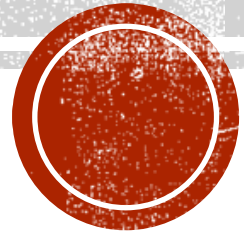
1.1: CABLES AND CONNECTORS



LEARNING OUTCOMES

- Understand the computer hardware
- Understand cable and connectors

WHAT IS THE COMPUTER HARDWARE?

- Computer hardware is the components of the computer system.
- Computer hardware is the physical equipment such as the case, storage drives, keyboards, monitors, cables, speakers, and printers.

CABLES AND CONNECTOR

BASIC CABLE AND CONNECTOR TYPES

- Two main types of computer cables;
  - ***Data cable***
  - ***Power cable.***
- A **data cable** is a cable that provides communication between devices.
- Example;
  - Data cable that connects your monitor to your computer and allows your computer to display a picture on the monitor.
  - Other data cables include the CAT5, IDE/EIDE, SATA, and USB cables..

- **Power cable** is any cable that powers the device.
- Example;
  - Power cord that connects to your computer
  - Molex style cable inside the computer

UNIVERSAL SERIAL BUS (USB)

- **USB** is a standard interface for connecting hot-swappable peripheral devices to a computer. Some devices can also be powered through the USB port.
- The Universal Serial Bus standard has been extremely successful. USB ports and cables are used to connect hardware such as printers, scanners, keyboards, mice, flash drives, external hard drives, joysticks, cameras, monitors, and more to computers of all kinds, including desktops, tablets, laptops, netbooks, etc.

UNIVERSAL SERIAL BUS (USB)

The USB Standards List

- There have been several major USB standards, with USB4 2.0 the newest version available:
- USB4 2.0: This version of USB4, which supports 80 Gbps (81,920 Mbps), was released in October 2022.
- USB4: Based on the Thunderbolt 3 specification, USB4 supports 40 Gbps (40,960 Mbps).
- USB 3.2 Gen 2x2: Also known as USB 3.2, compliant devices are able to transfer data at 20 Gbps (20,480 Mbps), called Superspeed+ USB dual-lane.
- USB 3.2 Gen 2: Previously called USB 3.1, compliant devices are able to transfer data at 10 Gbps (10,240 Mbps), called Superspeed+.

UNIVERSAL SERIAL BUS (USB)

The USB Standards List

- USB 3.2 Gen 1: Previously called USB 3.0, compliant hardware can reach a maximum transmission rate of 5 Gbps (5,120 Mbps), called SuperSpeed USB.
- USB 2.0: USB 2.0 compliant devices can reach a maximum transmission rate of 480 Mbps, called High-Speed USB.
- USB 1.1: USB 1.1 devices can reach a maximum transmission rate of 12 Mbps, called Full Speed USB.

WHAT IS HDMI (HIGH-DEFINITION MULTIMEDIA INTERFACE)?

- HDMI (High-Definition Multimedia Interface) is a proprietary specification designed to ensure compatibility between video and audio devices over a single digital interface.
- The specification is used for consumer electronics -- including high-definition and ultra-HD TVs, DVD and Blu-ray players, game consoles, streaming devices such as Roku, soundbars, laptops and PCs -- as well as for automotive and commercial devices.
- HDMI cables connect these devices and carry both uncompressed digital audio and video signals over a single cable.

WHAT IS HDMI (HIGH-DEFINITION MULTIMEDIA INTERFACE)?

- HDMI specifications include physical features, or how cables and devices interface mechanically; electrical features, or how much power the cable carries; and communication protocols, or what signals are sent over cables to allow two pieces of equipment to communicate.
- The **first** HDMI specification was released in December 2002. It was developed by Philips, Lattice Semiconductor Corp., Maxell Ltd., Panasonic Group, Sony Group Corp., Toshiba Corp. and Vantiva. The specification is licensed by HDMI Licensing Administrator Inc.

WHAT IS HDMI (HIGH-DEFINITION MULTIMEDIA INTERFACE)?

