



Chapter 1: Introduction to the Personal Computer



IT Essentials: PC Hardware and Software v4.0

Chapter 1 Objectives

- 1.1 Explain the IT industry certification
- 1.2 Describe a computer system
- 1.3 Identify the names, purposes, and characteristics of cases and power supplies
- 1.4 Identify the names, purposes, and characteristics of internal components
- 1.5 Identify the names, purposes, and characteristics of ports and cables
- 1.6 Identify the names, purposes, and characteristics of input devices
- 1.7 Identify the names, purposes, and characteristics of output devices
- 1.8 Explain system resources and their purposes

Information Technology (IT)

- The design, development, implementation, support, and management of computer hardware and software applications
- An IT professional is knowledgeable about computer systems and operating systems.
- This chapter will review IT certifications and the components of a basic personal computer system.

IT Technician

- Has specialized skills to install, maintain, and repair computers
- Computers include desktop, laptop, and personal electronic devices



Education and Certification

- A successful IT technician has training and experience in the following:

Personal computers, printers, scanners, and laptop computers

Safe lab procedures

Troubleshooting

Operating systems

Networks

Security

Communication skills



- Industry standard certification:

CompTIA A+

European Certification of Informatics Professional
(**EUCIP**) IT Administrator Certification (Modules 1 – 3)

CompTIA A+ Certification

An A+ Certification candidate must pass two exams:

1. CompTIA A+ Essentials (220-601)

covers the basic skills needed to install, build, upgrade, repair, configure, troubleshoot, optimize, diagnose, and maintain basic personal computer hardware and operating systems

2. The second advanced exam depends on the type of certification desired:

IT Technician (220-602)

Remote Support Technician (220-603)

Depot Technician (220-604)

EUCIP IT Administrator Certification

- Covers the standards prescribed by the Council of European Professional Informatics Societies (CEPIS)

- Consists of five exams:

Module 1: Computer Hardware

Module 2: Operating Systems

Module 3: Local Area Network and Network Services

Module 4: Expert Network Use

Module 5: IT Security



EUCIP IT Administrator Certification

Modules 1-3 covered in this course:

- **Module 1: Computer Hardware**

Includes the functions of the components of a personal computer, diagnosis and repair of hardware problems, and selection and recommendation of appropriate hardware

- **Module 2: Operating Systems**

Includes installing and updating most common operating systems and applications and using system tools for troubleshooting and repairing operating systems

- **Module 3: Local Area Network and Network Services**

Includes installing, using, and managing local area networks, adding and removing users and shared resources, and using system tools to repair problems

Basic Personal Computer System

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



What are Computer Cases and Power Supplies

Computer Cases and Power Supplies

Computer case

- Provides protection and support for internal components
- Should be durable, easy to service, and have enough room for expansion

Power supply

- Converts AC power from the wall socket into DC
- Must provide enough power for the installed components and future additions



Computer Cases



- Contain the framework to support and enclose internal components of the computer
- Typically made of plastic, steel, and aluminum
- Available in a variety of styles
- The size and layout of a case is called a **form factor**
- Designed to keep internal components cool
- Helps to prevent damage from static electricity

Case Selection

Factor	Rationale
Model Type	Two main case models (one for desktop PCs and the other for tower PCs). The type of motherboard determines the type of case. Size and shape must match exactly.
Size	If a computer has many components, it will need more room for airflow to keep the system cool.
Available Space	Desktop cases allow space conservation in tight areas because the monitor can be placed on top of the unit. The case design may limit the number and size of the components that can be added.
Power Supply	Match the power rating and connection type of the power supply to the type of motherboard chosen.
Appearance	There are many case designs to choose from if it is necessary to have a case that is attractive.
Status Display	LED indicators that are mounted on the front of the case can tell you if the system is receiving power, when the hard drive is being used, and when the computer is on standby or sleeping.
Vents	All cases have a vent on the power supply. Some cases have more vents to dissipate an unusual

