Windows\System32 folders in Windows XP

Deleting Temporary Files in Windows (continued)

- Files to delete using the Disk Cleanup Tool:
 - Downloaded program files
 - Temporary Internet files
 - Recycle Bin
 - Temporary files
 - WebClient/publisher temporary files
 - Catalog files for the Content Indexer

UNIX/Linux

- Some of the options associated with the *ls* command in Red Hat Enterprise Linux 3.0:
 - *-a* lists all files
 - *-C* formats the listing in columns for easier reading
 - *-d* lists directories
 - *-f* displays files in an unsorted list
 - The remainder are listed on page 498 of the textbook

UNIX/Linux (continued)

- Remove (*rm*) command
 - delete files or folders
 - *-i* or interactive option
 - *-r* or recursive command

UNIX/Linux (continued)

- A file can be found by using the *find* command:
 - *atime* for last accessed time
 - *ctime* for last changed time
 - *mtime* for last modification time
 - *name* for the filename, including the use of wildcard searches
 - see page 500 for other options

UNIX/Linux (continued)

- Disk space allocation
 - *df* command
- UNIX server,
 - administrator can set up disk quotas

Mac OS X

- Delete files to make sure you do not run out of disk space
- Find utility
 - used to find files that are no longer needed
- Sherlock utility
 - to perform complex searches

NetWare

- Manage files and folders
 - NetWare Administrator
 - Network Neighborhood or My Network Places from Windows PCs
 - NetWare Remote Manager
- NetWare files can be salvaged/Suspended until they are purged/removed

Maintaining Large and Small System Disks

- Other disk management tasks:
 - Defragmenting disks
 - Spread the load between multiple disks
 - Using disk utilities to repair damaged files
 - Deploying RAID techniques (Redundant Array of Independent Disks)
 - It is a method of mirroring or striping data on clusters of low-end disk drives

Defragmenting Disks

- Fragmentation
 - Means that unused space develops between files and other information written on a disk
- Defragmentation
 - Process of removing the empty pockets between files and other information on a hard disk drive

Defragmenting Disks (continued)

- Oldest method
 - complete backup and full restore
- Surface analysis
 - before performing restore
- Disk defragmentation tools

Defragmenting Disks (continued)

- Windows 2000/XP/Server 2003 up-to newer version
 - built-in defragmentation utilities
 - enhance performance
- UNIX defragmenting tool
 - *defragfs*
- Mac OS X
 - designed to minimize disk fragmentation

Moving Disk Files to Spread the Load

- Extend the life of disk drives
 - spread files evenly across disks
 - used mainly servers
 - examine files to achieve even loading in terms of activity

Using Disk Utilities to Repair Damaged Files

- Utilities to repair damaged files and file links:
 - **First Aid** in the Mac OS
 - *fsck* and *p-fsck* in UNIX
 - *chkdsk* in Windows

Using Disk Utilities to Repair Damaged Files (continued)

- *chkdsk*
 - */f* switch
 - */v* switch
 - */r* switch
 - */l:size* switch

Deploying RAID Techniques

- RAID
 - used to extend the life of a set of disks
 - using disk striping
- Basic RAID levels:
 - RAID level 0 – RAID level 1
 - RAID level 2 – RAID level 3
 - RAID level 4 – RAID level 5

Deploying RAID Techniques (continued)

- Hardware RAID
 - controlled through a specialized RAID adapter
- Software RAID
 - set up and managed by the server operating system

Making Backups

- **Binary backup**
 - backs up the *disk contents* in binary format (byte level)
 - simple to perform
 - includes everything on the disk
 - cannot restore individual files or directories
- **Full file-by-file backup**
 - disk contents are backed up as individual directories and files
- **Differential backup**
 - backs up all files that have an archive attribute but does not remove the archive attribute
- **Incremental backup**
 - backs up all files that have the archive attribute and removes the attribute

Windows Backups (continued)

- Backup utility options:
 - Normal backup (full file-by-file backup)
 - Incremental backup
 - Differential backup
 - Daily backup for files that changed on the same day as the backup
 - Copy backup that is performed only on specified files

UNIX/Linux

- *Volcopy*
 - not available in Red Hat Enterprise Linux 3.0
 - binary backup that creates a mirror image
- *Volcopy*
 - write to one or multiple tapes
- *dump* utility
 - in Red Hat Enterprise Linux 3.0
 - used for full or partial file-by-file backups
 - all files, files that have changed by date, or files that have changed after the previous backup

NetWare

- Storage Management System (SMS)
 - to create backups
 - three NetWare Loadable Modules (NLMs) are loaded at the server console

Mac OS X

- ES-Backup
 - download latest version from Apple
- Apple's backup service
- Third-party vendors

Tuning/Adjusting the Operating System

- Slow workstations and servers
 - cumulative impact on network
 - poor network performance may workstations and servers that cannot keep up with the network
- Ways to *tune/adjust* operating systems
 - tuning virtual memory
 - installing operating system updates and patches
 - tuning for optimal network communications

Tuning Virtual Memory

- Virtual memory
 - disk storage used when there is not enough RAM
- Paging or swap file (using virtual memory)
 - area where information is swapped back and forth from RAM to disk and from disk to RAM
- Mac OS X
 - no option for turning on virtual memory because it is always enabled
- UNIX/Linux (installed by default, but you can install as follows)
 - use the *vmstat* utility → `sudo apt-get install sysstat`
 - use *iostat* to track disk activity → `sudo apt install sysstat -y`

Installing Operating System Updates and Patches

- Keep OS tuned
 - installing operating system updates and patches
 - Windows Update for Windows OS
 - Red Hat Network Alert Notification Tool for Red Hat Enterprise Linux 3.0
 - AppleCare Help Desk Support and AppleCare Protection Plan for Macs
 - Novell Product Updates

Tuning for Network Communications

- Check computers
 - periodically to make sure that the connectivity is optimized
- NIC drivers
 - also, check periodically for updated drivers
- Protocol tuning
 - check which protocols are configured
 - eliminate those that are no longer used
 - Windows enables you to specify the order to handle protocols
 - set protocol binding order so that the most frequently used protocol is handled first

Testing Network Connectivity

- Internet Control Message Protocol (ICMP)
 - used for network error reporting
 - to determine if there are network problems
- Ping utility
 - poll another network device
 - statistics on the network connection

Summary

- Maintaining an operating system is important
- Regularly find and delete unused files
- Defragment disks, move files to relatively unused disks, find and repair disk problems, and set up RAID
- Make regular backups

Summary (continued)

- Backups are vital
- Make sure the software is compatible with the computer hardware and operating system
- Periodically tune the operating system
- Adjust paging for better performance
- Keep current with OS patches and updates

To be continue on →
on Practical Sessions



Technical and Vocational Training Institute (TVTI)
Faculty of Electrical/Electronics & Information and Communication
Technology Department of Information Technology

Course Title: Computer Maintenance

Chapter – 3:

Computer Hardware

Maintenance

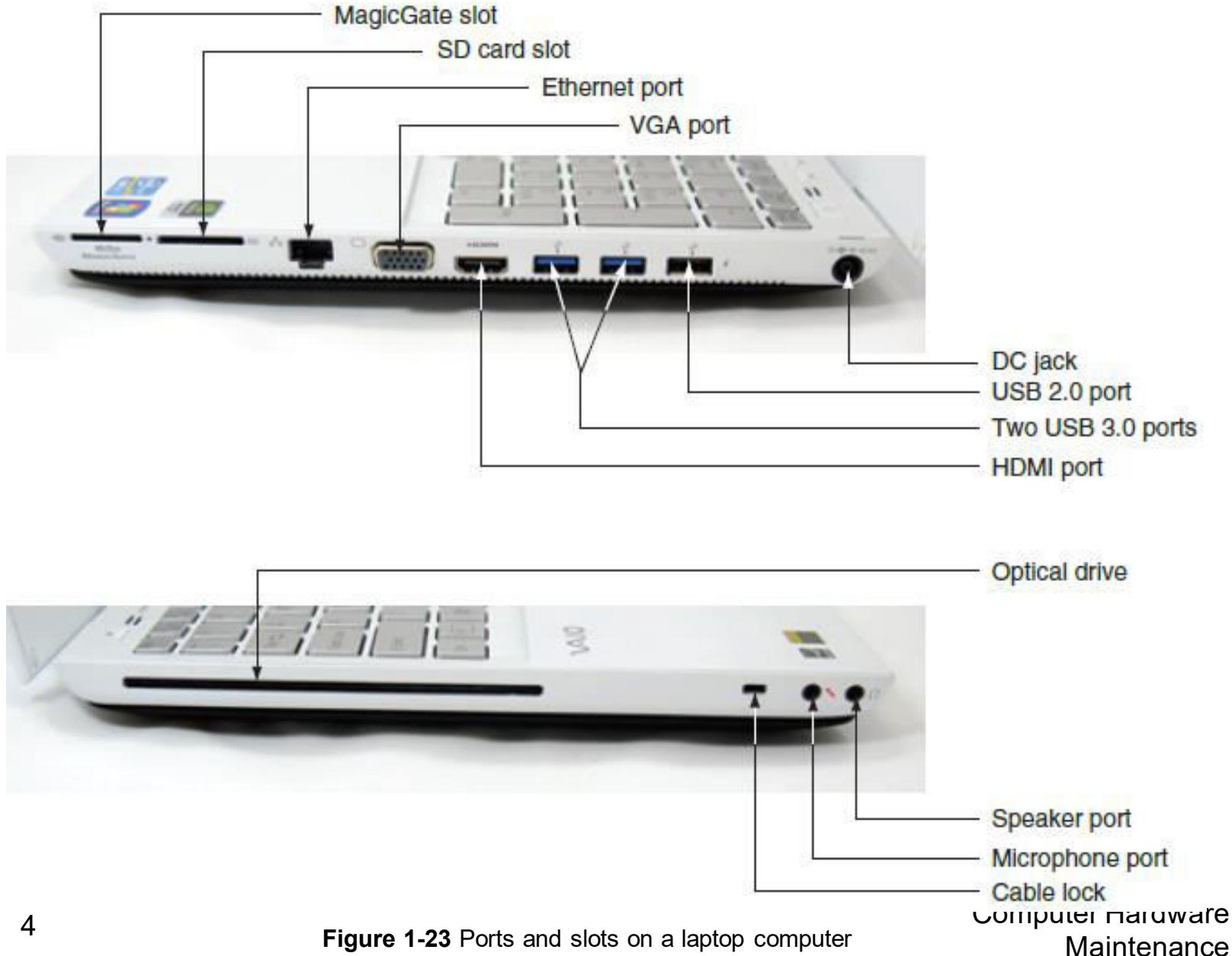
Chapter 3 – Contents (Continued)

1. Identifying hardware components of Desktop PC (covered chapter 1)
2. Identifying hardware components of Laptop
3. BIOS and Beep Sounds
4. Troubleshooting Hardware components of Desktop.
5. Troubleshooting Hardware components of Laptop
6. Troubleshooting hardware components of Mobile devices

3.2 Identifying hardware components of Laptop

- Laptop (notebook): portable computer
 - Variation of a laptop is a netbook
 - Smaller and has less features than laptop
 - Comparing laptops to desktop computers
 - Use the same technology as desktops
 - Smaller, portable, and use less power
 - Replacement parts cost more than desktops
 - Laptops offer a variety of ports and slots

First Look at Laptop Computers



Laptop Computers Command Ports

- Ports common to laptops include:
 - USB, FireWire, network, dial-up modem, audio, and video ports
- Most laptops include slots for flash memory cards
- When a laptop is missing a port or slot, you can use a USB dongle to provide the port or slot
 - Examples:
 - *USB to RJ-45* dongle to connect to a wired network
 - *USB to Wi-Fi dongle* to connect to a wireless network

First Look at Laptop Computers



Figure 1-25 USB to RJ-45 dongle provides a network port to connect to a wired network



Figure 1-26 This USB to Wi-Fi adapter plugs into a USB port to connect to a local wireless network

Special Keys, Buttons, and Input Devices on a Laptop

- Button or switches might be above the keyboard
 - Most of the same settings that these buttons control may also be changed using Windows tools
 - Some settings might be:
 - Volume
 - Keyboard backlight
 - Touch pad on or off
 - Screen brightness and screen orientation
 - Dual displays
 - Bluetooth or Wi-Fi
 - Media options
 - GPS on or off

ExpressCard Slots

- Most peripheral devices on today's laptops use a USB port to connect to a laptop
- Before USB, laptops offered ExpressCard slots
 - Sometimes called PCMCIA cards
- ExpressCard matches PCI Express and USB 2.0
 - Two sizes: ExpressCard/34 and ExpressCard/54
 - Not backward compatible
 - Hot-pluggable, hot-swappable, and supports autoconfiguration

Express Card Slots

- Windows services for ExpressCard
 - Socket service establishes communication between the card and the laptop
 - Card service provides the device driver to interface with the card after the socket is created
- Removing card from ExpressCard slot
 - Use the Safely Remove Hardware icon in the notification area to stop one card before inserting another
 - Proceed to eject the card

Docking Stations

- Some laptops have a connector called a docking port
- A docking station provides ports to allow a laptop to easily connect to a full-sized monitor, keyboard, AC power adapter, and other peripheral devices
- To use a docking station:
 - Plug all peripherals into docking station
 - Connect laptop to the station
 - No software needed

Laptop Internal Components



Laptop Internal Components

- List of important components:
 - Battery pack
 - Hard drive
 - CPU, heat sink, and fan
 - Memory
 - Wireless card
 - System board
 - Optical drive

What's Inside an All-in-One Computer

- All-in-one computer: uses a mix of components sized for a desktop and a laptop
 - For some components, you'll need to buy replacements from the manufacturer because they are most likely proprietary
 - See the service manual for specific directions about replacing parts