The first five releases of the HDMI specification were the following:

- 2002. HDMI 1.0, which supported 4.95 gigabits per second (Gbps), or 1K@60, which is 1K resolution per frame, or 1920 x 1080 pixels at 60 frames per second.
- 2004. HDMI 1.1, which added support for DVD-Audio.
- 2005. HDMI 1.2, which added 1-bit audio for Super Audio CDs.
- 2006. HDMI 1.3, which supported 10.2 Gbps, or 4K@30, which is 4K resolution per frame, or 3840 x 2160 at 30 frames per second.
- 2009. HDMI 1.4, which added HDMI Ethernet Channel, ARC, 3D over HDMI, a new micro HDMI connector, an expanded set of colors and an automotive connection system (ACS

THUNDERBOLT AND LIGHTNING

THUNDERBOLT

- Thunderbolt is a type of hardware interface technology that is used to connect various devices to a PC.
- The latest generations use the USB-C connector
- Introduced in 2015, Thunderbolt 3 features a USB-C connector, a max transfer speed of 40GB/s, and up to 15W of power for running accessories. It can also support one 4K display and is compatible with USB4 specification
- A Thunderbolt Port is the standard for modern high-speed connectivity to peripherals, mobile devices, computers, and storage products. It speeds up to 10 Gbps and has the ability to daisy-chain up to six devices. Thunderbolt provides the fastest and most versatile interface on the market today.
- Thunderbolt 1 and 2 used Mini DisplayPort, where Thunderbolt 3 and 4 use USB-C

THUNDERBOLT AND LIGHTNING

LIGHTNING

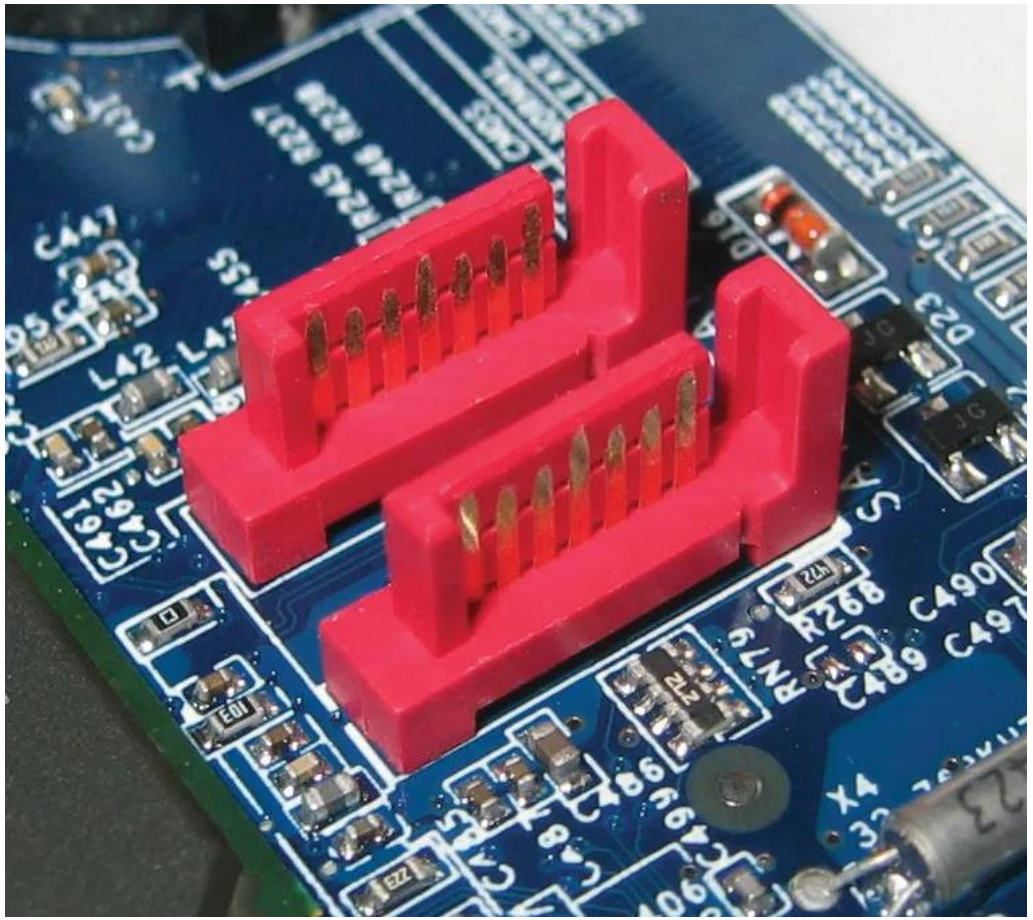
- Lightning is a proprietary computer bus and power connector, created and designed by Apple Inc.
- It was introduced on September 12, 2012, in conjunction with the iPhone 5, to replace its predecessor, the 30-pin dock connector.
- The Lightning connector is used to connect Apple mobile devices like iPhones, iPads, and iPods to host computers, external monitors, cameras, USB battery chargers, and other peripherals.
- Using 8 pins instead of 30, Lightning is much smaller than its predecessor. The Lightning connector is reversible. The plug is indented on each side to match up with corresponding points inside the receptacle to retain the connection.

