

Primary Storage

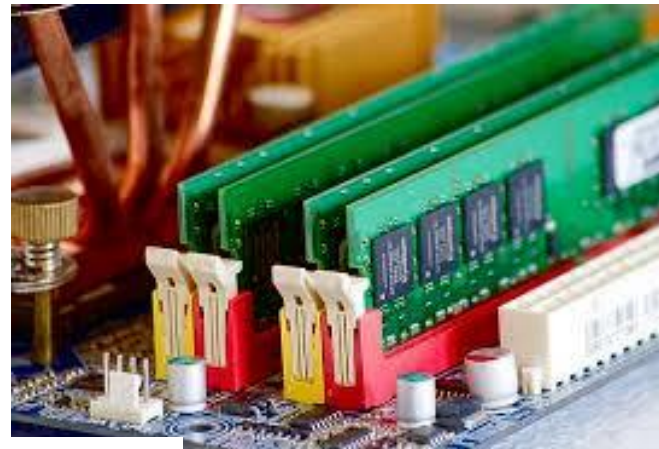
Unit Introduction

- **Primary Storage**, also called main memory or immediate access store (IMAS) is a group of chips that resides in the motherboard of the computer.
- Primary storage device consists of Three types of memory chips:
 1. Random Access Memory
 2. Read Only Memory
 3. Cache
- A memory chip is an Integrated Circuit (IC) made up of millions of transistors and capacitors.



1. Random Access Memory (RAM)

- Hold data and instructions (programs) temporarily while processing is taking place.
- OR RAM, is memory that temporarily holds data and instructions that will be needed shortly by the CPU. RAM is also main memory, internal memory, or primary storage.
- It also holds the data that results from processing.



- Programs and data stored in secondary storage must therefore first be loaded into the RAM before they can be processed.
- Random Access Memory (RAM) □ RAM is volatile: it is temporary and changeable. Operating like a chalkboard that is constantly being written on, then erased, then written on again
- RAM are limited in storage capacity.
- RAM are expensive and are a major determinant of the final price of a computer.

- Random access comes the fact that data can be stored and retrieved at random from anywhere in the electronic RAM chips in approximately equal amounts of time, no, matter what the specific data locations are.
- RAM chips are often mounted on a small circuit board, such as a SIMM (single inline memory module) or DIMM (double inline memory module) which are plugged into the mother board.

SIMM, or single in-line memory module

- **SIMM, or single in-line memory module**, is a type of memory module containing random-access memory used in computers from the early 1980s to the late 1990s.

A DIMM or dual in-line memory module

- A **DIMM** or **dual in-line memory module** comprises a series of dynamic random-access memory integrated circuits. These modules are mounted on a printed circuit board and designed for use in personal computers, workstations and servers.
- One of the differences between the SIMM and the DIMM is that standard SIMMs have a 32-bit data path, while standard DIMMs have a 64-bit data path

RAM chips Cont'd

- Two principal types of RAM chips
 1. DRAM (Dynamic random access memory)
 2. SRAM (Static random access memory) chips, used for some specialized purposes within main memory.

Dynamic random-access memory (DRAM)

- **Dynamic random-access memory (DRAM) is a type of random access semiconductor memory that stores each bit of data in a memory cell consisting of a tiny capacitor and a transistor, both typically based on metal-oxide-semiconductor (MOS) technology**

Static random-access memory (SRAM)

- **Static random-access memory (static RAM or SRAM)** is a type of semiconductor random-access memory (RAM) that uses bistable latching circuitry (flip-flop) to store each bit.
- The term *static* differentiates SRAM from DRAM (*dynamic* random-access memory) which must be periodically refreshed. SRAM is faster and more expensive than DRAM; it is typically used for CPU cache while DRAM is used for a computer's main memory.

2. CACHE

- **A special high speed memory area that the CPU can access much more quickly than main memory or RAM. It can be located on the microprocessor chip or elsewhere on the motherboard. The most frequently used instructions are stored in cache memory so the CPU can look there first. This allows the CPU to run very fast.**



CPU

2nd CACHE

3. Read Only Memory (ROM)

- ROM chips also known as Firmware holds data and instructions necessary for starting up the computer when it is switched on.
- It is commonly used to store system-level programs such as BIOS (Basic Input/output System) program.
- Read Only Memory contains instructions that are fixed at the time of manufacture.



- **Instructions stored in ROM are always there, whether the power is on or not. ROM is therefore non-volatile: it cannot easily be changed, because it is read only.**
- **BIOS (basic input/output system) is the program a personal computer's microprocessor uses to get the computer system started after you turn it on. BIOS is an integral part of your computer and comes with it when you bring it home.**

- **When BIOS boots up (starts up) your computer, it first determines whether all of the attachments are in place and operational and then it loads the operating system.**
- **There are three variations of ROM chips namely; PROM, (Programmable Read Only Memory), EPROM (Erasable Programmable Read Only Memory) and EEPROM (Electrically Erasable Programmable Read Only Memory)**

- PROM or **programmable ROM (programmable read-only memory)** is a computer memory chip that can be **programmed** once after it is created. Once the PROM is **programmed**, the information written is permanent and cannot be erased or deleted.