What's Inside an All-in-One Computer

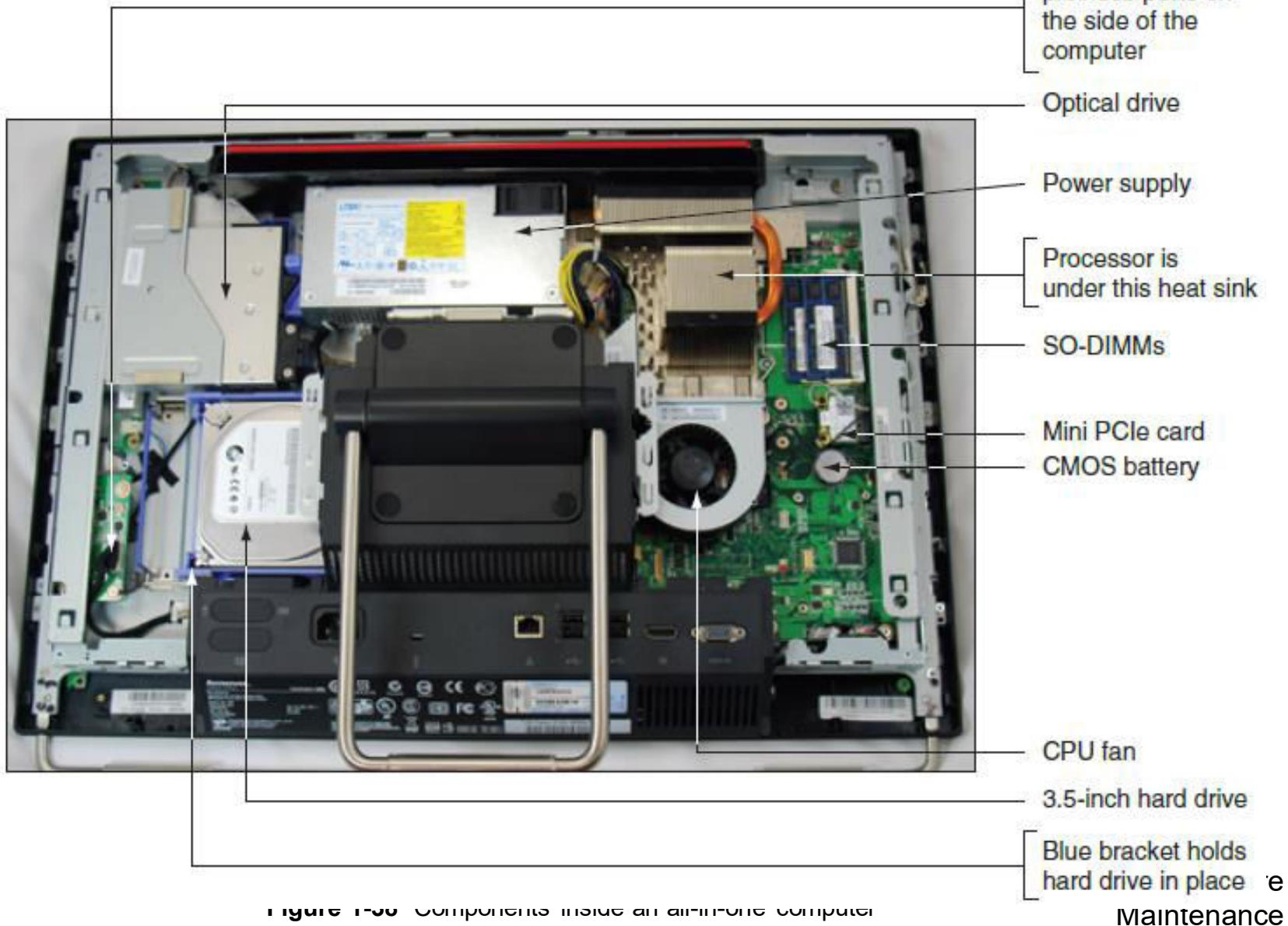


Figure 1-30 Components inside an all-in-one computer

Maintaining Laptops and Mobile Devices

- **General guidelines:**

- Do not touch LCD panel with sharp objects
- Do not pick up or hold by the lid
- Use Original Equipment Manufacturer (OEM) recommended battery packs
- Do not tightly pack in a suitcase – use carrying case
- Do not move while hard drive is being accessed
- Do not put close to appliances generating strong magnetic field
- Always use passwords to protect your laptop when connected to a public network or if device is stolen

Maintaining Laptops and Mobile Devices

- **General guidelines (cont'd):**
 - Keep notebook at room temperature
 - Keep away from smoke, water, dust
 - Do not power up and down unnecessarily
 - Do not run it while it is in the case, resting on pillow or covered by a blanket
 - Protect notebook against ESD
 - Remove CD/DVD or USB flash drives before traveling
 - Take precautions if notebook gets wet
 - Keep current backups of important data

Maintaining Laptops and Mobile Devices

- **Cleaning tips:**
 - Clean LCD panel with a soft dry cloth
 - Use compressed air
 - To clean keyboard, track ball, and touch pad
 - To blow out air vents
 - Remove keyboard if keys are sticking and then blow air under keys
 - Use contact cleaner
 - Remove battery and clean battery connections

Mobile Device Hardware

- A smart phone is a cell phone with added capabilities
 - Ability to send/receive text messages with photos, video, or other multimedia content
 - Web browsing
 - Manage email
 - Play games
 - Take photos and video
 - Use a variety of apps

Mobile Device Hardware

- **Basic hardware**
 - Touch Screen
 - Processing Units
 - RAM, ROM, and Memory Card
- **Connectivity**
 - Network
 - Bluetooth
 - USB
- **Sensors**
 - Proximity Sensor
 - Accelerometer
 - Gyroscope

Mobile Device Hardware

- Touch Screen, Types

1. **Resistive Touch Screen**

- Composed of two flexible sheets coated with a resistive material.
- When contacts is made to the surface of the touchscreen, the two sheets are pressed together.
- Two sheets there are horizontal and vertical lines that when pushed together, register the precise location.
- **Pros:**
 - The screens are usually inexpensive
 - It can be easily operated with any pointing devices
 - They are much more accurate than capacitive touch screens
 - They are easy to use and are more reliable
- **Cons:**
 - Multi touch support not available
 - These are highly sensitive to scratches
 - Poor visibility in sunlight

Mobile Device Hardware

- Touch Screen, Types

2. Capacitive Touch Screen

- Consists of an insulator such as glass, coated with a transparent conductor such as indium tin oxide
- Human body is also an electrical conductor.
- Touching the surface of the screen result in a distortion of the screen's electrostatic field.
- **Pros:**
 - Multi touch supports available
 - Good visibility by dirt and moisture glossy looks
- **Cons:**
 - Humidity must be at least 5% to achieve capacitive effect
 - Expensive than resistive touch screen
 - Doesn't work with pointed objects

Mobile Device Hardware

- **Touch Screen, Resolution and size**

- The size of the screen which is measured diagonally across the face screen
- Measured by inches
- Most common resolution
 - iPhone 3.5-inch
 - HTC 4-inch
 - Ranges from (3.0 to 4.5) inches
- It is the number of distinct pixels in each dimension that can be displayed
- Represented by physical number of columns and rows of pixels creating the display (e.g. 240X320)
- More Pixels == More Realistic Screen.
- DPI the number of ‘dots’ or pixels per each inch.
- Eye detects the up to 300 DPI.
- As programmer you concern about resolution NOT Screen size.

Mobile Device Hardware

- **Microprocessor**

- Mobile microprocessors must be small and consume little power
- Size can be solved with System-on-a-Chip configuration
- Sleep mode during longer pauses (requires support from the OS and possibly from the applications).
- System-on-a-chip is (CPU, GPU, ROM, RAM, Radio, External interface)

Mobile Device Hardware

- **RAM, ROM, and Memory Card**
 - **ROM:** where the OS (Firm Ware) of the mobile installed, it can be modified (system update), and size range from (512MB to 1.5GB)
 - **RAM:** read/write from/to any address, fast, loses data when powered off, and size range from (128MB to 1GB and more), important for Apps programmers.
 - Storage uses Flash Memory to store data permanently into two types.
 - On chip flash memory as (N8 16GB and iPhone 32GB).
 - Extension by using SD cards(mini and micro SD).
 - Notice on chip flash memory in NOT a RAM

Mobile Device Hardware

- Other mobile devices replaceable
 - E-readers
 - Smart cameras
 - Subscriber Identity Module (SIM)
- Wearable technology devices
 - Smart watches, wristbands, arm bands, eyeglasses, headsets, and clothing

Connection Types

- Some ways a mobile device connects to outside world:
 - Wi-Fi local wireless network and cellular network
 - Bluetooth and Infrared
 - Near Field Communication (NFC)
 - Wired connection
 - Tethering and mobile hotspots

Connection Types

- A mobile device can use the following to sense its position:
 - Gyroscope or accelerometer
 - Motion and position sensing device
 - Helps to adjust screen orientation
 - Used by games to sense device movement
 - GPS
 - Mobile devices might contain a GPS receiver
 - Routinely reports its position to the owner of the OS
 - Geo-tracking: possible for companies to track device's whereabouts

Mobile Sensors

- **Proximity Sensor**
 - A sensor able to detect the presence of nearby objects
 - Emits an electromagnetic or electrostatic field and looks for change in the field or return signal,
 - Used for auto turn-off
 - May used in further application
- **Accelerometer**
 - Is use for measuring vibrations
 - Sense movement in only one direction, so true 3D position sensing must use three.
 - Used in all smart phone and device like Wii Remote
 - First introduced by Apple in iPhone
- **Gyroscope**
 - It is a device for measuring or maintaining orientation.
 - Three degrees of rotational freedom
 - Introduced by Apple in iPhone is

Mobile Device Accessories

- Examples of accessories:
 - Wireless keyboards
 - Speakers
 - Ear buds
 - Headsets
 - Game pads
 - Docking stations
 - Printers
 - USB adapters
 - Credit card readers

Field-Serviceable Parts for Mobile Devices

- There are few field-replaceable unit (FRU) in mobile devices
- It is possible to replace screens in some mobile devices
 - A support technician is not generally expected to do this
- SIM cards and batteries can be replaced

Tools Used By a Computer Hardware Technician

- **Essential tools**
 - ESD strap (ground bracelet)
 - Flat-head screwdriver
 - Phillips-head or cross-head screwdriver
 - Torx screwdriver set (size T15)
 - Insulated tweezers
 - Extractor
 - OS recovery CD or DVD
- Many other non-essential tools exists
- Use a toolbox

Tools Used By a Computer Hardware Technician



Figure 1-52 Tools used by IT support technicians when maintaining, repairing, or upgrading computers

Post Diagnostic Cards

- Post Diagnostic Cards
 - Helps discover, report computer errors and conflicts at power-on self test (POST)
 - Tests performed by startup UEFI/BIOS

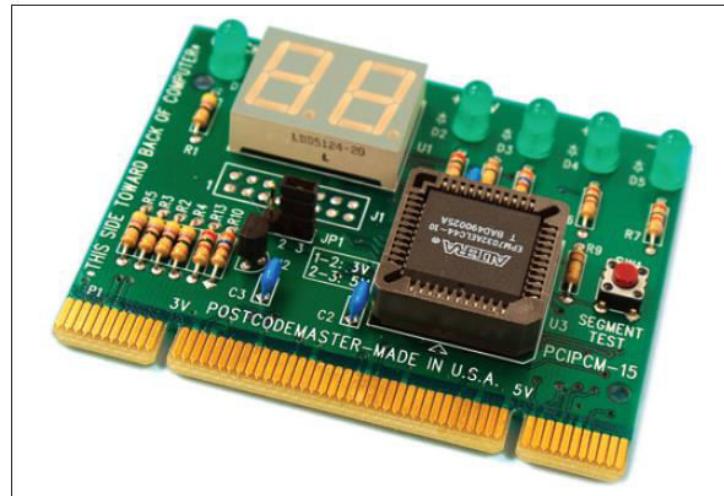


Figure 1-56 Post Code Master diagnostic card by Microsystems Developments, Inc. installs in a PCI slot

Post Diagnostic Cards

- **Firmware** – programs and data stored on the motherboard
- Two types of firmware may be used:
 - BIOS (basic input/output system) contains:
 - System BIOS
 - Startup BIOS
 - BIOS setup
 - UEFI (Unified Extensible Firmware Interface)
 - More robust and secure than BIOS
 - Can assure boot is secure and no rogue OS hijacks the system

Power Supply Tester

- Power Supply Tester
 - Measures output of each power supply connector

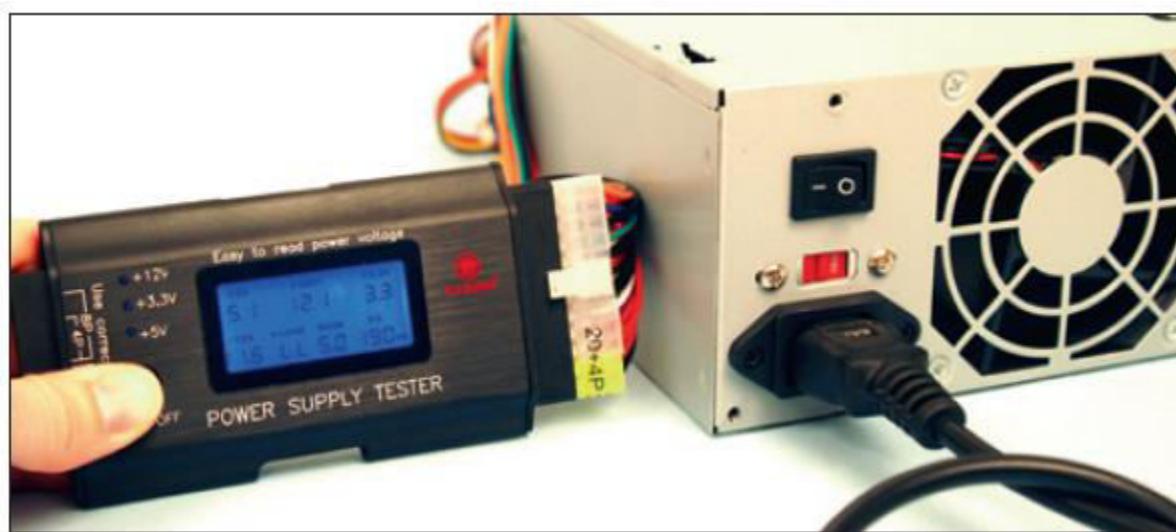


Figure 1-57 Use a power supply tester to test the output of each power connector on a power supply

Multimeter

- Multimeter
 - Measures several characteristics of electricity in a variety of devices

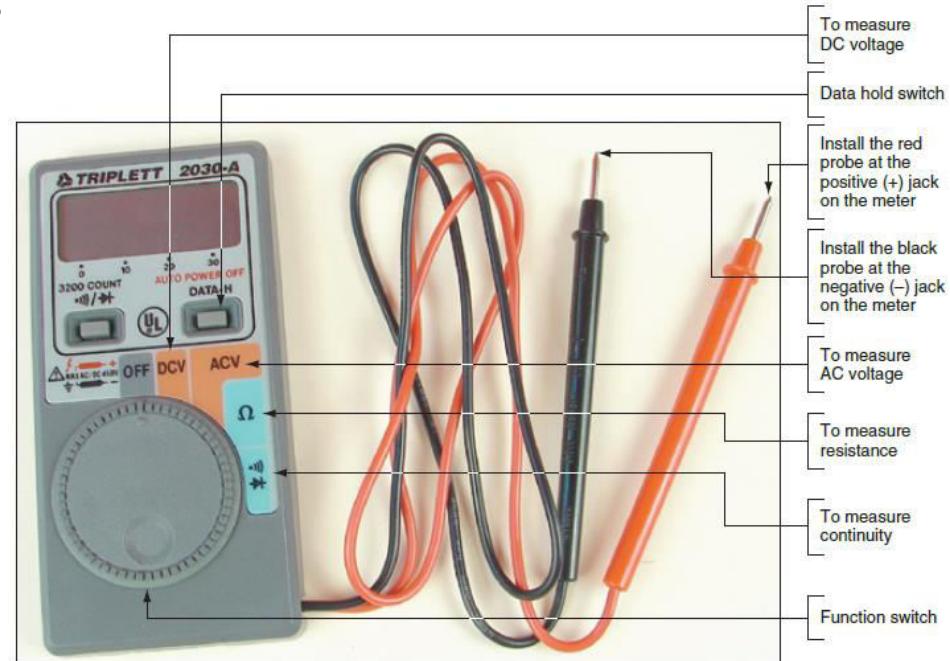


Figure 1-58 This digital multimeter can be set to measure voltage, resistance, or continuity

Loopback Plugs

- Loopback plug
 - Used to test a port in a computer or other device to make sure the port is working
 - May also test the throughput or speed of port



Figure 1-59 A loopback plug testing a network port and network cable

3.3 BIOS and Beep Sounds

- Bios Beep Codes and Setup
 - When the computer is booted, the basic input/output system (BIOS) performs a basic hardware check.
 - This check is called a power-on self-test (POST).
- The POST checks whether the computer hardware is operating correctly.
 - If a device is malfunctioning, an error or a beep code alerts the technician of the problem.
 - Typically, a single beep means that the computer is functioning properly.
- If there is a hardware problem, a error m blank screen might appear at bootup, and the computer emits a series of beeps.
- Each BIOS manufacturer uses different codes to indicate hardware problems.