Power Supplies

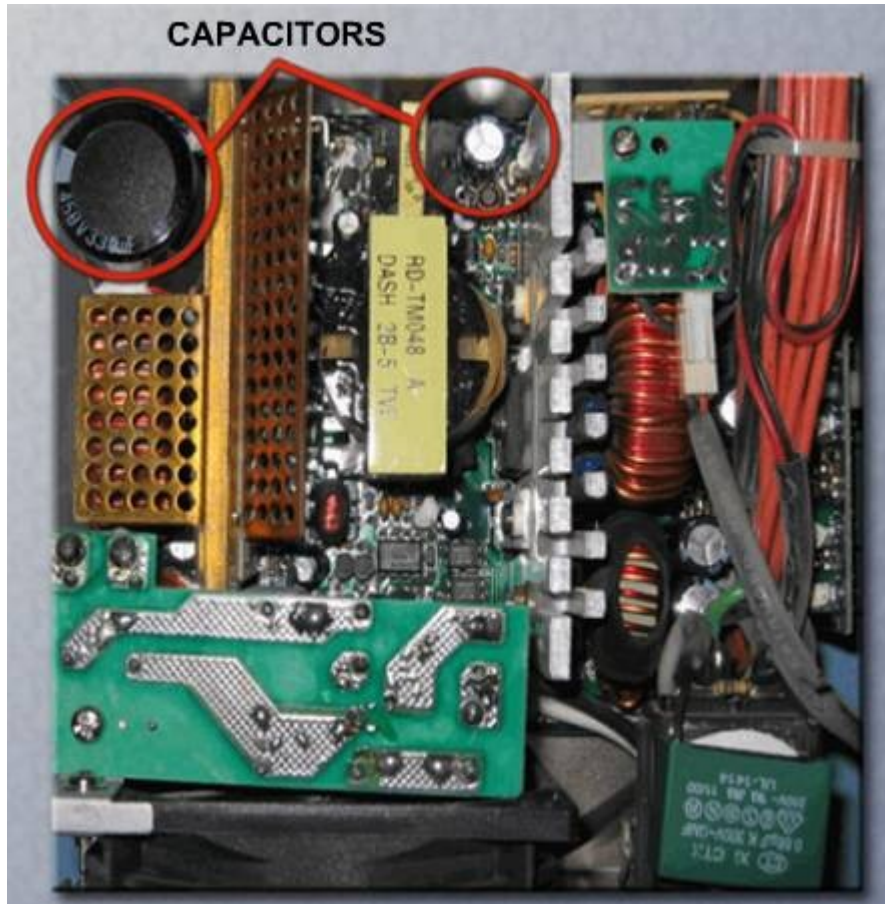
- The power supply converts alternating-current (AC) power coming from a wall outlet into direct-current (DC) power, which is a lower voltage.
- DC power is required for all of the components inside the computer.
- Cables, connectors, and components are designed to fit together snugly. Never force any connector or component.



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**. 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)**. 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**. Lower resistance allows more current to flow through a circuit.

Power Supplies



CAUTION: Do not open a power supply.

Electronic capacitors located inside of a power supply can hold a charge for extended periods of time.

Internal Components



What components does motherboard comprises?

Motherboards

- The main printed circuit board
- Contains the buses, or electric pathways found in a computer
Buses allow data to travel among the various components
- Also known as the system board, the backplane, or the main board.
- 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.



Motherboard Form Factors

- The form factor of motherboards pertains to the size and shape of the board.
- It also describes the physical layout of the different components and devices on the motherboard.
- Various form factors exist for motherboards.

AT – Advanced Technology

ATX – Advanced Technology Extended

Mini-ATX – Smaller footprint of ATX

Micro-ATX – Smaller footprint of ATX

LPX – Low-profile Extended

NLX – New Low-profile Extended

BTX – Balanced Technology Extended

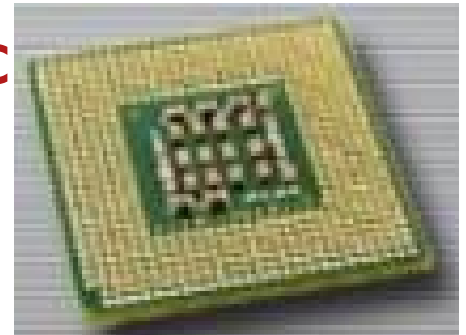


Central Processing Unit (CPU)