- EPROM (erasable programmable read-only memory) is programmable read-only memory (programmable ROM) that can be erased and re-used. Erasure is caused by shining an intense ultraviolet light through a window that is designed into the memory chip.

- **EEPROM (electrically erasable programmable read-only memory)** is user-modifiable read-only memory (ROM) that can be erased and reprogrammed (written to) repeatedly through the application of higher than normal electrical voltage. Unlike EPROM chips, **EEPROMs** do not need to be removed from the computer to be modified.

NB

Some people use BIOS and CMOS interchangeably but they are distinct.

- The BIOS is a small program that controls the computer from the time it powers on until the time the operating system takes over. The BIOS is firmware, and thus cannot store variable data.
- CMOS is where the BIOS stores the date, time, and system configuration details it needs to start the computer.

Scoundary Storage Hardware

Unit Introduction

- **(ii) SECONDARY MEMORY** is used by Computer systems to store larger amounts of data, and information more permanently than allowed with primary memory.

Definition of Terminologies

- A **Storage medium** is the physical material on which a computer keeps data. There is a variety of storage media available.
- **Storage Device**.this is the device that reads data from or writes data to a storage medium.eg floppy Disk Drive,CD drive etc
- **Capacity** is the number of bytes (characters) a storage medium can hold.
- A **Storage Device** reads and writes data to and from a storage medium.

Definition of Terminologies (cont)

- **Reading** is the process in which a storage device transfers data, from a storage medium into memory.
- **Writing** is the process in which a storage device transfers data from memory to a storage medium (saving).
- **Access time**, *is a measure of the amount of time it takes a storage device to locate an item on a storage medium.*
- **Transfer rate** *is the speed with which data, instructions, and information move to and from a device.*
- *Transfer rates for storage are stated in KBps (kilobytes per second)*

Categories of Secondary Storage Media

- There is a wide variety of storage devices in the following categories.
- (A) Magnetic media, or
- (B) Optical media and
- (C) Other Types of Storage Media such as
 - Punched Cards
 - USB flash drive
 - Flash memory cards
 - Photographic film
 - Microfilm and Microfiche

(A) Magnetic media

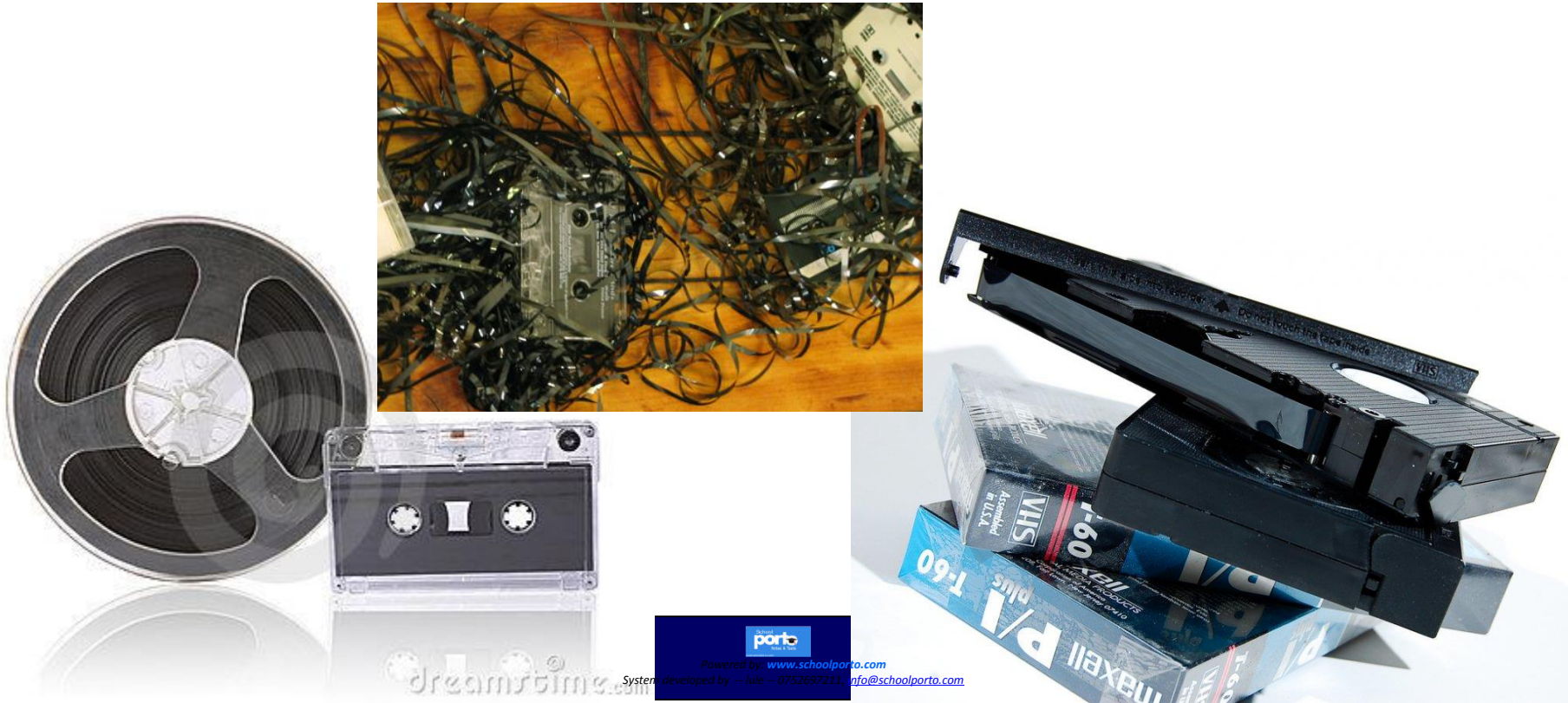
- **Magnetic storage media** represent data as magnetic spots on the tape or disk, with a magnetized spot representing a 1 bit and the absence of such a spot representing a 0 bit.
- **Common examples of magnetic media include:**
 - Magnetic tape**
 - Floppy disk,**
 - Zip and Jaz disks**
 - Hard disks**