3.3 BIOS and Beep Sounds

- The beep sound comes out of a small speaker on the motherboard.
- When your computer beeps, it means that an error has occurred in the hardware.
- BIOS recognizes internal errors and sends signals in the form of beep sounds, indicating the location of the problem in the hardware.
- Every BIOS has a different beep sound codes.
BIOS Manufacturer AMI (American Megatrends) developed for Personal Computer BIOS and award signal different codes for similar errors



3.3 BIOS and Beep Sounds

- The Table below shows a **AMI Bios chart of beep codes**. The beep codes for your computer might be different, & motherboard documentation to get the beep codes for your computer.

Beep Code	Meaning	Cause
1 Beeps (No Video)	Memory Refresh Failure	Bad Memory
2 Beeps	Memory Parity failure	Bad Memory
3 Beeps	Base 64 mem failure	Bad Memory
4 Beeps	Timer not operational	Bad motherboard
5 Beeps	Processor error	Bad processor
6 Beeps	Keyboard Controller A20 failure/error	Bad CPU or Motherboard
7 Beeps	Processor Exception	Bad processor
8 Beeps	Video Memory error	Bad Video card or memory
9 Beeps	ROM checksum error	Bad BIOS
10 Beeps	CMOS checksum error	Bad Motherboard
11 Beeps	Cache memory bad	Bad CPU or motherboard
1 Long, 3 short beeps	Conventional/Extended memory failure	Bad Graphic card/Memory
1 long 8 short beeps	Display/Retrace failure	Bad Video card

3.3 BIOS and Beep Sounds

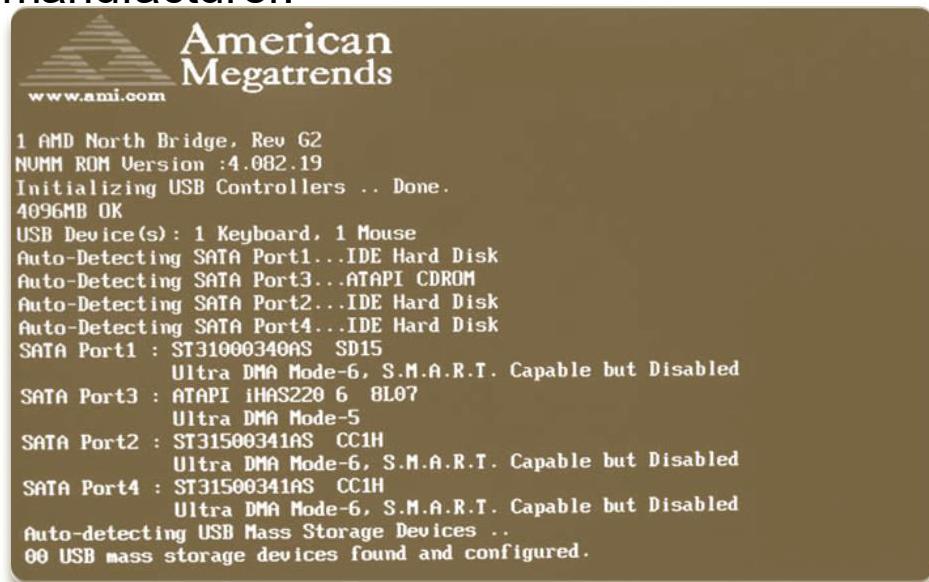
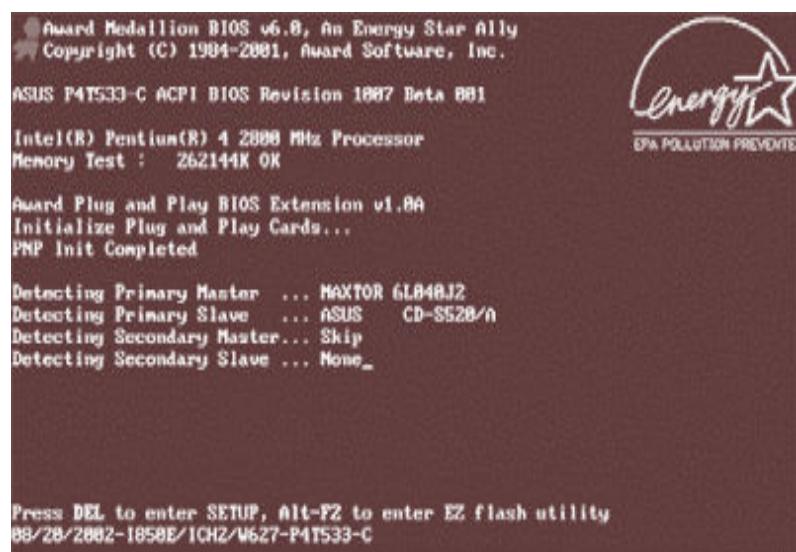
- The Table below shows a **IBM Bios chart of beep codes.**

Beep Code	Meaning
No beeps	No Power, Loose Card, or short
1 Short Beeps	Normal POST, Computer is OK
2 short Beeps	POST error, review screen for error code
Continuous Beep	No Power, Loose Card, or short
Repeating Short Beep	No Power, Loose Card, or short
1 Long and 1 Short Beep	Motherboard issue
1 Long and 2 Short Beep	Video(Mono/CGA Display Circuitry) issue
1 Long and 3 Short Beep	Video (EGA) Display circuitry
3 Long Beeps	Keyboard or Keyboard card error
1 beep, Black or Incorrect Display	Video Display Circuit
11 Beeps	Cache memory bad
1 Long, 3 short beeps	Conventional/Extended memory failure
1 long 8 short beeps	Display/Retrace failure

3.3 POST, BIOS and Beep Sounds

- **POST Card**

- When troubleshooting a computer problem when no video is available, you can use a POST card.
- A POST card is installed in a port on the motherboard, such as PCI or PCIe. When the computer is started, and errors are encountered, the computer issues a code that is displayed on the POST card.
- This code is used to diagnose the cause of the problem through the motherboard, BIOS, or POST card manufacturer.



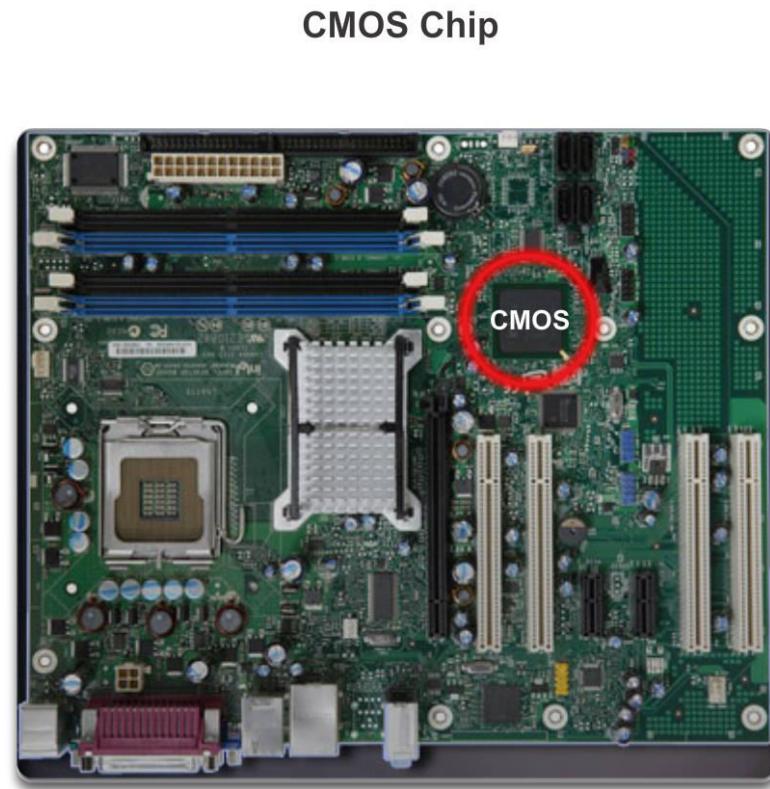
3.3 POST, BIOS and Beep Sounds

- **POST Error Message Code:**
- POST is the Power-On Self Test which your computer performs when you turn it on and/or re-boot. Below is listed what POST checks:
 - 100 Series: Motherboard checks
 - 200 Series: Memory chip checks
 - 300 Series: Keyboard checks
 - 400 Series: Monochrome monitor checks
 - 500 Series: Color monitor (CGA) checks
 - 600 Series: Floppy Disk Drive checks
 - 700 Series: Math Co-processor checks
 - 900-1000 Series: Parallel Port Adapter Checks
 - 1100-1200 Series: Serial Port Adapter Checks
 - 1300 Series: Game Port Adapter Checks
 - 1400 Series: Printer Checks
 - 1700 Series: Hard Disk/Disk Controller Checks

3.3 POST, BIOS and Beep Sounds

- **BIOS Setup**

- The BIOS contains a setup program to configure settings for the hardware devices.
- The configuration data is saved to a memory chip called a Complementary Metal Oxide Semiconductor (CMOS).
- CMOS is maintained by the battery in the computer.
 - If the battery dies, the BIOS setup configuration data is lost.
 - If this occurs, replace the battery and reconfigure the BIOS settings that do not use the default settings.



3.3 POST, BIOS and Beep Sounds

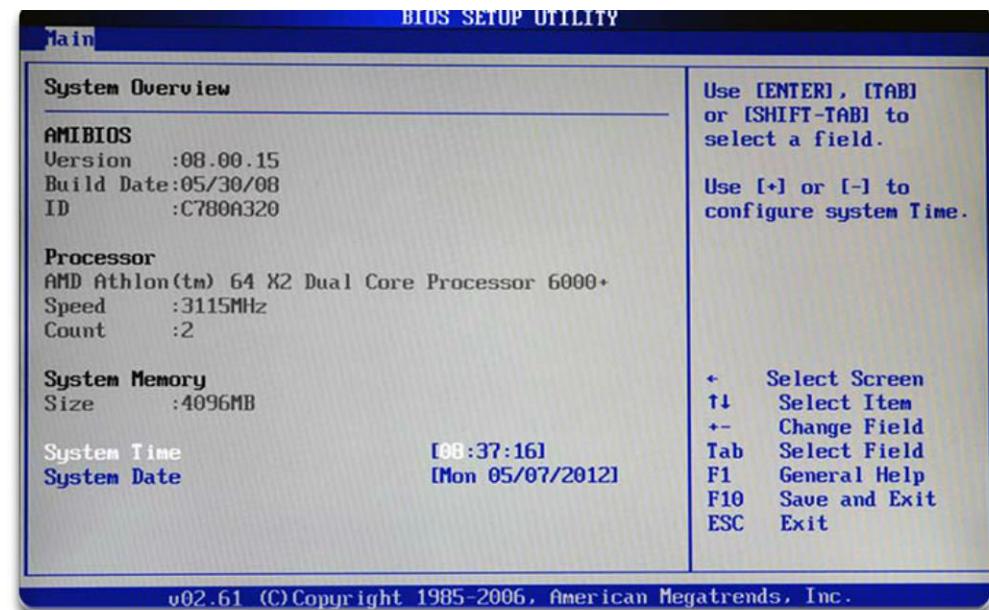
• BIOS Setup

- The modern motherboards use nonvolatile memory to store BIOS configuration settings, and this is no need electric power, it uses a CMOS battery to keep the correct time and date in the clock
- To enter the BIOS setup program, you press the proper key or key sequence during POST (commonly F2)
- These are some common BIOS setup menu options:
 - Main - Basic system configuration
 - Boot - Boot device options and boot order
 - Security – Security settings
 - Power – Advanced power management configurations
 - JUSTw00t! - Advanced voltage and clock settings
 - Exit - BIOS exit
 - options and loading default settings

3.3 POST, BIOS and Beep Sounds

• BIOS Components

- Common component information items that are displayed in the BIOS:
 - **CPU** - Displays the CPU manufacturer and speed. The number of installed processors is also displayed.
 - **RAM** - Displays the RAM manufacturer and speed. The number of slots and which slots the RAM modules are installed in might also be displayed.
 - **Hard Drive** - Displays the manufacturer, size, and type of the hard drives. The type and number of hard disk controllers might also be displayed.
 - **Optical Drive** - Displays the manufacturer and type of optical drives.



3.3 POST, BIOS and Beep Sounds

• BIOS Configuration

- Another function of the BIOS setup program is to customize specific aspects of the computer hardware to fit individual needs.
- The features that can be customized are determined by the BIOS manufacturer and version. Before making changes to the BIOS, it is important to have a clear understanding of how the changes can affect the computer. Incorrect settings can have an adverse effect.
 - **Time and Date**- BIOS has a System Time field and a System Date field to set the system clock.
 - **Clock Speed**- Some BIOS setup programs allow you to change the CPU clock speed. Reducing the CPU clock speed makes the computer run slower and cooler
 - **Disabling Devices**- BIOS settings to disable devices that are not needed
 - **Boot Order** – an order list of device, that PC is allowed to boot
 - **Virtualization** – allow computer run multiple OS

3.3 POST, BIOS and Beep Sounds

- **BIOS Security Configuration**
- It supports many different security features to protect BIOS settings and data on the hard drive, and also help recover the computer if it is stolen.
- There are several common security features found in the BIOS.
- **BIOS passwords** – Passwords allow different levels of access to the BIOS settings, as shown in the figure.
 - **Supervisor Password** - This password can access all user-access passwords and all BIOS screens and settings.
 - **User Password** – This password becomes available after the Supervisor Password is enabled. Use this password to define the level of access to users.
- These are some common levels of user access:
 - **Full Access** - All screens and settings are available, except the supervisor password setting.
 - **Limited** - Changes can be made to certain settings only, for example, the time and date.
 - **View Only** - All screens are available, but no settings can be changed.
 - **No Access** - No access is provided to the BIOS setup utility.