- Known as the brain of the computer. Also referred to as the processor.
- Most important element of a computer system. Executes a program, which is a sequence of stored instructions.
- Two major CPU architectures related to instruction sets:

Reduced Instruction Set Computer (RISC)

Complex Instruction Set Computer (CISC)

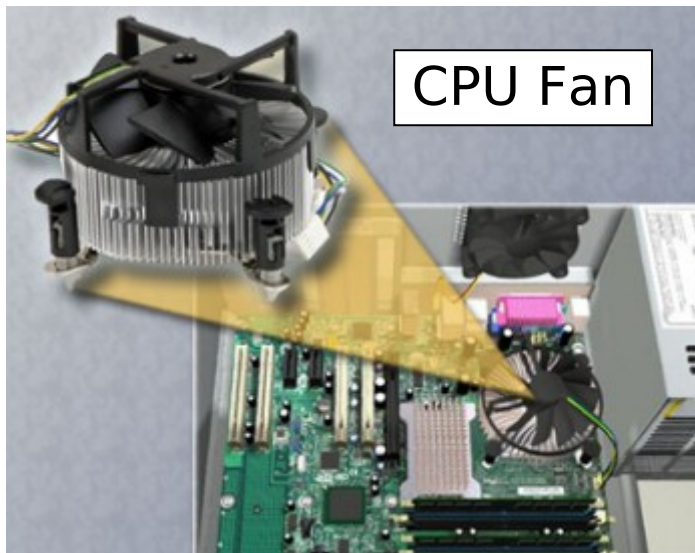
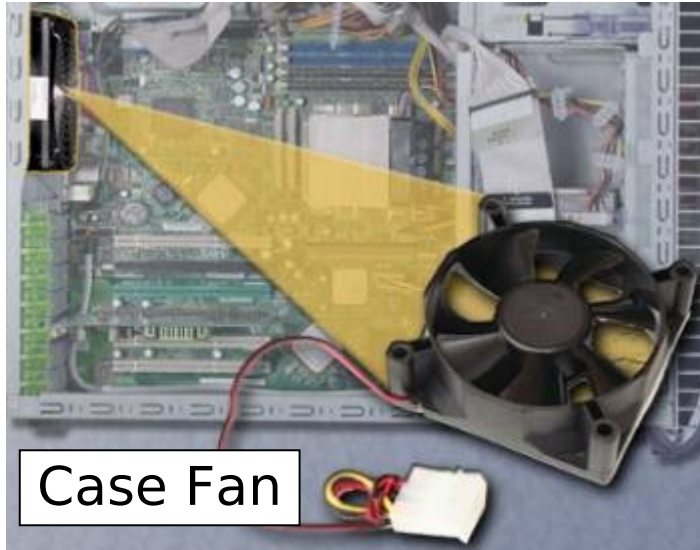


Central Processing Unit (CPU)

- To an operating system, a single CPU with **hyperthreading** appears to be two CPUs.
- The wider the processor data bus width, the more powerful the processor. Current processors have a 32-bit or a 64-bit processor data bus.
- **Overclocking** is a technique used to make a processor work at a faster speed than its original specification.
- **MMX** enabled microprocessors can handle many common multimedia operations that are normally handled by a separate sound or video card.
- The latest processor technology has resulted in CPU manufacturers finding ways to incorporate more than one CPU core onto a single chip.

Single core CPU and **Dual core CPU**

Cooling Systems



- Electronic components generate heat. Too much heat can damage components.
- 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 are dedicated to cool the **Graphics-processing unit (GPU)**.

Read-only Memory (ROM)

- Basic instructions for booting the computer and loading the operating system are stored in ROM.

ROM Types	ROM Types	Description
ROM	Read-only memory chips	Information is written to a ROM chip when it is manufactured. A ROM chip cannot be erased or re-written and can become obsolete.
PROM	Programmable read-only memory	Information is written to a PROM chip after it is manufactured. A PROM chip cannot be erased or re-written.
EPROM	Erasable programmable read-only memory	Information is written to an EPROM chip after it is manufactured. An EPROM chip can be erased with exposure to UV light. Special equipment is required.
EEPROM	Electrically erasable programmable read-only memory	Information is written to an EEPROM chip after it is manufactured. EEPROM chips are also called Flash ROMs. An EEPROM chip can be erased and re-written without having to remove the chip from the computer.