(i) Magnetic tape

- Magnetic tape is a magnetically coated ribbon of plastic capable of storing large amounts of data and information at a low cost.
- Tape storage requires sequential access, i.e. data must be accessed in the order in which it is stored hence random data access is not possible

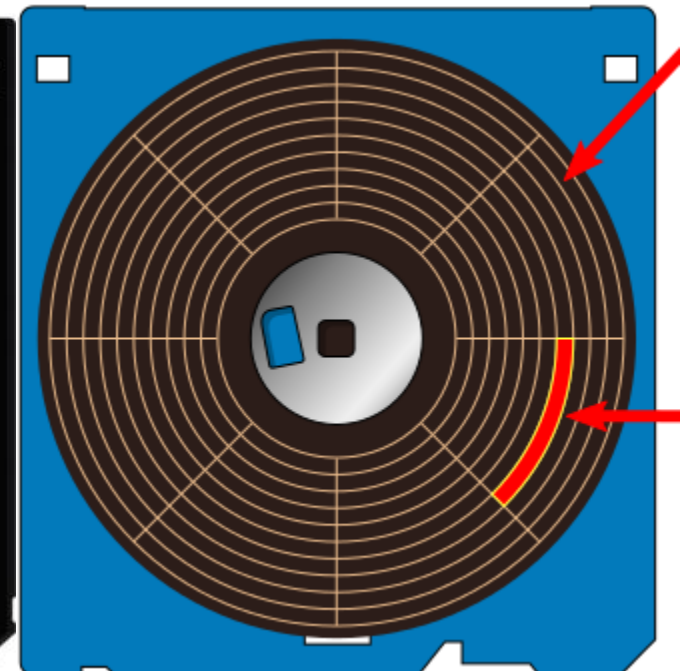
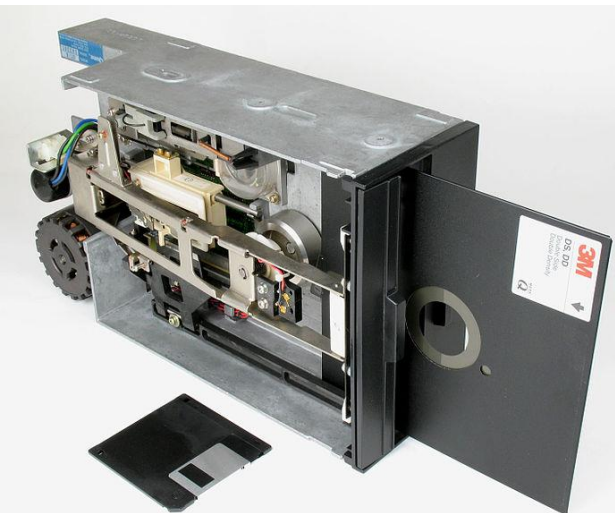
Demerits of Magnetic tapes

- Random data access is not possible.
- Magnetic Tape Data storage has a limited shelf life of about 2 years only.