3.3 POST, BIOS and Beep Sounds

- **BIOS** Hardware Diagnostics and Monitoring
 - The BIOS built-in hardware monitoring features are useful for collecting information and monitoring the activity of the hardware connected to the motherboard.
 - The type and number of *monitoring features varies by motherboard model*.
 - Use the hardware monitoring page to view **temperatures, fan speeds, voltages**, and other items.
 - The type and number of monitoring features varies by motherboard model. Use the hardware monitoring page to view the
 - Temperatures,
 - Fan speeds,
 - voltages, and other items.

3.3 POST, BIOS and Beep Sounds

- **Temperature**
 - Motherboards have heat sensors under the CPU to monitor heat sensitive hardware.
 - This sensor monitors the temperature of the CPU and might increase the speed of the CPU fan to cool the CPU if it becomes too hot.
- **Fan Speed**
 - Fan speeds are monitored by the BIOS.
 - These are some common CPU fan speed profiles:
 - **Standard** - The fan automatically adjusts depending on the temperature of the CPU, case, power supply, or other hardware.
 - **Turbo** - Maximum fan speed.
 - **Silent** - Minimizes the fan speed to decrease fan noise.
 - **Manual** - The user can assign fan speed control settings.
- **Voltages**
 - You can monitor the voltage of the CPU or the voltage regulators on the motherboard.
 - If you find that voltages are not at or near the correct amount, make sure that the power supply is operating properly.
- **Clock and Bus Speeds**
- **Intrusion Detection**

3.3 POST, BIOS and Beep Sounds

- **Clock and Bus Speeds**
 - In some BIOS setups, you can monitor the speed of the CPU&bus.
 - Incorrect bus speeds can cause increased heat within the CPU and connected hardware, or cause adapter cards and RAM to malfunction.
- **Intrusion Detection**
 - Some computer cases have a switch that triggers when a computer case is opened.
 - You can set the BIOS to record when the switch is triggered so that the owner can tell if the case has been tampered with.
- **Built-in Diagnostics**
 - If you notice a problem with a device connected to the system or a basic function, such as a fan or temperature and voltage control, you might be able to use built-in system diagnostics to determine where the problem is.
- **These are some common built-in diagnostics:**
 - **Start test** - Checks the main components
 - **Hard drive test** - Checks the hard drive for damaged areas.
 - **Memory test** - Checks the memory modules to make sure that they are working properly.
 - **Battery test** - Checks that the battery is functioning properly.

3.4. Troubleshooting Hardware components of Desktop.

- **Troubleshooting** is
 - The process of figuring out how to solve a computer problem.
 - Even with the most updated software and hardware, occasionally computers can malfunction.
- In order to solve a problem, you must figure out which part of the system is malfunctioning.
- You will need to check each component of the computer, unless it is obvious where the problem is coming from.
- ***Isolating the problem*** will help you solve the problem quickly.
- Knowing how to solve these problems with a shortcut perhaps using only a few keys on the keyboard can save time and effort.
- Backing up your important computer files to another source will ensure that if your problem cannot be corrected, you will still have a safe copy of your information.

3.4. Troubleshooting Hardware components of Desktop.

- **Basic Troubleshooting Steps**

1. Close open programs and windows you are not currently using.
2. Make sure all of your cords are connected properly.
3. Try to repeat the sequence of commands you performed before the problem occurred. See if this causes the same response by your computer.
4. Press the F1 key to access the Help window. You can search for a solution to your problem once the Help window appears.
5. If there is an error message, record the full message for future reference.
6. Restart your computer to see if it clears the problem. To restart your computer, open the start window and select the Restart button instead of the Log Off button.
7. If restarting the computer does not clear the problem, shut down the computer and then start it back up again.
8. If the issue is still not resolved, check the common technology issues below or call your system administrator.

3.4. Troubleshooting Hardware components of Desktop.

- **Common Technology Issues**
- some of the most commonly encountered technology issues
 - The printer is not working.
 - The computer is frozen. A program is not responding.
 - The keyboard is not working.
 - New hardware or software is working incorrectly.
 - The mouse is not working.

3.4. Troubleshooting Hardware components

- **Common Solutions for Technology Issues**
- **Issue:** The printer is not working.
 - Check if the printer is turned on. If not, turn it on and try again.
 - Check if the printer has paper. If not, put paper in the paper tray and try printing again.
 - Check if the printer has a paper jam. If so, remove the paper, close the printer, and try printing again.
 - Ensure that all printer cables are properly connected.
 - Turn off the printer and turn on again.
 - Check to see if a new printer driver is needed. Do this by going to the manufacturer's website to search for your printer model and checking for any updated driver
 - other errors are regarding replacements of Tonner, Rollers, RAM, USB card and others.

3.4. Troubleshooting Hardware components

- **Common Solutions for Technology Issues**
- **Issue:** The computer is frozen. A program is not responding.
 - Push the ***Ctrl, Alt, and Delete keys*** at the same time. Then, start the Task Manager, highlight the program's name, and hit the **End Task button**
 - Perform a **hard reboot** by simply ***pressing the on/off button to turn off*** the computer manually. This action should only be done as a last resort if you have an **unresponsive program or critical error**. This process could cause **data loss or corruption**.
 - Once the computer is responding again, run a **virus check**.
- **Issue:** The keyboard is not working.
 - ***Make sure the keyboard is connected*** to the computer. If not, connect it to the computer.
 - If you are using a wireless keyboard, ***try changing the batteries***.
 - If one of the keys on your keyboard gets stuck, turn the computer off and ***clean with a damp cloth***
 - Use the **mouse to restart** the computer.

3.4. Troubleshooting Hardware components

- **Common Solutions for Technology Issues**
- **Issue:** New hardware or software is working incorrectly.
 - Verify your **computer meets the requirements** of the program or utility.
 - **Uninstall** and **install the program**
 - There **could be a conflict with another installed** program and you should contact your system administrator.
- **Issue:** The mouse is not working correctly.
 - Check if the mouse is securely plugged into the computer. If not, plug it in completely.
 - Check to see if the cord has been damaged. If so, the mouse may need replacing.
 - If you are using a cordless mouse, try pushing the connection button on the underside of the mouse to reestablish a connection.
 - **Clean the mouse.**

3.4. Troubleshooting Hardware components

- **Common Solutions for Technology Issues**
- **Issue:** The computer is slow.
 - ***Restart*** your computer
 - ***Empty*** your recycle bin.
 - ***Check your mail files.*** Remove any large attachments and delete unused mail messages and videos take up a lot of space, so consider moving those to an **external drive**.
 - ***Remove temporary*** files from the Internet.
 - Perform a ***disk cleanup***.
 - Run ***defrag***.
 - Run a ***virus scan*** to remove potential viruses that can slow down your computer.

3.5 Troubleshooting Hardware components of Laptop

- **Issues-1:** Computer doesn't turn on at all.

- When you plug the AC adapter into the laptop, there are no lights turning on at all.
- The laptop appears to be completely dead, makes no sounds, no indications of life.

- **Possible problem:**

1. The **AC adapter failed** and the battery has no charge left.
2. In this case test the AC adapter with a voltmeter. If it's dead, replace it with a new one.
3. **DC jack failed** and the motherboard doesn't receive any power from the adapter & replace it.
4. **Motherboard failed.**



3.5 Troubleshooting Hardware components of Laptop

• Issues-2: Screen is blank.

- The laptop turns on, power LED lights up, cooling fan works but nothing appears on the screen.
- The screen is completely black and blank.
- There is no image on the screen at all.

• Possible problem:

- This can be ***memory failure***:- It's possible one of the memory modules failed.
- ***try reseating memory modules*** to make sure they are making good contact with the slot.
- If reseating/replacing memory doesn't help, try removing the ***hard drive, DVD drive, modem, wireless card, keyboard***, etc...



3.5 Troubleshooting Hardware components of Laptop

- **Issues-3:** Laptop turns on and off repeatedly.
 - The laptop turn-on without showing any image on the screen, and
 - After a few seconds it ***turns off by itself.*** Then it ***turns on and off again.***
- **Possible problem:**
 - Most likely this is ***motherboard failure.***
 - You can try ***reseating/replacing memory*** as described in the Issue-2.
 - If it doesn't help, probably the ***motherboard failed.***



3.5 Troubleshooting Hardware components of Laptop

- **Issues-4:** Laptop makes noise while running.

- The laptop **turns on** and **everything works fine**, except it makes some **constant weird grinding or rattling noise**.

- **Possible problem:**

- In most cases this noise is coming from the **cooling fan** or **hard drive**. Take a closer look at the **cooling fan**.
- If the fan doesn't spin but the laptop makes noise, probably it's coming from the **hard drive**.
- **Back up all personal data** as soon as possible and **replace the hard drive**.
- you can also, **remove the hard drive** and **start the laptop**. If the laptop still makes noise, most likely it's **bad fan**.



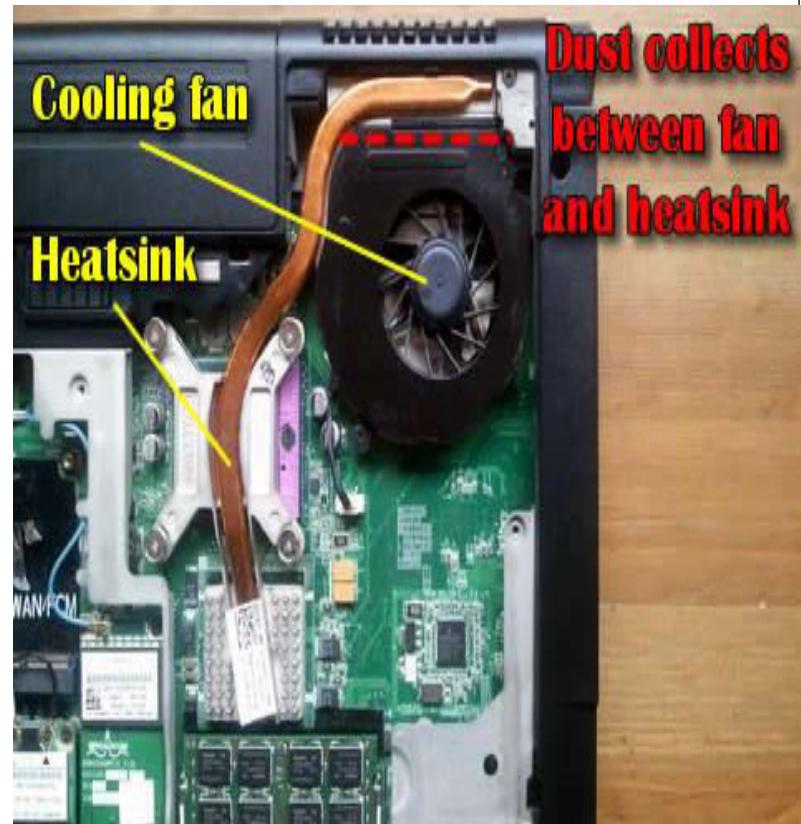
3.5 Troubleshooting Hardware components of Laptop

- **Issues-5:** Laptop shuts down or freezes

- The laptop runs properly but after a while it ***freezes or shuts down without any warning.***
- When it happens, the ***bottom feels hot.*** Also, the ***cooling fan*** runs ***louder than usual.***

- **Possible problem:**

- Most likely this is heat related issue.
- It happens because the fan heat sink is ***clogged with dust*** and the ***processor not cooling down properly.***
- **Cleaning** the fan and heat sink from dust should fix it.



3.5 Troubleshooting Hardware components of Laptop

- **Issues-6: Battery not charging properly**

- The battery stopped charging properly.
- It **doesn't charge at all** or charges only after you adjust the position of AC adapter plug inside the power connector.

- **Possible problem:**

1. **Failed battery.** If it doesn't charge completely try reconnecting the battery first.

- Also, try running the laptop just from **AC adapter** with **battery removed**.
- If it runs fine from AC adapter, most likely it's either **bad battery** or **failed motherboard**. --
→ Try **replacing the battery** first.

2. **Failed DC power connector.** If the battery charges only after you adjust the position of AC adapter tip inside the connector, most likely this the **DC jack failed**



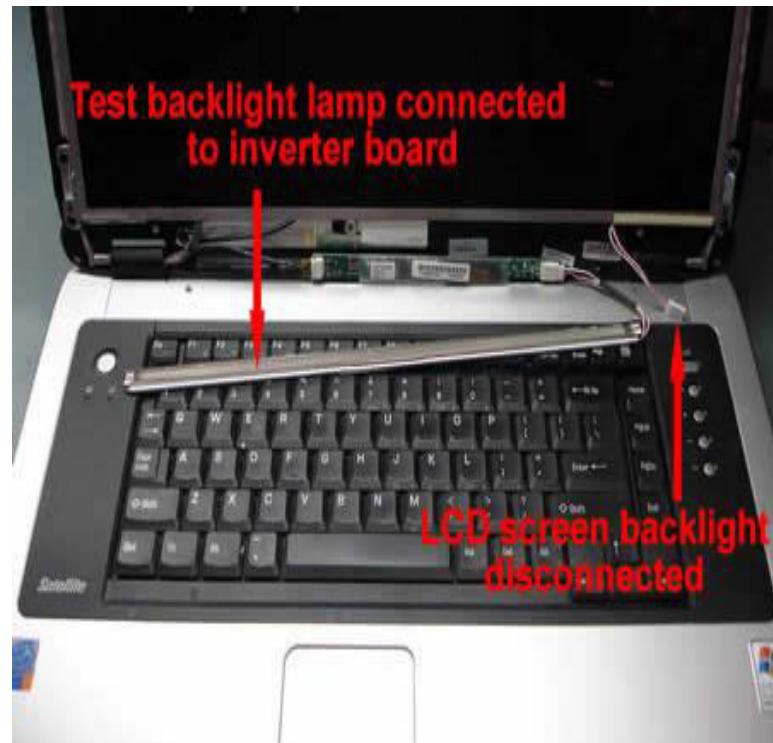
3.5 Troubleshooting Hardware components of Laptop

• Issues-7: Screen light fails

- The laptop starts properly but after a while the **screen light turns off**. The image still appears on the screen but it's **very dark**.
- In some cases, the **screen light never starts** and all you can see is a **very faint image**.

• Possible problem:

- Most likely it's either **failed screen inverter** or **backlight lamp (CCFL) failure**.
- When either one fail, the backlight stops working.
- In order to troubleshoot this, you'll need some **spare parts**: either **new working inverter** or known **good backlight lamp**.



3.5 Troubleshooting Hardware components of Laptop

- **Issues-8:** Strange or garbled image on the screen

- The laptop turns on properly but has a distorted or garbled image on the screen.

- **Possible problem:**

- The **graphics card failed**.
 - First of all, test your laptop with an external **monitor or TV**.
 - If you see the same garbled image on the external screen, most likely the graphics card failed.
- If the problem appears only on the laptop screen, this can be related to one of the following:
 - poor connection between the **video cable** and **motherboard** or **screen**.
 - Also can be failed video cable or screen.



3.5 Troubleshooting Hardware components of Laptop

- **Issues-9: Some keyboard keys stopped working**

- Some keyboard keys do not work **at all** or **type wrong characters**.

- **Possible problem:**

- Most likely the keyboard failed and they are not repairable. You have to [replace the keyboard](#).