Types of RAM?

Random-access Memory (RAM)

- Temporary storage for data and programs that are being accessed by the CPU
- Volatile memory, which means that the contents are erased when the computer is powered off
- More RAM means more capacity to hold and process large programs and files, as well as enhance system performance.
- **Types of RAM:**
 - Dynamic Random Access Memory (DRAM)
 - Static Random Access Memory (SRAM)
 - Fast Page Mode DRAM (FPM Memory)
 - Extended Data Out RAM (EDO Memory)
 - Synchronous DRAM (SDRAM)
 - Double Data Rate SDRAM (DDR SDRAM)
 - Double Data Rate 2 SDRAM (DDR2 SDRAM)
 - RAMBus DRAM (RDRAM)

Memory Modules

- **Dual Inline Package (DIP)** is an individual memory chip. A DIP had dual rows of pins used to attach it to the motherboard.
- **Single Inline Memory Module (SIMM)** is a small circuit board that holds several memory chips. SIMMs have 30-pin and 72-pin configurations.
- **Dual Inline Memory Module (DIMM)** is a circuit board that holds SDRAM, DDR SDRAM, and DDR2 SDRAM chips. There are 168-pin SDRAM DIMMs, 184-pin DDR DIMMs, and 240-pin DDR2 DIMMs.
- **RAM Bus Inline Memory Module (RIMM)** is a circuit board that holds RDRAM chips. A typical RIMM has a 184-pin configuration.

Cache and Error Checking

Cache

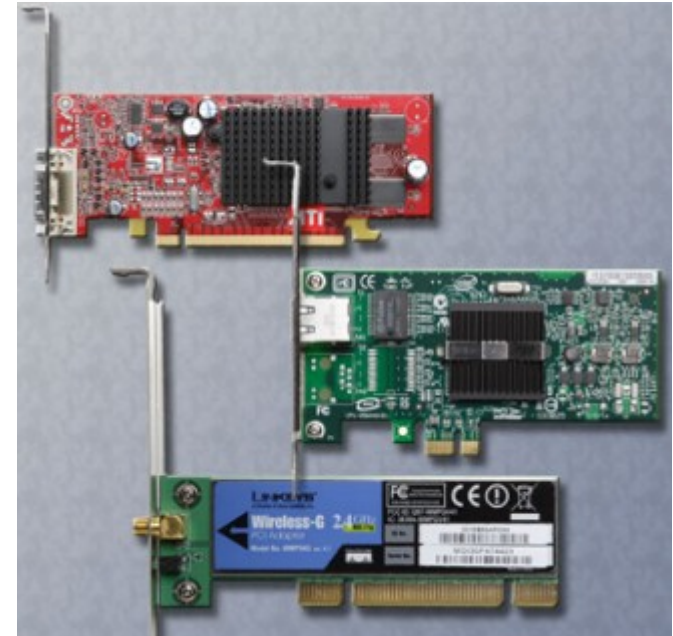
- **SRAM** is used as cache memory to store the most frequently used data.
- SRAM provides the processor with faster access to the data than retrieving it from the slower DRAM, or main memory.

Error Checking

- Memory errors occur when the data is not stored correctly in the RAM chips.
- The computer uses different methods to detect and correct data errors in memory.

Adapter Cards

- Increase the functionality of a computer by adding controllers for specific devices or by replacing malfunctioning ports.
- Examples of adapter cards:
 - Sound adapter and video adapter
 - USB, parallel, and serial ports
 - RAID adapter and SCSI adapter
 - Network Interface Card (NIC), wireless NIC, and modem adapter
- Types of expansion slots:
 - Industry Standard Architecture (ISA)
 - Extended Industry Standard Architecture (EISA)
 - Microchannel Architecture (MCA)
 - Peripheral Component Interconnect (PCI)
 - Advanced Graphics Port (AGP)
 - PCI-Express



Hard Drives and Floppy Drives

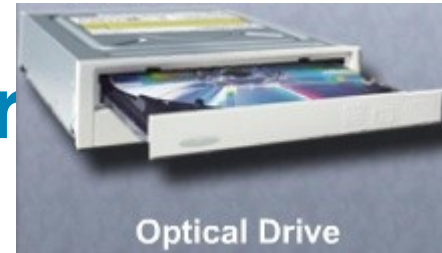
- Reads or writes information to magnetic or optical storage media
- May be fixed or removable
- The **hard disk drive (HDD)** is a magnetic storage device installed inside the computer. The storage capacity is measured in gigabytes (GB).