(ii) Floppy disk (diskette)

- ***A floppy disk, or diskette, is a portable, inexpensive storage medium that consists of a thin circular, flexible plastic disk with a magnetic coating enclosed in a square-shaped plastic shell.***



Floppy disk (...cont)

- A standard floppy disk is 3.5-inches wide and has storage capacities up to 1.44 MB.
- *A floppy disk drive is a device that can read from and write to a floppy disk.*
- Before you can write on a new disk, it must be formatted.
- *Formatting is the process of preparing a disk for reading and writing by organizing the disk into storage locations called tracks and sectors*

- The differences in spelling correspond both with regional differences and with different senses of the word. For example, in the case of flat, rotational data storage media the convention is that the spelling *disk* is used for magnetic storage (e.g. hard disks) while *disc* is used for optical storage (e.g. compact discs, better known as CDs). When there is no clear convention, the spelling *disk* is more popular in American English, while the spelling *disc* is more popular in British English.

Care for diskettes

- A floppy disk should not be exposed to heat, cold, magnetic fields and dust.
- Never leave diskettes in the disk drive.
Diskettes should be rolled up and stored in pencil holders.
- Diskettes should not be inserted or removed from the drive while the red light is flashing.
- Avoid touching the inner magnetic strip of the diskette.

Advantages of Floppy Disks

- Floppy diskettes are portable
- Floppy diskettes are cheap
- Random Data Access on a diskette is possible
- A floppy diskette can be write-protected from being changed.

Disadvantages of Floppy Disks

- Floppy diskettes are not reliable – they need to be handled with a lot of care, else risk losing data.
- Floppy diskettes are not durable.
- Data Access time is relatively slow.
- They have limited Storage capacity (only 1.44MB)

Zip and Jaz drives with media.



(v) Hard disks

- A hard disk, also called hard drive, usually consists of several inflexible, circular metal platters coated with magnetic oxide that can be magnetized to represent data.
- The entire device is enclosed in an air-tight, sealed case to protect it from contamination.
- Hard disks come in a variety of sizes.
- In most personal computers, the hard disk is housed inside the system unit.

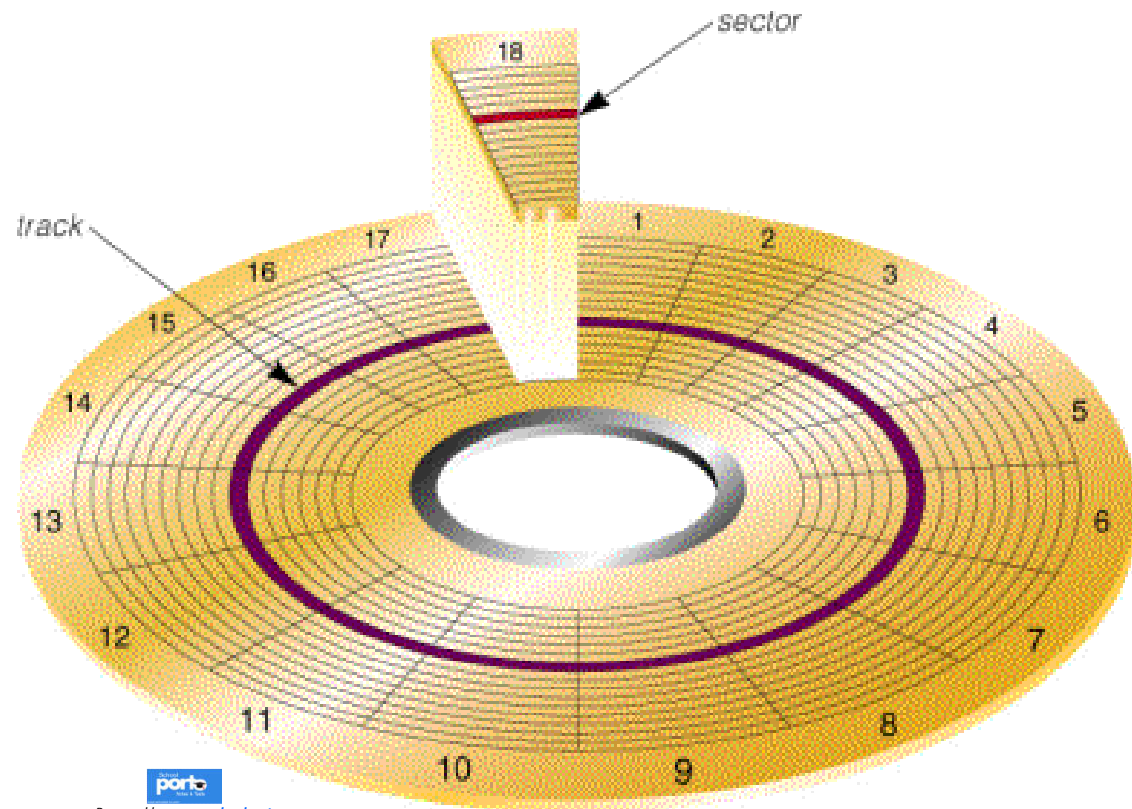
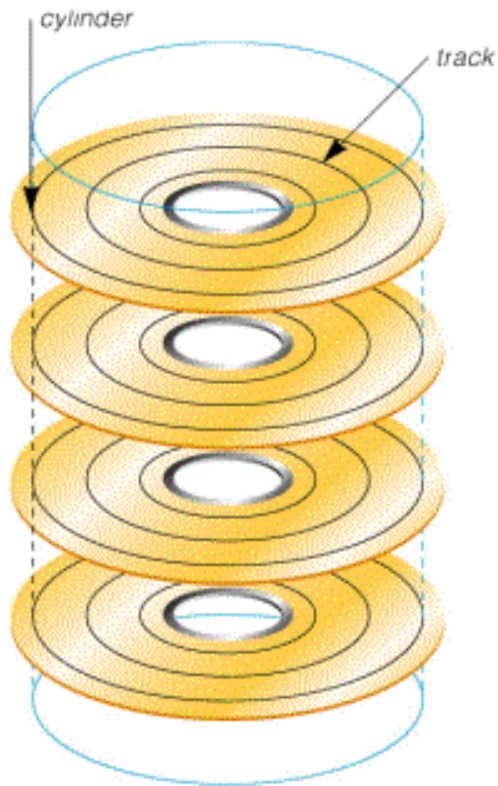