- **Issues-10: Keyboard has missing or broken keys**

- A key got separated from the laptop keyboard.

- **Possible problem:**

- If a key separated from the keyboard, it's still possible to fix it.
- If you have many keys missing, probably it makes sense to replace the whole keyboard.



3.5 Troubleshooting Hardware components of Laptop

- **Issues-11:** Repetitive beep sound on startup

- You turn on the laptop but there is **no video on the screen**, & it starts making repetitive beeping sound.
- In some cases you can “**fix**” the problem temporarily if you press on the **keyboard keys**.

- **Possible problem Solution:**

- Most likely you **have stuck keys**. In this case you'll have to [replace the keyboard](#).

- **Issues-12:** Liquid spill

- You **spilled something** on the laptop and it's **stopped working**.

- **Possible problem Solution:**

- Liquid spills are **very dangerous** and **unpredictable**.
- If it happened, turn off the laptop, → remove the battery and → do not use it until all internal parts are inspected for liquid damage.
- It's still possible to make it work again.



3.6 Computer Virus and Anti - Malware

- Viruses will affect your PC in 4 different ways

1. The Boot Sector:

- The boot sector is where your operating system files reside on your floppy or hard disk.
- A virus will go to that location on your disk and corrupt these files (**IO.SYS**, **MSDOS.SYS**, and **COMMAND.COM**) so that your PC will NOT boot up as expected.
- EXAMPLE: the STONED virus.

2. The File Allocation Table:

- The File Allocation Table (FAT) is a list of all the files on your **hard disk**, and where the files are physically located on the disk.
- A virus will corrupt the **FAT** so that you **cannot locate or access your files**.
- EXAMPLE: the CASCADE virus.

3.6 Computer Virus and Anti - Malware

- Viruses will affect your PC in 4 different ways

1. The Boot Sector:

2. The File Allocation Table:

3. The Partition Table:

- The partition table on your HARD DISK tells MS-DOS how big your hard disk is, and what percentage of it is used by MS-DOS.
- A virus can corrupt your partition table, which wipes out ALL of your files in an instant.
- EXAMPLE: the MICHELANGELO virus.

4..COM and .EXE Files:

- Files with these extensions are **EXECUTABLE** files, which perform a specific action.
- A virus can attach itself to one of these kinds of files and corrupt the way it operates.
- EXAMPLE: the 4096 virus.

3.6 Computer Virus and Anti - Malware

- **VIRUS PROTECTION PROGRAM**

- 1. Scan for viruses:**

- A good program should be able to check your **hard disks** and **removable medias** for viruses, as well as the **RAM** of your computer, and detect the presence of a virus in the locations mentioned above.

- 2. Clean up the virus:**

- A good program must be able to get rid/ free of the virus it finds in any of the places mentioned above; otherwise, it's useless.

- 3.. Protect You From Viruses:**

- A good program must have the ability to load a piece of the program into memory at boot-up time, to protect you from getting a virus in the first place.
- This type of program is called a "Terminate-and-Stay-Resident" (TSR) program.

End of Chapter-3

Thank You





Technical and Vocational Training Institute (TVTI)
Faculty of Electrical/Electronics & Information and Communication
Technology Department of Information Technology

Course Title: Computer Maintenance

Chapter – 4:

Printer Maintenance

Printer Types and Features

- Configure, repair, maintain printers
 - Requires knowledge of printer types and features
- Understanding how a printer works
 - Helps in fixing printer problems



Printer Types and Features

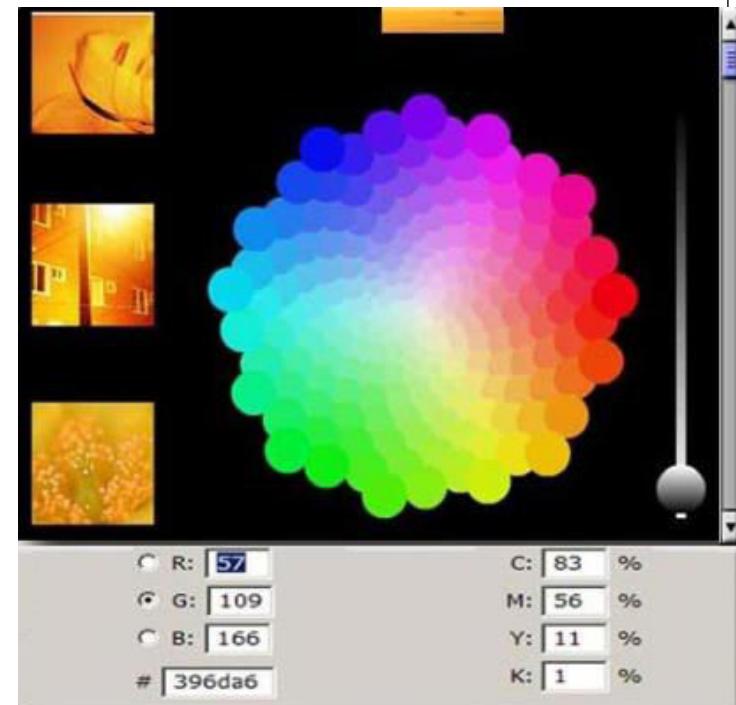
Printer Speed, Quality, and Color

- **Speed and Quality**

- Speed – measured in pages per minute (ppm)
- Quality – measured in dots per inch (dpi)

- **Color**

- Cyan, magenta, and yellow (CMY)
- Black for inkjets is the base or key color



Printer Types and Features

Reliability and Total Cost of Ownership

- Warranty
- Scheduled servicing
- Mean time between failures (MTBF)
- Total cost of ownership (TCO)
 - Initial purchase price
 - Cost of consumable supplies
 - Price per page
 - Pages per month
 - Maintenance costs
 - Warranty costs



Types of Printers

- Major categories:
 - Laser, inkjet (ink dispersion), solid ink, dye sublimation, thermal printers, and impact printers
- Laser printer: electrophotographic printer
 - Uses mechanical, electrical, and optical technologies



Figure 12-1 Okidata C3200n color laser printer
Courtesy: Course Technology/Cengage Learning

Types of Printers

Laser Printer Characteristics

- **Advantages**

- Low cost per page
- High PPM
- High capacity
- High quality
- Fast (uses a laser beam or LEDs to create an image)
- Print comes out dry

- **Disadvantages**

- High initial cost
- Toner cartridges can be expensive



Laser Printer Characteristics



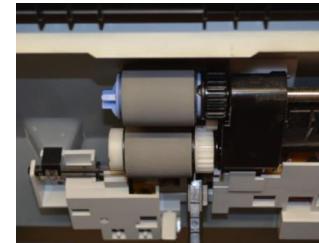
Imaging Drum



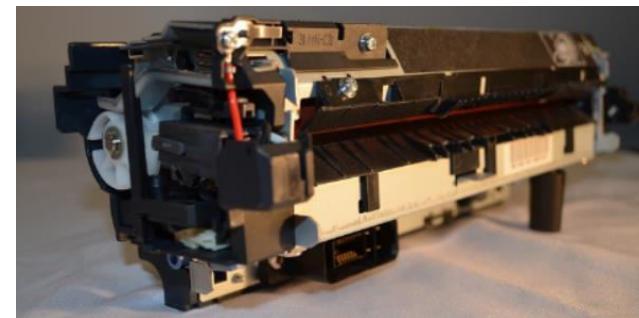
Toner Cartridge



Transfer Roller



Pickup Rollers



Fuser Assembly



Duplexing
Assembly

Types of Printers (cont'd.)

Laser Printer Characteristics

- Electrophotography overview
 - Toner placed on electrically charged rotating drum
 - Toner deposited on paper moving at drum speed
- Six steps in laser printing:
 - **Cleaning:** drum cleaned of residual toner and charge
 - **Conditioning:** drum surface charged to -600 V
 - **Writing:** laser beam writes -100 V image to drum surface
 - **Developing:** toner applied to -100 V areas of the drum
 - **Transferring:** toner drawn off drum and onto paper
 - **Fusing:** heat and pressure fuse toner to paper

Laser Printer Characteristics

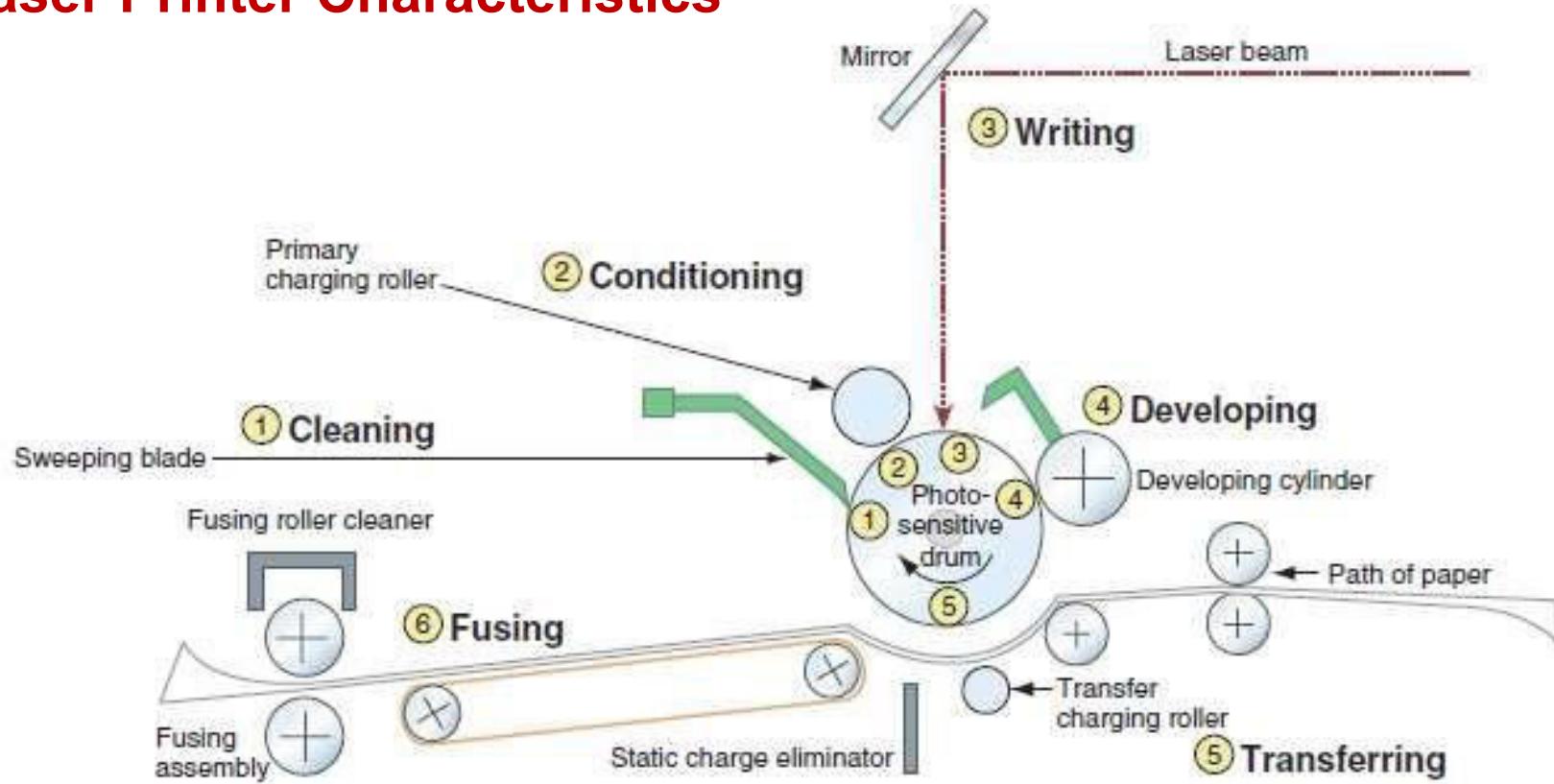


Figure 12-2 The six progressive steps of laser printing
Courtesy: Course Technology/Cengage Learning

Types of Printers (cont'd.)

- First four laser printing steps undergo the most wear
 - Reduce costs by performing steps in removable cartridges
- Color laser printing
 - Writing process repeated four times
- Overview of **inkjet printer technology**
 - Print head moves across paper
 - One line of text created with each pass
 - Ink applied to paper using matrix of small dots
 - Plates with magnetic charge direct path to the page

Types of Printers (cont'd.)

- Comparing inkjet to laser printers:
 - Lower resolution
 - Images smudge on inexpensive paper
 - Usually cost less
- Inkjet printer buying advice:
 - Printer using two or four separate cartridges



Figure 12-4 The ink cartridges of an inkjet printer Courtesy: Course Technology/Cengage Learning

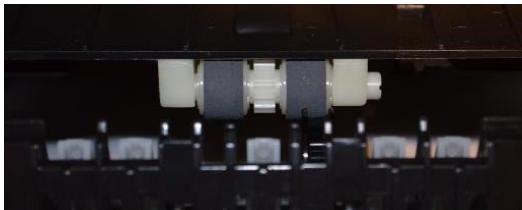
Types of Printers (cont'd.)

Inkjet Printer Characteristics

- Easy to use
- Cheaper than laser printers
- Advantages
 - Low cost
 - High resolution
- Disadvantages
 - Some nozzles prone to clog
 - Cartridges can be expensive
 - Ink can be wet after printing



Inkjet Printer Parts



Roller



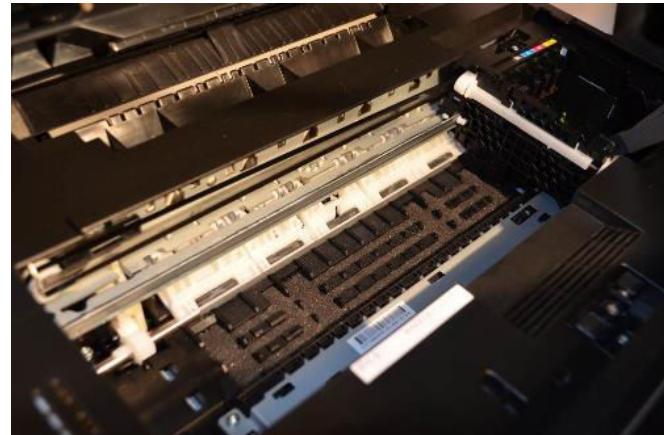
Carriage/Belt



Print Head



Duplexing
Assembly



Feeder



Ink Cartridge/
Paper



Types of Printers (cont'd.)

- **Overview of impact printer technology**
 - Dot matrix printer
 - A print head moves across width of the paper
 - Pins is used to print matrix of dots on the page
 - Pins shoot against a cloth ribbon
 - Ribbon impacts paper and deposits ink
- Dot matrix printer technology advantages:
 - Continuous tractor feed allows event and data logging
 - Can use carbon paper: print multiple copies
 - Extremely durable

Impact Printer Characteristics



- Impact printers – dot matrix and daisy wheel
- Have print heads that strike an inked ribbon with a specific number of pins
 - Higher number of pins means better quality
- **Advantages**
 - Ribbons are less expensive supplies than other types
 - Can use regular paper or continuous feed paper
 - Can print carbon copies
- **Disadvantages**
 - Noisy
 - Graphics are low-resolution
 - Limited color capabilities

Types of Printers (cont'd.)