- A **floppy disk drive (FDD)** is storage device that uses removable 3.5 inch floppy disks that can store 1.44 MB of data.

Optical Drives and Flash Drives

- An **optical drive** is a storage device that uses lasers to read data on the optical media. The two types are CD and DVD.



- A **flash drive** is a removable storage device that connects to a USB port. A flash drive uses a type of memory that requires no power to maintain the data.



- Some common drive interfaces:
 - Integrated Drive Electronics (IDE)
 - Enhanced Integrated Drive Electronics (EIDE)
 - Parallel ATA (PATA)
 - Serial ATA (SATA)
 - Small Computer System Interface (SCSI)

Internal Cables

Data cables connect drives to the drive controller, which is located on an adapter card or on the motherboard.

- Floppy disk drive (FDD) data cable
- PATA (IDE) data cable
- PATA (EIDE) data cable
- SATA data cable
- SCSI data cable



Serial Ports and Cables



- A serial port can be either a DB-9, as shown, or a DB-25 male connector.
- Serial ports transmit one bit of data at a time.
- To connect a serial device, such as a modem or printer, a serial cable must be used.
- A serial cable has a maximum length of 50 feet (15.2 m).

USB Ports and Cables

- USB is a standard interface for connecting peripheral devices to a computer.
- USB devices are hot-swappable.
- USB ports are found on computers, cameras, printers, scanners, storage devices, and many other electronic devices.
- A single USB port in a computer can support up to 127 separate devices with the use of multiple USB hubs.
- Some devices can also be powered through the USB port, eliminating the need for an external power source.



FireWire Ports and Cab

- FireWire is a high-speed, hot-swappable interface.
- A single FireWire port in a computer can support up to 63 devices.
- Some devices can also be powered through the FireWire port, eliminating the need for an external power source.
- The IEEE 1394a standard supports data rates up to 400 Mbps and cable lengths up to 15 feet (4.5 m). This standard uses a 6-pin connector or a 4-pin connector.
- The IEEE 1394b standard supports data rates in excess of 800 Mbps and uses a 9-pin connector.



Parallel Ports and Cables



- Parallel ports can transmit 8 bits of data at one time and use the IEEE 1284 standard.
- To connect a parallel device, such as a printer, a parallel cable must be used.
- A parallel cable has a maximum length of 15 feet (4.5 m).

SCSI Ports and Cables

- A SCSI port can transmit data at rates in excess of 320 Mbps and can support up to 16 devices.
- Three different types of SCSI ports:
 - DB-25 female connector
 - High-density 50-pin female connector
 - High-density 68-pin female connector
- **NOTE:** SCSI devices must be terminated at the endpoints of the SCSI chain. Check the device manual for termination procedures.
- **CAUTION:** Some SCSI connectors resemble parallel connectors. The voltage used in the SCSI format may damage the parallel interface.



Network Ports and Cables

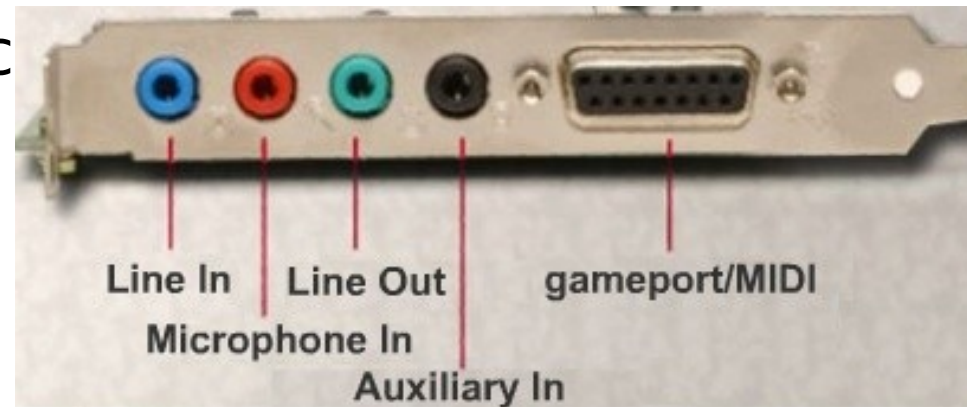
- A network port, also known as an RJ-45 port, connects a computer to a network.
- Standard Ethernet can transmit up to 10 Mbps.
- Fast Ethernet can transmit up to 100 Mbps.
- Gigabit Ethernet can transmit up to 1000 Mbps.
- The maximum length of network cable is 328 feet (100 meters).