hard disk installed
in system unit



Hard disks (cont)

- A cylinder is the vertical section of tracks through all platters on a hard disk



Hard disks (cont)

- ***A read/write head is the mechanism that reads items and writes items in the hard disk as it touches the disk's recording surface.it is built inside the hard disk hence the name hard drive.***

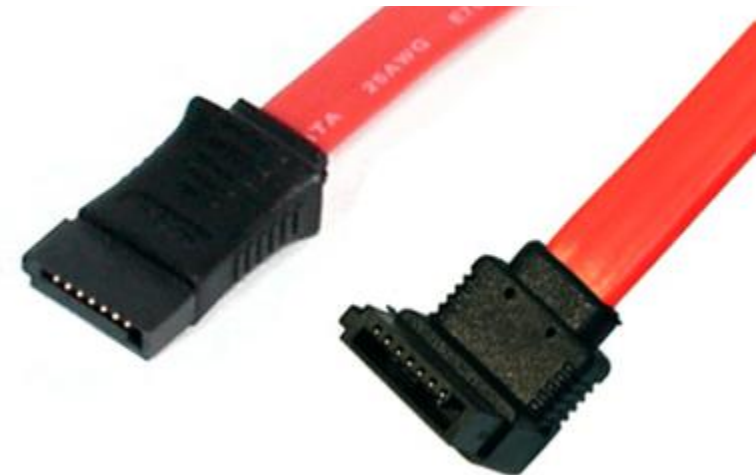
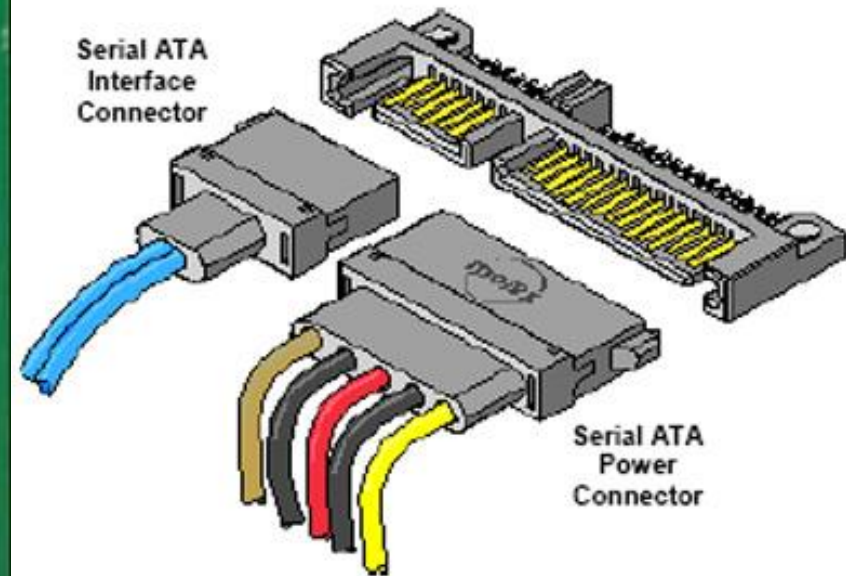
Hard disk interfaces

- The hard disk interface defines the physical means by which the hard disk connects to the rest of the computer.
- There are many disk interfaces:
 - External hard disk interfaces include:
 - USB
 - FireWire
 - Internal hard disk interfaces Include:
 - SATA, (*Serial Advanced Technology Attachment*)
 - EIDE, (*Enhanced Integrated Drive Electronics*)
 - SCSI, (*Small Computer System Interface*) and
 - SAS (*Serial-attached SCSI*)