SERIAL ADVANCE TECHNOLOGY ATTACHMENT (SATA) HARD DRIVE

SATA PORT

- SATA, an interface for transferring data between a computer's central circuit board and storage devices. SATA replaced the long-standing PATA (parallel ATA) interface.
- Serial communication transfers data one bit at a time, rather than in several parallel streams. Despite the apparent advantage of the parallel model, in practice serial transmission is less susceptible to interference, allowing SATA to operate at significantly higher speeds than PATA. The serial model also allows for simpler and slimmer cabling..

SERIAL ADVANCE TECHNOLOGY ATTACHMENT (SATA) HARD DRIVE

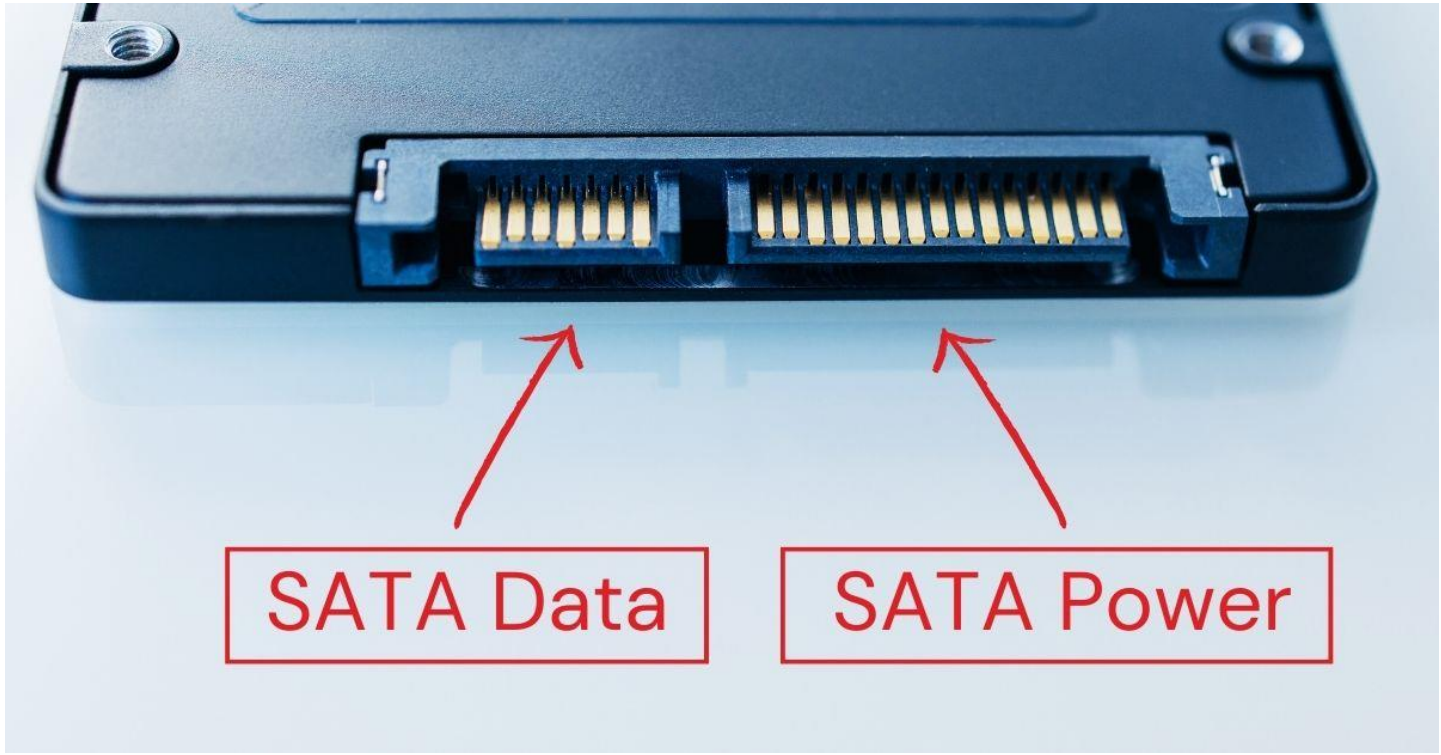


SERIAL ADVANCE TECHNOLOGY ATTACHMENT (SATA) HARD DRIVE

SATA

- SATA is the interface of a hard drive used to read and write data to and from the data storage and the computer. Also commonly referred to as serial ATAs, they are used on both hard disk drives (HDDs) and solid state drives (SSDs) and are found in a variety of electronic devices, from laptops and computers to servers.
- SATA interface has a number of advantages, including longer cables, faster throughput, multidrive support through port multiplier technology, and easier configuration.