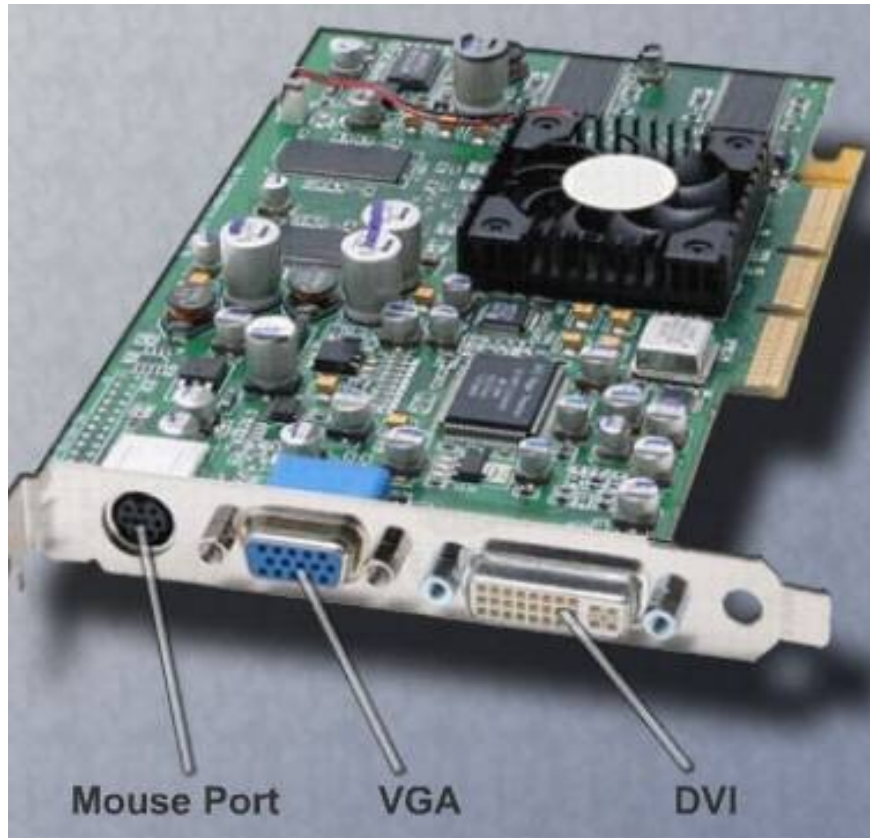
PS/2 Ports and Audio Ports



- A PS/2 port connects a keyboard or a mouse to a computer.
- The PS/2 port is a 6-pin mini-DIN female connector.
- Line In connects to an external source
- Microphone In connects to a microphone
- Line Out connects to speakers or headphones
- Gameport/MIDI connects to a joystick or MIDI-interfaced device



Video Ports



A video port connects a monitor cable to a computer.