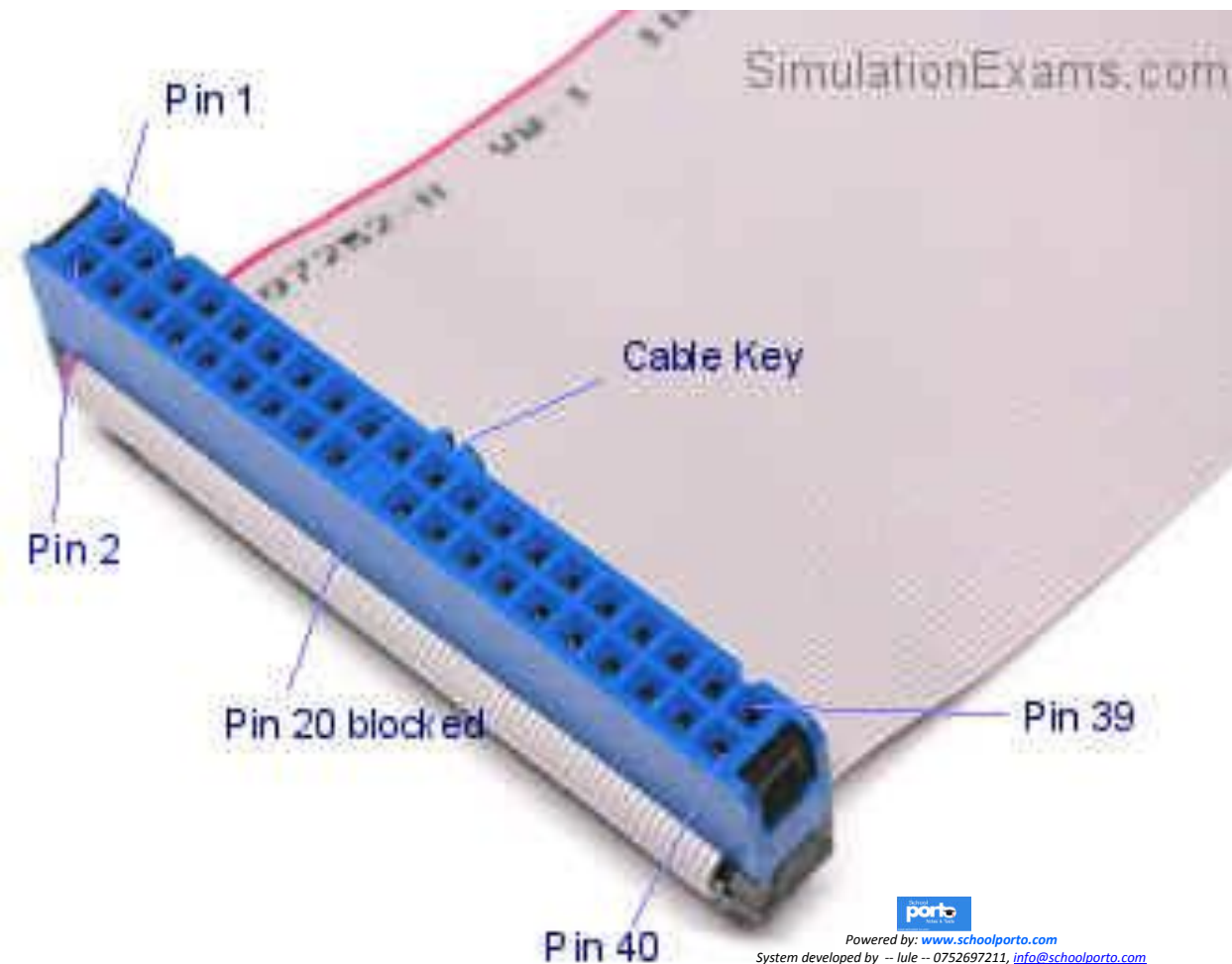
FireWire Interface



SATA Interface



EIDE Interface





SCSI Interface



SCSI (68 pin) Port

Power



Powered by: www.schoolporto.com

System developed by -- lule -- 0752697211, info@schoolporto.com



EIDE-SATA COMPARISON

Types of Hard Disks

- An Internal hard disk is fixed in the system unit and usually stores the operating system required for the computer to work.
- An *external hard disk* is a separate free-standing hard disk that connects with a cable to a USB port or FireWire port.

(B) Optical Media

- Optical storage refers to recording of data by making marks in a pattern that can be read back with the aid of light, usually a beam of laser light.
- The reflected light is converted into a series of bits that the computer can process.
- *An optical disc is a flat, round, portable storage medium made of metal, plastic, and lacquer that is written and read by a laser.*
- Optical discs used in personal computers are 4.75 inches in diameter.
- Smaller computers and devices use mini discs that have a diameter of 3 inches or less.