SERIAL ADVANCE TECHNOLOGY ATTACHMENT (SATA) HARD DRIVE



SERIAL ADVANCE TECHNOLOGY ATTACHMENT (SATA) HARD DRIVE

SATA

- There are different sizes of SATA devices based on their intended use. Desktop SATA drives are 4 inches wide, 1.03 inches tall, and 5.79 inches long. They are often called 3.5-inch hard drives.
- A more compact version of the desktop SATA drive is available for laptops. Laptop SATA hard drives are usually 2.7 inches wide, 0.37 inches tall, and 3.96 inches long. These are typically referred to as 2.5-inch hard drives

PORTS AND CABLES (CONTINUED)

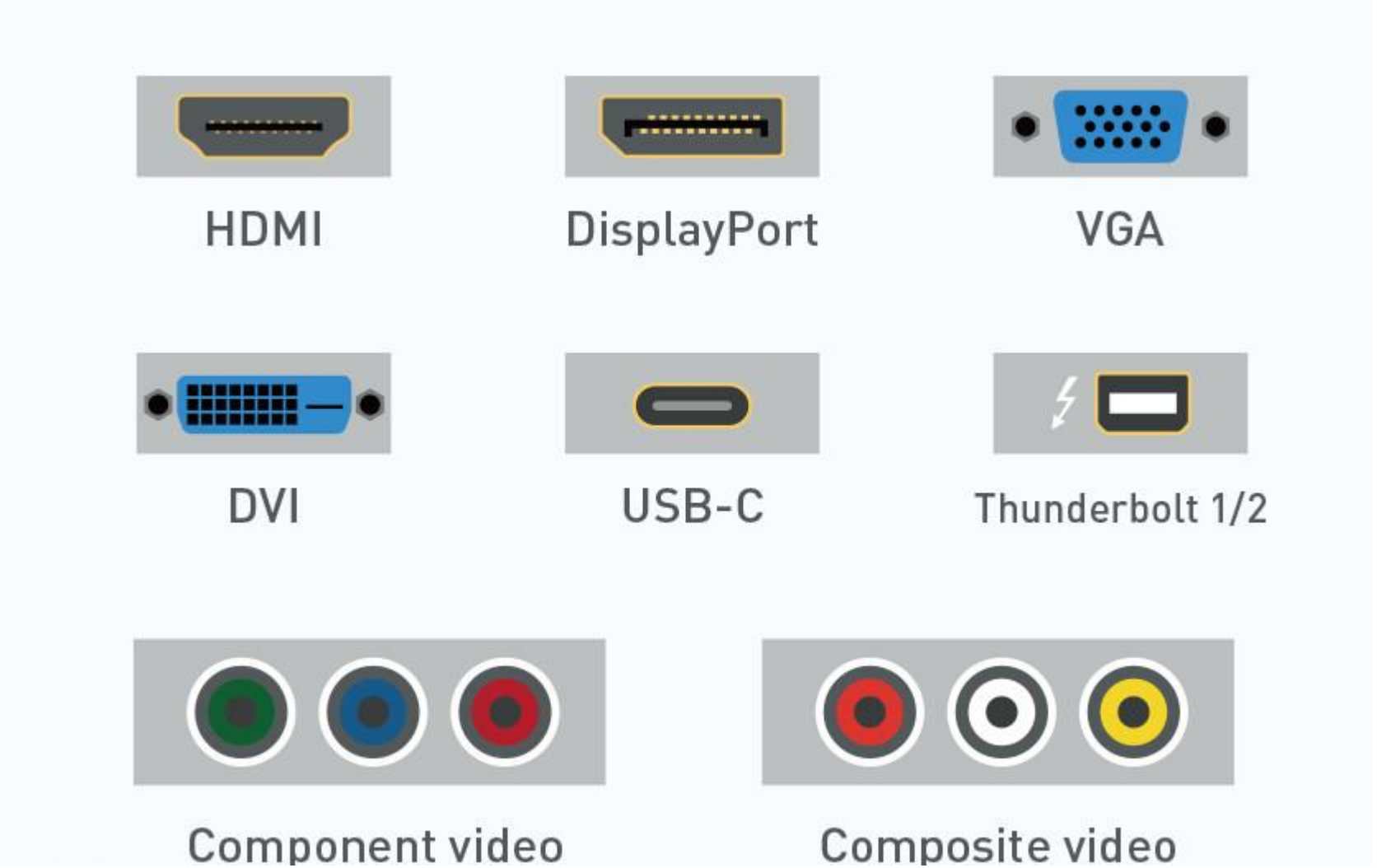
- A **SCSI port** can transmit data at rates in excess of 320 Mbps and can support up to 15 devices. SCSI devices must be terminated at the endpoints of the SCSI chain.
- A **network port**, also known as an RJ-45 port, connects a computer to a network. The maximum length of network cable is 328 feet (100 m).
- 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.
- An **audio port** connects audio devices to the computer.
- A **video port** connects a monitor cable to a computer.