- Guidelines for maintaining print heads:
 - Keep the printer in a cool, well-ventilated area
 - Do not print over 50 to 75 pages without a cool down

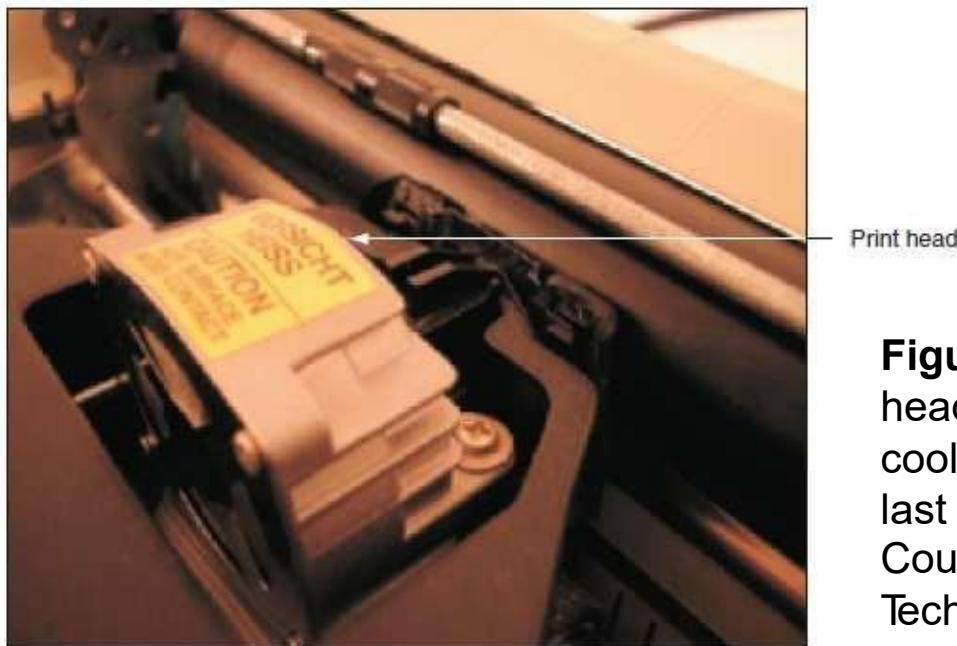


Figure 12-5 Keep the print head of a dot matrix printer as cool as possible so that it will last longer
Courtesy: Course Technology/Cengage Learning

Types of Printers (cont'd.)

- Overview of thermal printer technology
 - Use heat to produce output
 - Wax-based ink heated by heat pins
 - Heat pins melt ink onto paper
- Overview of dye-sublimation printer technology
 - Print head passes over and heats each color film
 - Heated film causes dye to vaporize onto glossy paper
- Overview of solid ink printer technology
 - Ink in solid blocks (color sticks) melted into print head
 - Head jets ink onto paper as it passes by on a drum

Printer Features

- Printer options
 - Extra paper trays, special paper feeders or transparency feeders, staplers, collators, sorters
 - Duplexing: printing on both sides
- Printer rating characteristics
 - Warm-up time (time to print first page)
 - Resolution (measured in dpi or dots per inch)
 - Maximum duty cycle (monthly quota set by warranty)
 - Printing speed (measured in pages per minute)
 - Technology for formatting a page

Printer Features (cont'd.)

- Combination fax machines, copiers, and scanners
- Powering a printer
 - AC power, AC adapter converting power to DC, or battery
- Local printer: connects directly to a computer
 - USB port, parallel port, serial port, wireless connection, IEEE 1394 port, SCSI port, PC Card, ExpressCard connection
- Network printer: uses Ethernet port
 - Connects using switch, hub, router port, or Wi-Fi

Cloud Printing

- Sends a print job to a remote printer somewhere on the network.
- Some printing companies have software that can send print jobs to their closest location.
- Google Cloud Print allows you to connect your printer to the web and you can send something to your own printer no matter where you are located.



Installing and Sharing Printers

- Installing a printer
 - Local printer attached to a PC using a port
 - Network printer connects directly with its NIC
 - Print server controls several network printers
- OS compatible print drivers required
 - CD bundled with the printer
 - Manufacturer's website
 - Windows Vista and XP

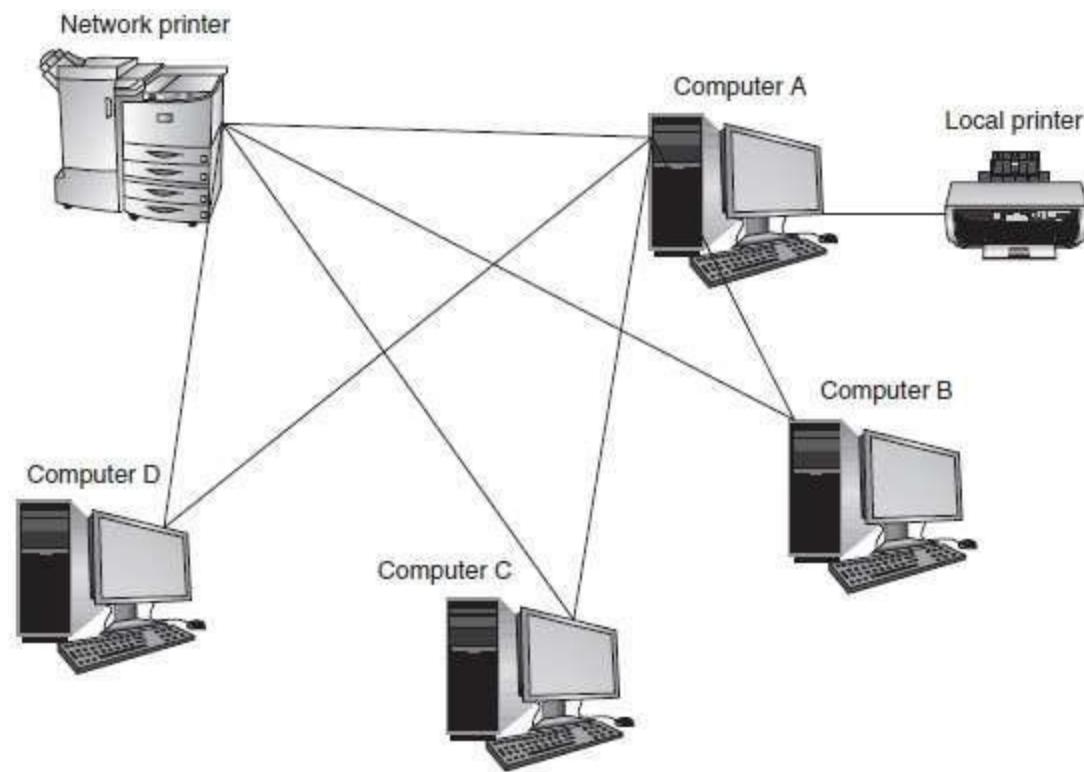


Figure 12-8 A shared local printer and a network printer
Courtesy: Course Technology/Cengage Learning

How to Install a Printer Using windows

- Ways to install a local USB printer
 - Plug in USB printer: Vista installs printer automatically
 - Launch the installation program
- Installing a non-USB local printer or network printer
 - Verify printer on and available
 - Open the Printers window
 - Click Add a printer and select the type of printer
 - Vista searches printers
 - Select from list or point to the port or IP address
 - Change the name of the printer and test

How to Install a Local Printer Using Windows os.

- Installation begins differently depending on port
 - FireWire, USB, PC Card, ExpressCard, wireless
 - Software installation or printer connection order vary
 - Review printer documentation
- Generals steps
 - Run setup program as an administrator
 - Connect the printer to the port when instructed
 - Close New Hardware Found Wizard
 - Make selection for default printer
 - Test the printer

How to Install a Local Printer Using Windows (cont'd.)

- Installing a local printer using an older port
 - SCSI, serial, parallel port: not hot-pluggable
- General steps
 - Plug printer into the port, turn on the printer
 - If installing drivers from manufacturer's program:
 - Launch printer setup program, followed directions
 - If using the Windows installation process:
 - Open Printers and Faxes window, click Add a printer
 - Follow Add Printer Wizard directions
 - Print a test page

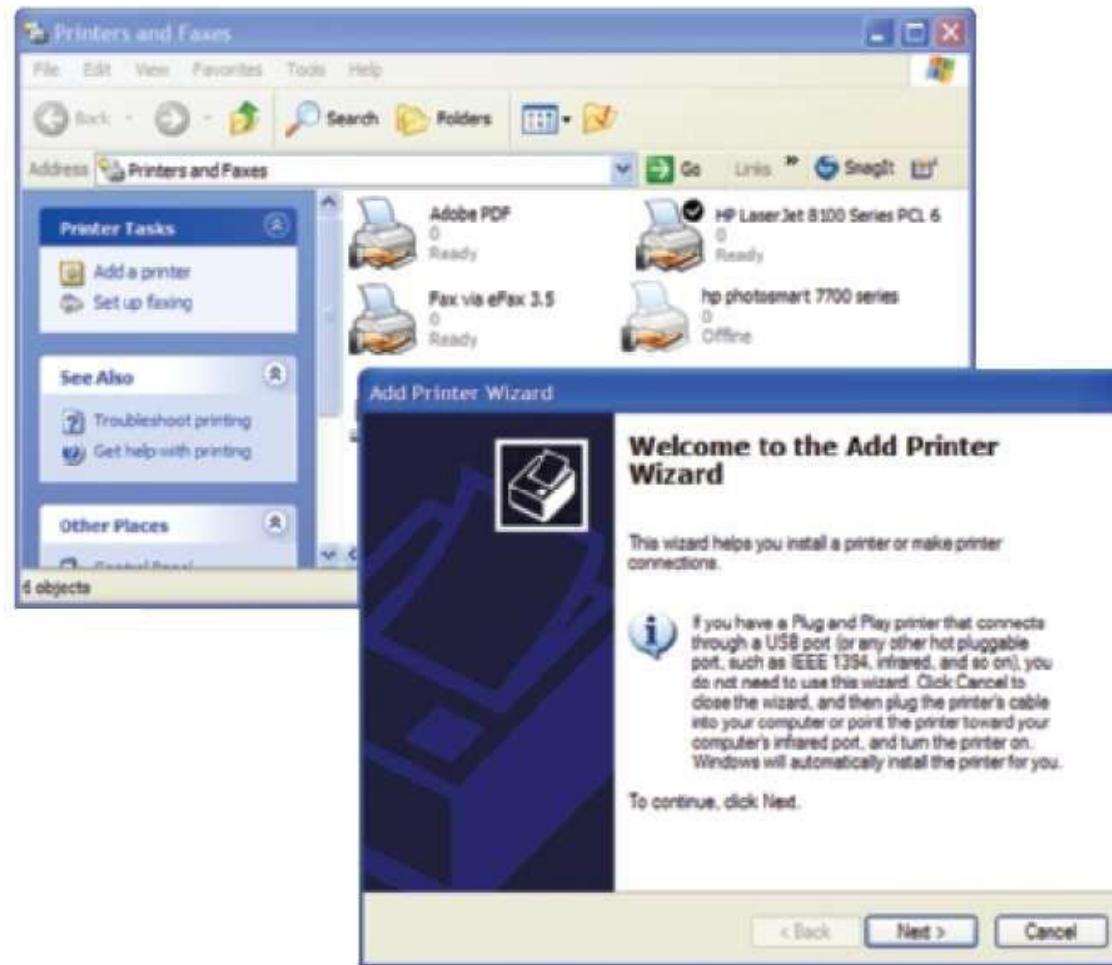


Figure 12-15 Use the Add Printer Wizard to install a printer
Courtesy: Course Technology/Cengage Learning

Steps To Install a Network Printer Using Windows OS

- Follow manufacturer directions
- General steps
 - Open Printers and Faxes window
 - Start the wizard to add a new printer
 - Select option to install a local printer
 - Do not ask Windows to automatically detect printer
 - Choose Create a new port
 - Select Standard TCP/IP Port, Click Next twice
 - Identify the printer on the network
 - Click Have Disk

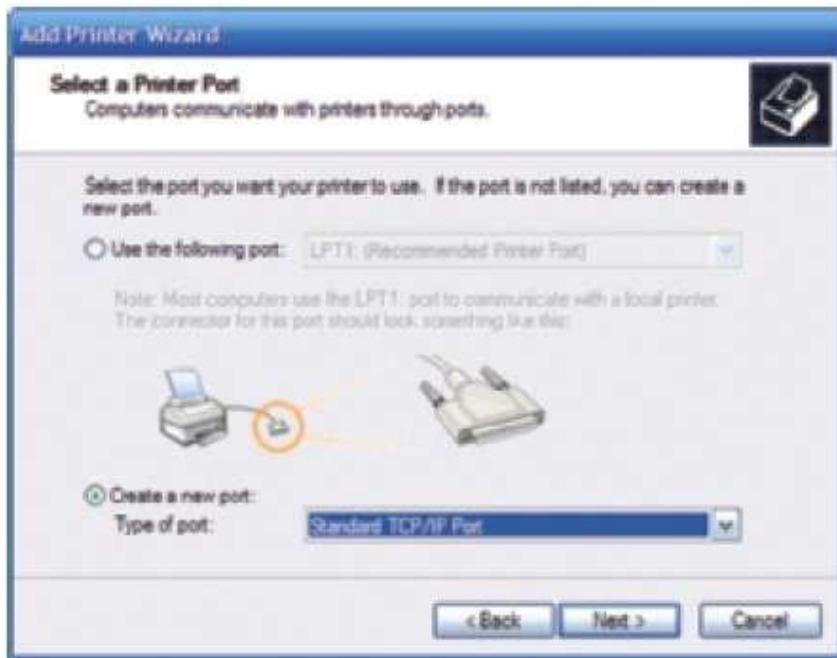


Figure 12-16 Configure a local printer to use a standard TCP/IP port. Courtesy: Course Technology/Cengage Learning

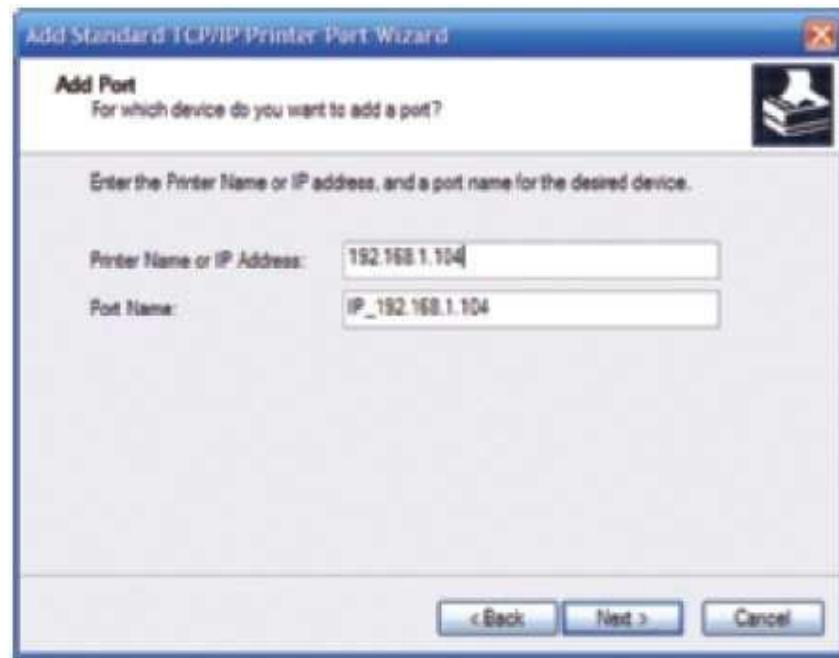


Figure 12-17 Enter the printer name or IP address to identify the printer on the network. Courtesy: Course Technology/Cengage Learning