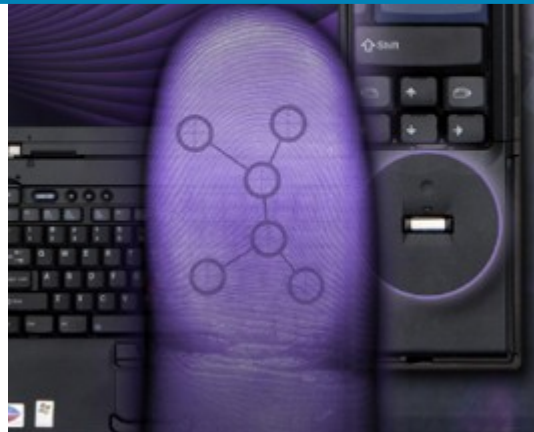
- Video Graphics Array (VGA)
- Digital Visual Interface (DVI)
- High-Definition Multimedia Interface (HDMI)
- S-Video
- Component/RGB

Input Devices

Input devices used to enter data or instructions into a computer:

- Mouse and Keyboard
- Digital camera and digital video camera
- Biometric authentication device
- Touch screen
- Scanner

Fingerprint scanner



Digital camera



Monitors and Projectors



The most important difference between these monitor types is the technology used to create an image:

- Cathode-ray tube (CRT) monitor is the most common monitor type. Most televisions also use this technology.
- Liquid crystal display (LCD) is commonly used in laptops and some projectors. LCD comes in two forms, active matrix and passive matrix.
- Digital light processing (DLP) is another technology used in projectors.

Other Output Devices

- **Printers, Scanners, and Fax Machines** - Printers are output devices that create hard copies of computer files. Other all-in-one type printers are designed to provide multiple services such as printing, fax, and copier functions.
- **Speakers and headphones** are output devices for audio signals.

Most computers have audio support either integrated into the motherboard or on an adapter card.

Audio support includes ports that allow input and output of audio signals.



System Resources

System resources are used for communication purposes between the CPU and other components in a computer.

There are three common system resources:

- Interrupt Requests (IRQs)
- Input/Output (I/O) Port Addresses
- Direct Memory Access (DMA)

Interrupt Requests (IRQs)

IRQ	Standard Function
0	System Timer
1	Keyboard Controller
2	2nd IRQ Controller Cascade
3	Serial 2 (COM2:)
4	Serial 1 (COM1:)
5	Sound/Parallel 2 (LPT2:)
6	Floppy Drive Controller
7	Parallel 1 (LPT1:)
8	Real-Time Clock
9	Avail. (as IRQ2 or IRQ9)
10	Available
11	Available
12	Mouse Port/Available
13	Math Coprocessor
14	Primary IDE
15	Secondary IDE

- IRQs are used by computer components to request information from the CPU.
- When the CPU receives an interrupt request, the CPU determines how to fulfill this request.
- The priority of the request is determined by the IRQ number assigned to that computer component.
- Today, most IRQ numbers are assigned automatically with plug and play (PnP) operating systems and the implementation of PCI slots, USB ports, and FireWire ports.

Input/Output (I/O) Port Addresses

- Used to communicate between devices and software.
- Used to send and receive data for a component.
- As with IRQs, each component will have a unique I/O port assigned.
- There are 65,535 I/O ports in a computer.
- They are referenced by a hexadecimal address in the range of 0000h to FFFFh.

Device	I/O Port Address
COM 1	3F8
COM 2	2F8
COM 3	3E8
COM 4	2E8
LPT 1	378
LPT 2	278

Direct Memory Access (DMA)

DMA Channel	Recommended Use
0	Sound
1	Sound
2	Floppy Drive Controller
3	LPT1: in ECP Mode
4	Cascade for DMA 0-3
5	Sound
6	Available
7	Available

- DMA channels are used by high-speed devices to communicate directly with main memory.
- These channels allow the device to bypass interaction with the CPU and directly store and retrieve information from memory.
- Only certain devices can be assigned a DMA channel, such as SCSI host adapters and sound cards.
- Newer computers have eight DMA channels that are numbered 0 to 7.

Chapter 1 Summary

- This chapter introduced the IT industry, options for training and employment, and some of the industry-standard certifications.
- This chapter also covered the components that comprise a personal computer system.



Additional Resources

- Career resources, news, jobs and resumes in Information Technology and Engineering
<http://www.techcareers.com/>
- CompTIA A+ ® Certification
<http://certification.comptia.org/a/default.aspx>
- European Certification of Informatics Professionals <http://www.eucip.com/index.jsp>
- Ohm's Law
http://www.grc.nasa.gov/WWW/K-12/Sample_Projects/Ohms_Law/ohmslaw.html
- HowStuffWorks: It's Good to Know
<http://computer.howstuffworks.com>