EXTERNAL PORTS

- **External** Internet users who want to access that application, address it using an **external port**, such as an Audio server.
- **External Ports** are the **ports** that the cable modem listens to from the WAN.
- Examples of external devices attached via ports are the mouse, keyboard, monitor, microphone, speakers, etc.

LEGACY CABLE TYPES

VIDEO CABLES



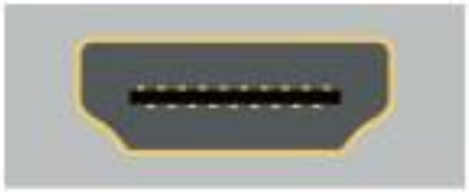
VIDEO CABLES

- Video cables are used for the transmission of video signals, including monochrome, composite and component color video signals. They are used with video cards, cameras, monitors, servers, and multiplexers; digital to video recorders (DVR); and scan and video converters

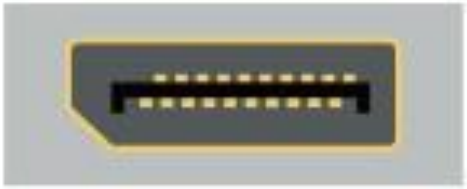
VIDEO CABLES

- **HDMI** – A mainstream audio and video transmission cable that's been predominantly used on consumer TVs and monitors, games consoles, DVD and Blu-Ray players for well over a decade. In some rare cases it's available in mini form
- **DisplayPort** – Another audio and video transmission cable that is more commonly found on desktop monitors. DisplayPort cables have traditionally offered greater bandwidth than HDMI, though that's not always the case. Mini DisplayPort cable type, which is a miniature version of the full-size port commonly found on laptops.

VIDEO CABLES



HDMI



DisplayPort

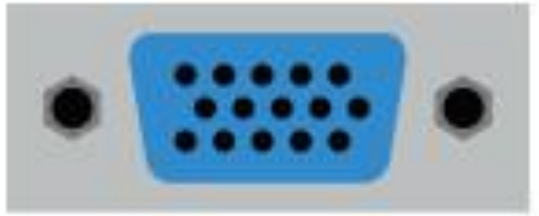
VIDEO CABLES

- **DVI –** A video only cable type that is typically found on older monitors, desktop graphics cards, and laptops. Commonly found in DVI-D and DVI-I formats, it was also available as Mini-DVI and Micro-DVI for a time

- **VGA –** An older analog standard of video-only cable that gained prominence in the early ‘90s. Since superseded by DVI, HDMI, and DisplayPort, it’s only typically found on older monitors