Figure 12-18 Select printer drivers
Courtesy: Course Technology/Cengage Learning

Manage Printer Features and Settings

- Printer Properties box
 - Configure add-on devices and set printer preferences
 - Useful option: print a test page

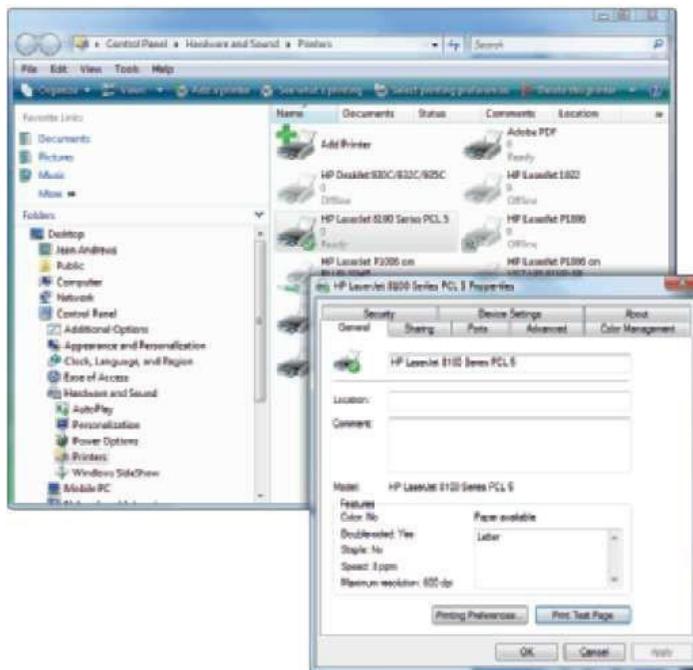


Figure 12-19 Use the printer Properties box to manage a printer. Courtesy: Course Technology/Cengage Learning

Manage Printer Features and Settings (cont'd.)

- Manage printer features and hardware devices
 - Click the Device Settings tab
 - Manage duplex printing and paper sizes
- Install physical device
 - Examples: input trays and feeders, staplers, sorters, stackers, binders, output trays to sort output by user
 - Enable new equipment
 - Users need to know how to use new features

Share an Installed Printer

- Vista: Printer sharing must be turned on
- XP: File and Printer Sharing must be installed
- Remote PC requires Client for Microsoft Networks
 - Verify computer set to wake on LAN
- General steps for win 7, 10
 - Open Properties dialog box, select Sharing
 - Select share this printer, enter name for the printer
 - Make drivers available in Additional Drivers window
 - 32-bit operating systems: select x86
 - 64-bit operating systems: select x64

How to Use a Shared Printer

- Remote PC must have network printer drivers
 - Can be installed from setup CD, windows, host PC
- Installing a shared printer on a remote computer
 - Use window Printers and Faxes window
 - Use Network or My Network Places window

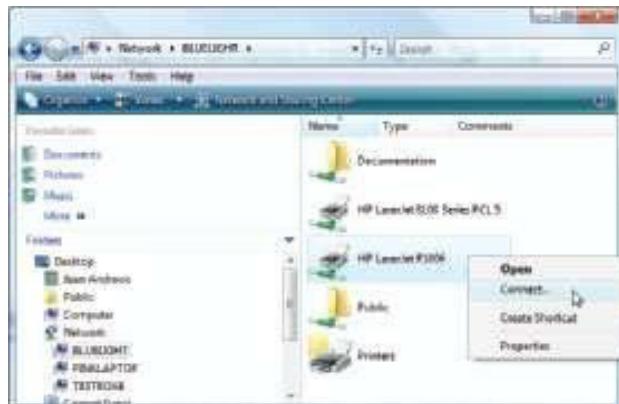


Figure 12-29 Install a shared printer using the Network window
Courtesy: Course Technology/Cengage Learning

Supporting Printers

- Extending printer working life
 - Follow manufacturer's directions for device use
 - Perform necessary routine maintenance
- Maintenance topics:
 - Communication protocols used by printers
 - Managing printers
 - Perform routine tasks needed to maintain a printer

Printer Languages

- Communication methods between OS and printer
 - Printer uses PostScript commands to build the page
 - Printer uses PCL commands to build the page
 - PCL: Printer Control Language
 - Windows GDI builds page, then sends it to the printer
 - GDI: Graphics Device Interface
 - Windows Vista uses XML Paper Specification (XPS) to build the page, then sends it to the printer
 - XPS (XML Paper Specification)
 - Raw data printed with little-to-no formatting

Using Windows to Manage Printers

- Spooling (simultaneous peripheral operations online)
 - Process of queuing print requests from application
 - Print spool: print queue
- Use window Printers and Faxes window
 - Delete printers, change Windows default printer, empty printer queue, perform printer maintenance
- At printer installation
 - Default settings for user accounts applied

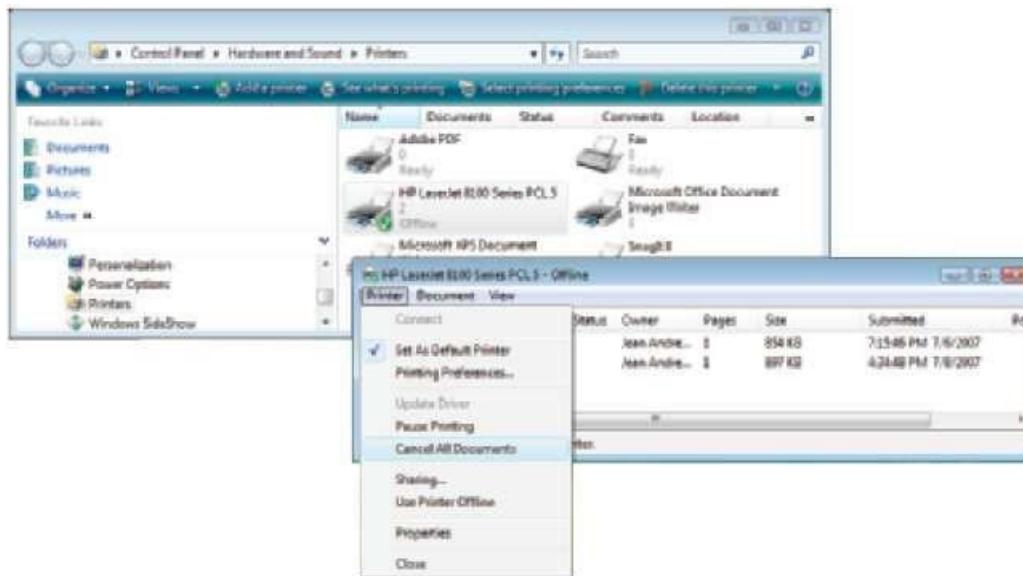


Figure 12-30 Clean the printer's queue
Courtesy: Course Technology/Cengage Learning

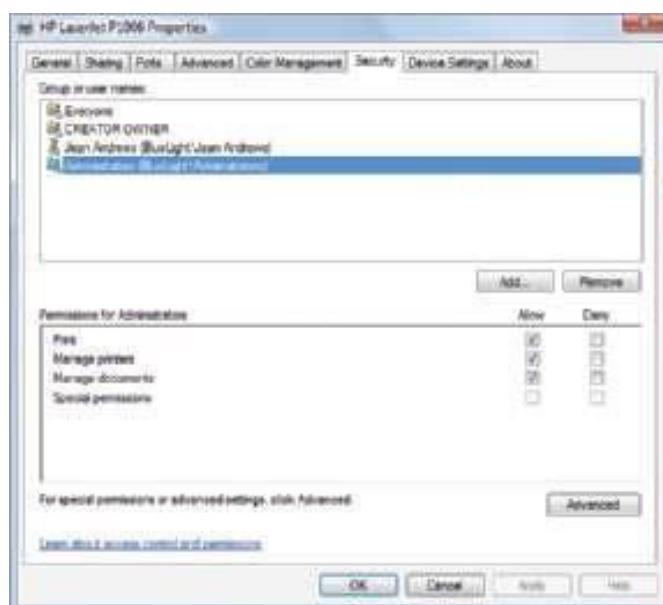


Figure 12-31 Change the default permissions for a printer
Courtesy: Course Technology/Cengage Learning

Printer Consumables

- Printer manufacturers user manual
 - Defines consumables and exchange procedures
- Protection when working inside a printer
 - Turn printer off, unplug it, wait about 30 minutes
 - Never look at laser beam
 - Use an antistatic ground bracelet
 - Have help nearby
- Keep full supply on hand: paper, ink ribbons, color sticks, toner cartridges, ink cartridges
 - Know how to exchange and how to recognize when they need exchanging



Danger, high voltage



Ground



Hot surface



Hot surface



Hot surface; wait 30 minutes to cool



Be careful to not pinch your fingers



Use caution

Figure 12-32 Symbols imprinted on a device that indicate danger
Courtesy: Course Technology/Cengage Learning



Figure 12-33 Installing an ink cartridge in an inkjet printer
Courtesy: Course Technology/Cengage Learning

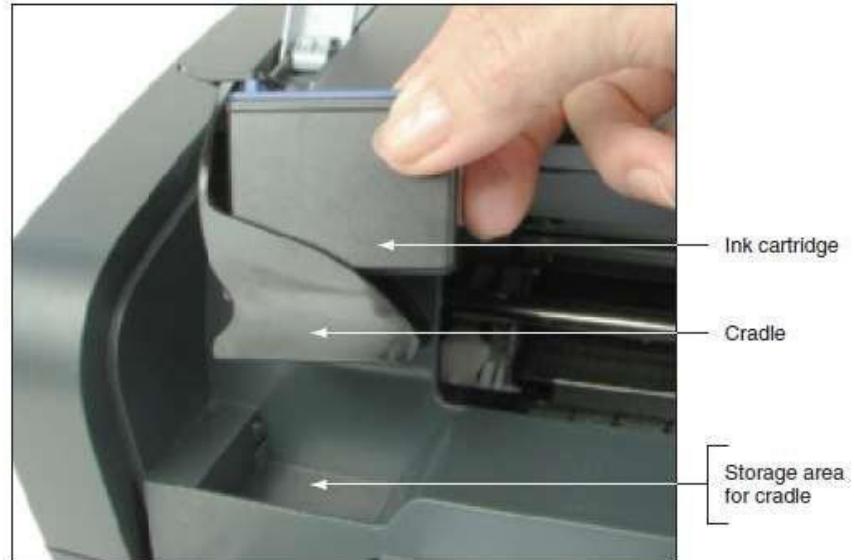


Figure 12-34 Use the protective cradle to keep an ink cartridge from drying out when it is not installed in a printer
Courtesy: Course Technology/Cengage Learning

Maintaining Printers

- Printer maintenance procedures
 - Vary widely from manufacturer to manufacturer
- Sources of specific maintenance procedures
 - Printer documentation
 - Manufacturer's Web site

Printer Maintenance Kits

- Printer maintenance kit
 - Specific printer components
 - Step-by-step instructions for performing maintenance
 - Special tools or equipment: utilities and printer buttons
- Examples of replacing printer consumables
 - Replacing a toner cartridge
 - Replacing an image drum
 - Replacing a fuser



Figure 12-35 Use buttons on the front of the printer to display information, including the page count
Courtesy: Course Technology/Cengage Learning

Upgrade the Printer Memory or Hard Drive

- Internal hard drives hold print jobs and fonts
- Extra memory speeds up memory performance, reduces print errors, prevents Out of Memory errors
- Installation:
 - Use a screwdriver to remove printer cover plate
 - Remove thumb screws on the back of the printer, pull out the formatter board
 - Memory modules and hard installed on this board
 - Hard drive embedded on proprietary board that fits in the bay
 - Enable and configure using printer properties window

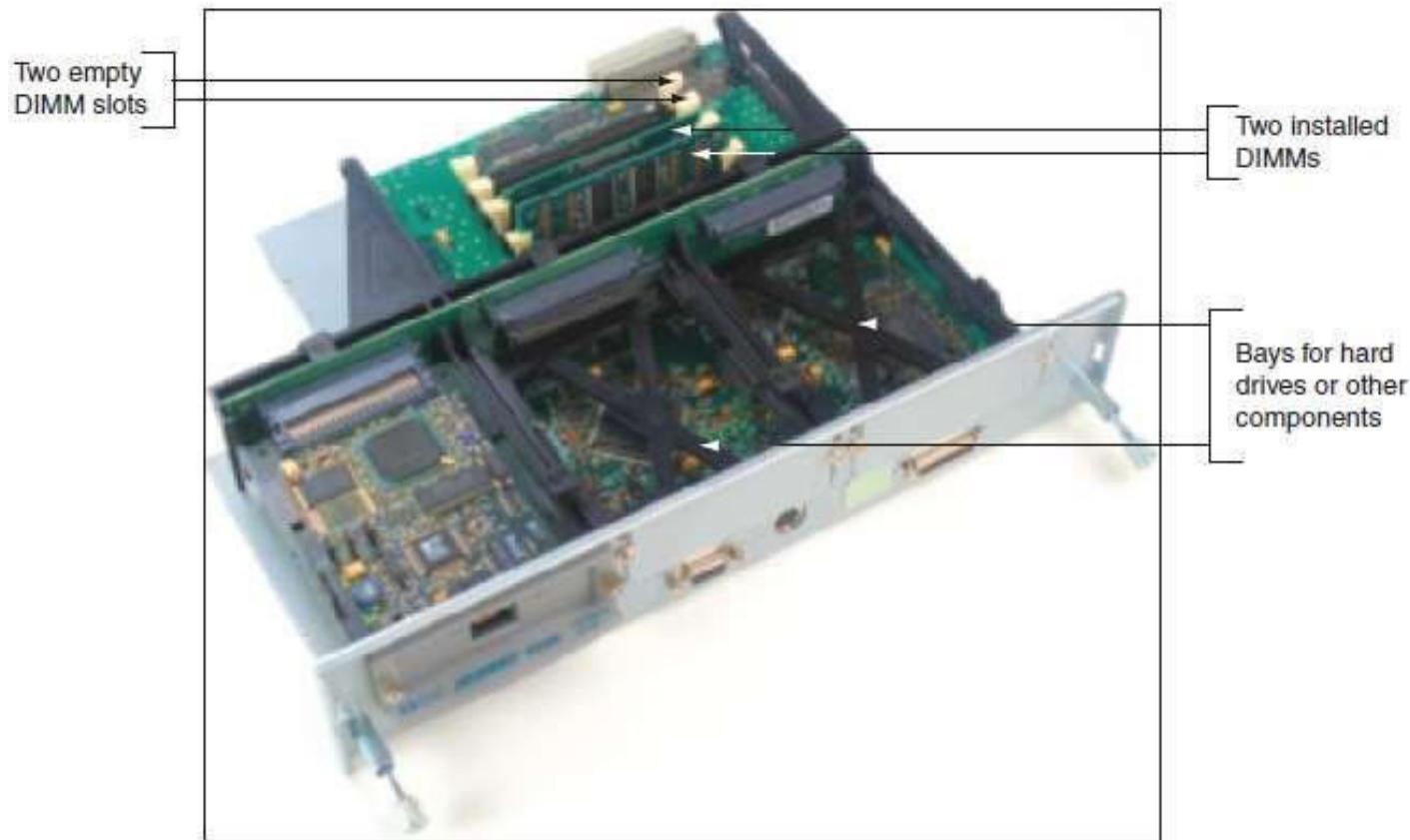


Figure 12-46 Memory is installed on the formatter board
Courtesy: Course Technology/Cengage Learning