Care for Optical Disks

- The following should be done for the safety of data on Optical disks:
- Do not expose the disc to excessive heat or sunlight
- Do not eat, smoke or drink near a disc.
- Do not stack disks.
- Do not touch the underside of the disk.
- Always store the disc in a jewel box when not in use
- Always hold a disc by its edges.
- Do not drop the disk to the ground.
- Don't bend the disk.

Care for Optical Disks



Do store the disc in a jewel box when not in use.



Do hold a disc by its edges.

Categories of Optical Disks

- Two general categories are CDs and DVDs, with DVDs having a much greater storage capacity than CDs.
- Examples of Optical Disks include:
 - *CD-ROM (compact disc read-only memory)*
 - The contents of standard CD-ROMs are written by the manufacturer and only can be read and used. A typical CD-ROM holds from 650 MB to 1GB of data,

Picture CD

- ***A Picture CD is a compact disc that only contains digital photographic images saved in the jpg file format.***
- ***You can purchase Picture CDs that already contain pictures.***
- ***A Picture CD is a multisession disc, which means you can write additional data to the disc at a later time.***

CD-R (compact disc-recordable)

- ***CD-R (compact disc-recordable) is a technology that allows you to write on a compact disc using your own computer's CD-R drive.***
- **Once you have recorded the CD-R, you can read from it as many times as you desire.**
- **A CD-R is a multisession optical disc which allows you to write on part of the disc at one time and another part at a later time.**
- **However, you cannot erase the disc's contents.**

CD-RW

(compact disc-rewritable)

- A CD-RW (compact disc-rewritable) is an erasable multisession disc that you can write on multiple times.
- Reliability of the disc tends to drop, however, with each successive rewrite.
- To write on a CD-RW, you must have a CD-RW drive and CD-RW software.
- A CD-RW drive has a lower read and write speed as compared to CD-Rs

Magneto-optical (MO) disk

- This is a hybrid disk, that combines the best features of magnetic and optical disk technologies.
- It has the erase and rewrite capabilities of magnetic disks, but it also has the very high-volume density capabilities of optical disks.
- MO disks are not popular because they are too expensive, and not as reliable as magnetic media.

DVDs

- ***DVD-ROM (digital video disc-ROM). A DVD-ROM is an extremely high capacity compact disc capable of storing from 4.7 GB to 17GB.***
- **In order to read a DVD-ROM, you must have a DVD-ROM drive, which can also read CDRoms.**
- **DVDs are also available in a variety of recordable and rewritable versions and formats such as DVD-R and DVD+R *DVD+RW, DVD+RE, and DVD+RAM.***

High Capacity DVD formats

- A *Blu-ray Disc-ROM (BD-ROM)* has storage capacities of up to 100 GB.
- The *HD (high-density) DVD-ROM* has storage capacities up to 60 GB.
- A mini-DVD that has grown in popularity is the *UMD (Universal Media Disc)*, which can store up to 1.8 GB of games, movies, or music.

Other Types of Storage Media

- **1. Punched Cards**
- **A punched card/punch card/ IBM card, or Hollerith card is a piece of stiff paper that contains digital information represented by the presence or absence of holes in predefined positions.**
- **Early digital computers used punched cards.**

Punched cards



- An 80-column punched card of the type most widely used in the 20th century.

USB flash drive

- **A USB flash drive is a flash memory storage device that plugs in a USB port on a computer**
- **USB flash drives are convenient for mobile users because they are small and lightweight enough to be transported in a pocket.**
- **Current USB flash drives have data storage capacities ranging from 256 MB to 64 GB.**
- **USB flash drives have become the mobile user's primary portable storage device, making the floppy disk nearly outdated.**