VIDEO CABLES

DVI



VGA

VIDEO CABLES

- **USB-C** – The most versatile monitor cable type, USB-C can transmit audio, video, and data simultaneously, thanks to its support of the DisplayPort Alt Mode protocol. USB-C monitors can, in some cases, also transmit power to connected laptops, while portable USB-C monitors can be powered entirely by a single USB-C from the host device
- **Thunderbolt –** A proprietary monitor cable type that was until recently restricted to Intel-based systems, different versions of Thunderbolt used different connectors. Thunderbolt 1 and 2 used Mini DisplayPort, where Thunderbolt 3 and 4 use USB-C. It can support audio, video, and data, and has some of the highest bandwidth of any monitor cable type

VIDEO CABLES

USB-C

Thunderbolt 1/2

VIDEO CABLES

- **Component** – These red, green, and blue connectors are sometimes included on monitors to offer an analog video connection type that's more capable than VGA. It can be useful for connecting older DVD players, or cable set top boxes.

- **Composite** – An older, lower resolution alternative to Component (though it can carry audio as well as video) this monitor cable type comes with red, white, and yellow connectors, and is largely used in older games consoles, VCRs, and set top boxes

VIDEO CABLES

Component video

Composite video

SMALL COMPUTER SYSTEM INTERFACE (SCSI)

- A small computer systems interface (SCSI) is a standard interface for connecting peripheral devices to a PC
- SCSI is used to increase performance, deliver faster data transfer transmission and provide larger expansion for devices such as CD-ROM drives, scanners, DVD drives and CD writers
- 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.
- SCSI is also frequently used with RAID, servers, high-performance PCs and storage area networks SCSI has a controller in charge of transferring data between the devices and the SCSI bus

SMALL COMPUTER SYSTEM INTERFACE (SCSI)

INTEGRATED DRIVE ELECTRONICS (IDE)

- IDE is a widely used interface standard in computing that allows for the connection and communication between a computer's motherboard and its storage devices.
- It is commonly used for connecting hard disk drives (HDDs) and optical disc drives (ODDs) to the computer system.
- IDE has played a significant role in the evolution of computer storage, offering a simple and efficient way to interface with various drives SCSI is used to increase performance, deliver faster data transfer transmission and provide larger expansion for devices such as CD-ROM drives, scanners, DVD drives and CD writers

INTEGRATED DRIVE ELECTRONICS (IDE)

INTEGRATED DRIVE ELECTRONICS (IDE)

- IDE is designed to provide a standardized interface between a computer's motherboard and its storage devices, such as hard drives and optical drives.
- By using IDE, you can easily connect and communicate with these devices, enabling data transfer and storage capabilities.
- IDE works by using a flat ribbon cable with multiple connectors that attach to the motherboard and the storage devices.
- IDE cable transfers data between the drives and the computer system using parallel communication, where multiple bits of data are transmitted simultaneously

SERIAL CABLES

- Serial cables and connectors are used to transfer data between computers or between a computer and peripheral hardware devices.
- Three primary serial cables and connector categories have been heavily utilized in personal computers: RS232/RS422/RS485, FireWire, or USB connections.
- However, RS232 and FireWire serial cables have since fallen out of favor and are no longer used in laptop or desktop computers.
- The USB connector is now the primary connection for computer peripheral devices

SERIAL CABLES

- **Female Connector** – The female connector is often called the "jack." The center of the connector contains an empty conductor for the male connector.

- **Male Connector** – The male RS232 connector has nine extruding pins. Male plugs will fit into the female plugs. The male connector is also called the "plug." The plug has a solid pin that acts as the conductor

SERIAL CABLES

SERIAL CABLES

- The RS232 serial cable was developed in the 1960s. The RS232 serial cable was at the height of its popularity in the 1990s. You may still find RS232 serial connectors in older laptops and desktops, but primarily you'll find an RS232 port in older printers, modems, or time clock applications.
- An RS232 serial connection sends **one single data bit** at a time through the cable. The slow transfer mechanism has made the RS232 obsolete in more current technologies. The standardized pin configuration of the RS232 allowed different product types to communicate back and forth with each other.

ADAPTER CABLES

- An adapter cable is a mechanical accessory and is also called a connector. A connector connects two connectors. An adapter cable is in short a connector that converts different voltages to the right one voltages. The junction converts signals into other voltages.

ADAPTER CABLES