Cleaning a Printer

- Routine printer maintenance
 - Clean outside of the printer with a damp cloth
 - Do not use ammonia-based cleaners
 - Clean the inside of the printer with a dry cloth
 - Do not blow out toner with compressed air
 - Two safe tools:
 - Toner-certified vacuum cleaner
 - Extension magnet brush
 - Software may be used to clean inkjet nozzles and align cartridges
 - Cartridge nozzles may have to be manually cleaned

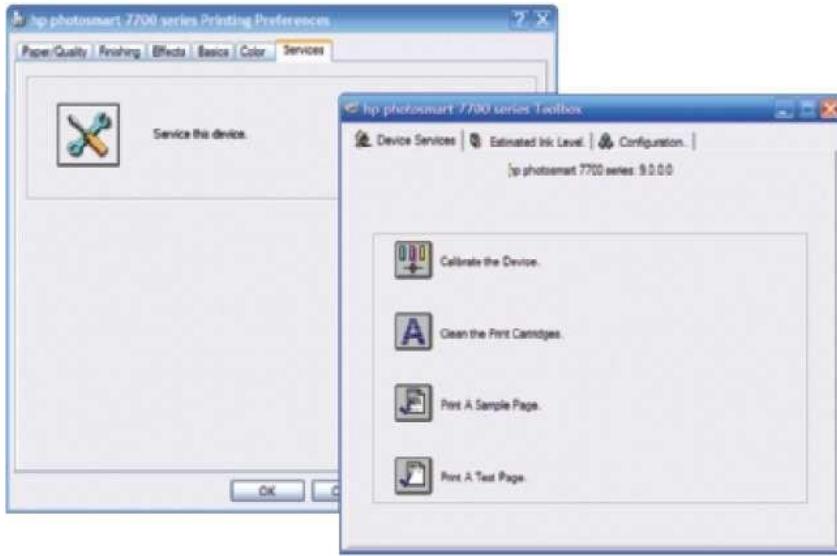


Figure 12-48 Use the Services tab in the Printing Preferences box to service this inkjet printer
Courtesy: Course Technology/Cengage Learning

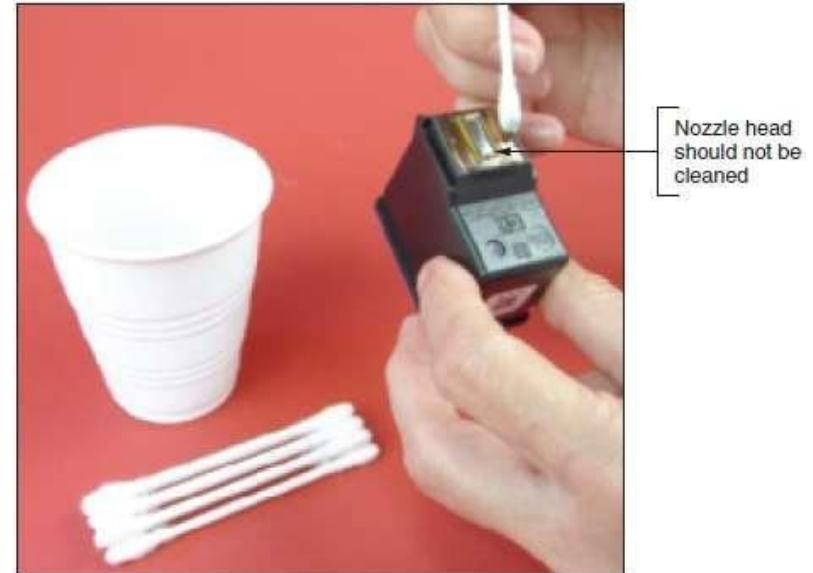


Figure 12-49 Clean the area around the nozzle plate with a damp cotton swab Courtesy: Course Technology/Cengage Learning

Online Support for Printers

- Printer manufacturer's Web site
 - Online documentation
 - Knowledge base of common problems
 - Explanation of what to do about them
 - Updated device drivers
 - Catalog of options and upgrades for purchase
 - Replacement parts
 - Printer maintenance kits
 - Additional software
 - Firmware updates

Updating Printer Firmware

- Replace printer's DIMM containing the firmware
 - Download the update from manufacturer's Web site
- Updating firmware (HP 8100 DN network printer)
 - Manual shows how to access firmware utility
 - Enter printer's IP address in browser address box
 - Click Administration, then click Configuration tab
 - Check for firmware upgrades
 - Click the Support tab
 - Connect to the HP Web site
 - Search for updates and the download the software

Troubleshooting Printers

- Section topics:
 - General printer troubleshooting
 - Troubleshooting specific problems
- General tasks performed during troubleshooting
 - Interview the user
 - Find out what works and does not work Make an
 - initial determination of the problem When the
 - problem is solved, check with the client
 - Document problem symptoms and solutions

Printer Does Not Print

- Organize diagnostic questions in a flowchart
- Isolate problem to one of the following areas:
 - The printer itself
 - Connectivity between the PC and its local printer
 - Connectivity between the PC and a network printer
 - OS and printer drivers
 - Application attempting to use the printer

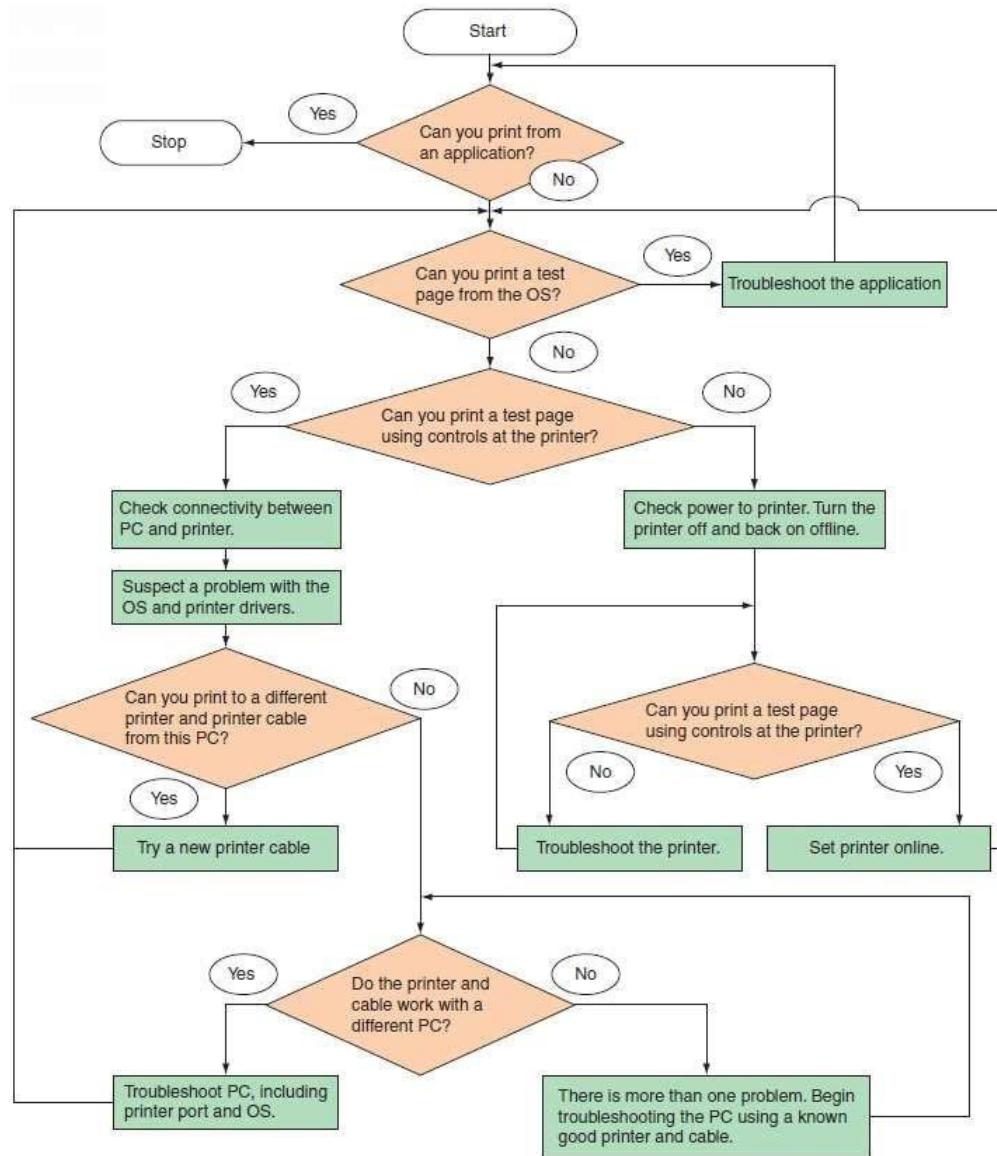


Figure 12-53 How to isolate a printer problem.
Courtesy: Course Technology/Cengage Learning

Printer Does Not Print (cont'd.)

- Problems with the printer itself
 - Verify that the printer is on
 - Print a self-test page
 - Review test page for clues
 - Test page not printing
 - Troubleshoot the printer until it prints correctly: paper issues, cover issues, cartridges installed, power source issues, reset the printer, check documentation
 - Test page will not print at all
 - Take printer to a certified repair shop

Printer Does Not Print (cont'd.)

- Some tasks for fixing a problem with a cable or port
 - Verify cable firmly connected at both ends
 - Try a different cable, use a shorter cable
 - Use same cable with different PC
 - Use Device Manager, BIOS setup, port tester

Printer Does Not Print (cont'd.)

- Problems with connectivity for a network printer
 - Verify printer is online, power cycle printer, reboot PC
 - Verify correct default printer selected
 - Delete and reinstall printer
 - Verify configuration, ping the printer, run diagnostics
 - Research error codes, flash firmware

Printer Does Not Print (cont'd.)

- Problems with connectivity for a shared printer
 - Print a test page from local computer
 - Verify correct default printer selected and online
 - At remote computer, verify access to the computer to which printer attached Delete
 - printer and reinstall Print to
 - another shared printer
 - Verify hard drive space

Printer Does Not Print (cont'd.)

- Problems printing from Windows
 - Delete all print jobs in the printer's queue
 - Verify correct default printer selected and online
 - Verify printer properties; e.g., lower resolution
 - Reboot the PC, verify cable connections
 - Delete printer and reinstall, look for updated driver
 - Check Event Viewer for recorded events
 - Verify printer properties, try lower resolution
 - Disable print spooling, verify disk space, check for errors
 - Print from Safe Mode

Printer Does Not Print (cont'd.)

- Problems printing from applications
 - Verify correct printer
 - Printing different file within same application
 - Delete spool files, cancel print jobs using controls at the printer, power cycle printer
 - Print text from Notepad
 - Reopen application, create new data file, print
 - Print from another application
 - Add more memory to printer
 - Reinstall printer drivers

Problems with Laser Printers

- Poor print quality or toner low message displayed
 - Unplug a heated printer, allow it to cool
 - Rock or replace toner cartridge
 - Verify EconoMode is off, check paper
 - Clean the printer
- Printer stays in warm-up mode
 - Turn off printer, disconnect cable, turn on printer
 - Verify cable is connected to correct port
 - Verify data id being sent to the correct port
 - Reboot PC, print from another PC, check the network

Problems with Laser Printers (cont'd.)

- A paper jam occurs or paper out message appears
 - Check for jammed paper in input tray and output bin
 - Check tray for problems
 - Check dampness of paper
- One or more white streaks appear in the print
 - Remove toner cartridge, shake it, reinstall
 - Remove and clean the developer unit
- Print appears speckled
 - Replace the cartridge
 - Replace the laser drum

Problems with Laser Printers (cont'd.)

- Printed images are distorted
 - Check for debris, inspect drum for wear
- Ghosted images print
 - Check image drum or toner cartridge
 - Clean the drum with a utility if possible
 - Replace the less expensive toner cartridge
- Garbage printouts
 - Try using binary (bitmap) printing

Problems with Laser Printers (cont'd.)

- A portion of the page does not print
 - Add more memory
 - Print only simple pages with few graphics
- Printing is slow
 - Clean up the drive, install new drive, lower the resolution, add more printer or CPU memory

Problems with Laser Printers (cont'd.)

- Printer makes a strange noise
 - Verify printer sitting level or stable
 - Check for loose or broken parts and that the cover is fully closed
- Error codes appear in printer control panel window
 - Read documentation to resolve problem

Problems with Inkjet Printers

- Print quality is poor
 - Reinstall cartridge, check ink, clean nozzles
- Printing is intermittent or absent
 - Verify driver, ink supply, nozzles, cartridges
- Lines or dots are missing from the printed page
 - Clean the inkjet nozzles
- Ink streaks appear on the printed page
 - Clean the inkjet nozzles
- Paper jammed
 - Open back door, remove paper



Figure 12-60 Open the door on the back of an inkjet printer to remove jammed paper. Courtesy: Course Technology/Cengage Learning

Problems with Impact Printers

- Print quality is poor
 - Check ribbon advancement
 - Adjust the print head spacing
 - Check the print head for dirt
- Print head moves back and forth but nothing prints
 - Check ribbon installation
 - Check ribbon advancement
 - Jammed, dried out

Summary

- Printer types include:
 - Laser, inkjet, impact, solid ink, thermal, dye-sublimation
- Six steps in laser printing:
 - Cleaning, conditioning, writing, developing, transferring, and fusing
- Printer metrics:
 - Warm-up time, resolution, maximum duty cycle, printing speed, page formatting

Summary (cont'd.)

- Printer communication protocols:
 - PostScript, PCL, Windows GDI, XPS
- Windows printer configuration:
 - Vista Printers window
 - Windows Printers and Faxes window
- Routine maintenance:
 - Extends working life of printers

End of Chapter-3

Thank You