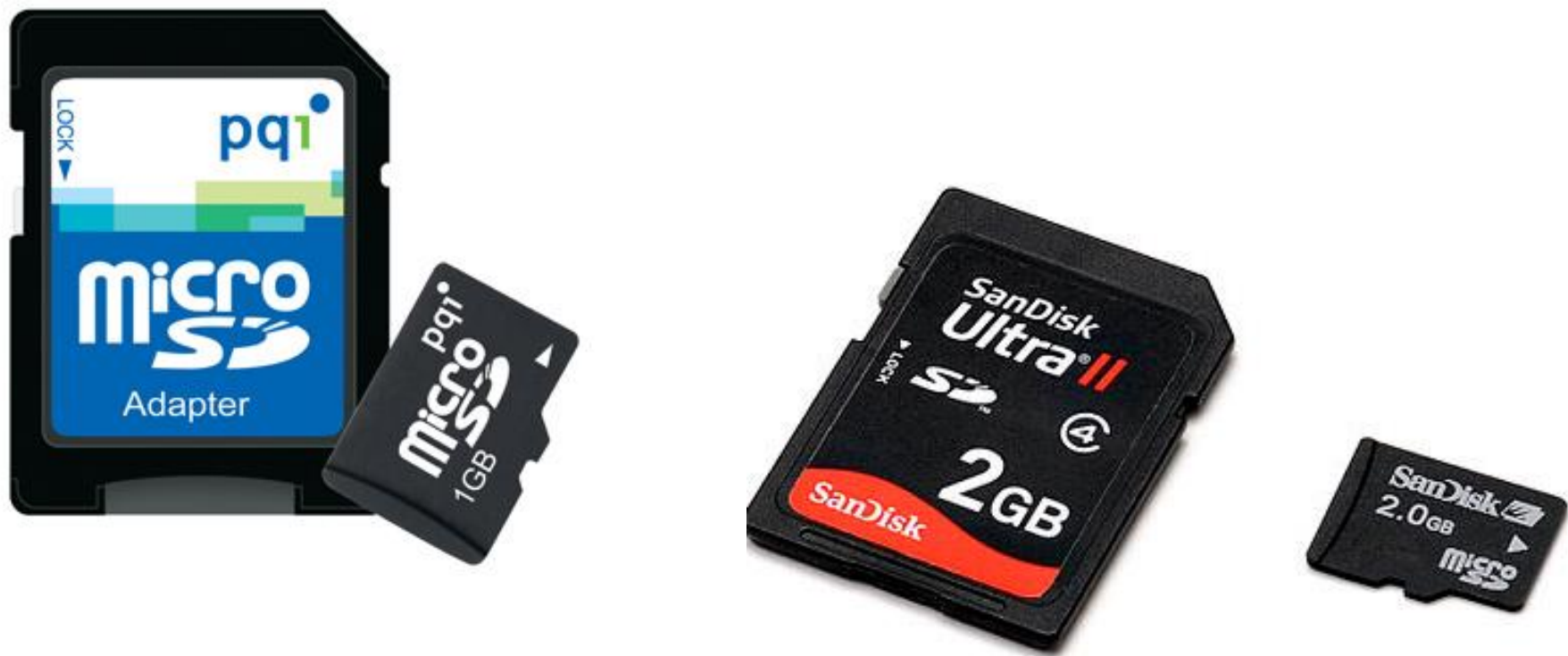
USB flash drive



Flash memory cards

- Flash memory cards are a type of solid-state media, which means they consist entirely of electronic components and contain no moving parts.
- Common types of flash memory cards include Memory Stick, CompactFlash (CF), SmartMedia, microSD, miniSD, xD, Picture Card, etc.
- They are commonly used in electronic devices such as digital cameras and mobile phones. They are tiny, re-recordable, and able to retain data without power.
- Depending on the device, manufacturers claim these storage media can last from 10 to 100 years.

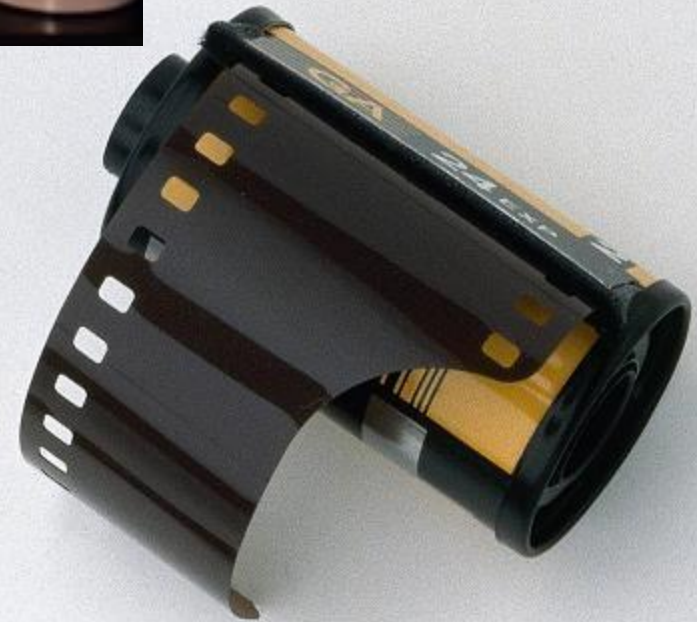
Flash memory cards



Photographic film

- **Photographic film is a sheet of plastic such as polyester coated with a light sensitive emulsion, that is used to record and store photographs.**

Photographic film



Microfilm and Microfiche

- These are media used to store microscopic images of documents on roll or sheet film.
- The images are recorded onto the film using a device called a computer output microfilm recorder.
- The stored images are so small they can be read only with a microfilm or microfiche reader.
- Microfilm and microfiche have the longest life of any storage medium.
- Libraries use these media to store back issues of newspapers, magazines, and genealogy records.

Microfilm and Microfiche

