Ch. 1: Computer System

part I

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Chapter 1   Computer System

- **Computer Classification**

- **Data Representation in Computer System**

- **Components of Computer System**

  - **Hardware**
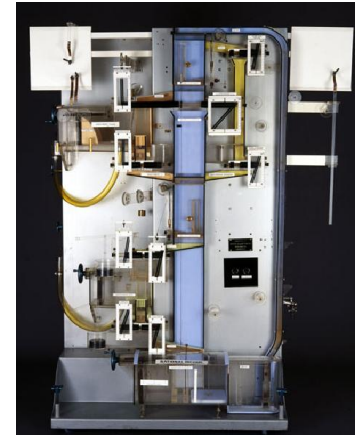
  - **Software**

  - **Peopleware**

Computer Classification

- **Classified by data handling**

- **Classified by work purposes**

- **Classified by size**

Classified by data handling

1. Analog Computer

- continuous (approximate) values

- real time processing

2. Digital Computer

- Discrete Value

- Data are represented as 0 and 1

- More accuracy than analog computer
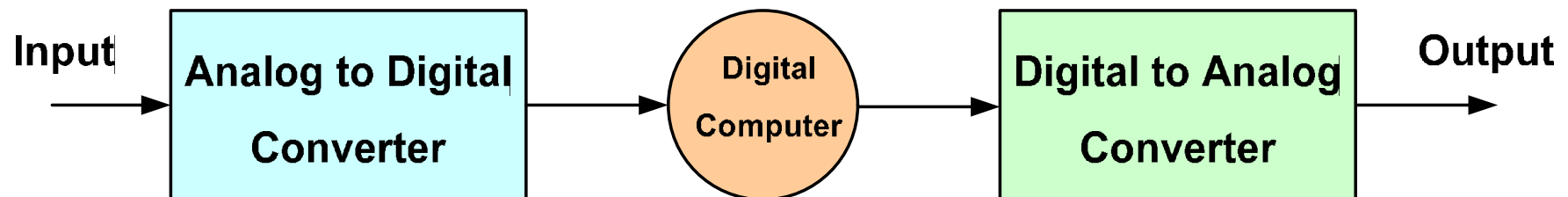

Phillips Hydraulic Computer

Personal Computer

Classified by data handling

3. Hybrid Computer

● A merge between an analog computer and a digital Computer

● Uses Converter b/w analog and digital

Input → | Analog to Digital Converter | → (Digital Computer) → | Digital to Analog Converter | → Output

Classified by work purposes

1. General Purpose Computer

- **Desktop Computer, Notebook Computer, Mobile Devices**

2. Special Purpose Computer

- **Embedded Computer**

- **Elevator, washing machine, Car**

Ref: http://sethf.com/infothought/blog/archives/000042.html

Classified by Capacity

1. **Embedded Computer**

2. **Microcomputer, Personal Computer**

3. **Workstation, Server**

4. **Mainframe**

5. **Supercomputer**

Embedded Computer

- **Computers that are a part of a machine or device**

- **execute a program that is stored in non-volatile memory**

Microcomputer, Personal Computer

- **Microcomputers are the most common type of computers used by people today**

  - Desktop computers, Notebook computers, Game consoles, Mobile devices

Workstation, Server

- high-end microcomputer designed for technical or scientific applications.

- They are optimized for the visualization and manipulation of different types of complex data and also mutitasking

  - 3D mechanical design, engineering simulation , (e.g. computational fluid dynamics), animation and rendering of images, and mathematical plots

Mainframe

- **high reliability and security**

- **Emphasizes on reliable of transactions**

- **High hardware and computational utilization rates to support <u>massive throughput</u>**

- **Run uninterrupted for long periods of time.**

Supercomputer

- **Emphasizes on speed of calculation**

- **Scientific and engineering problems (high-performance computing) with high precision**


Fujitsu K Computer, @Kobe, Japan

Cray Titan, @Oak Ridge, USA

Data representation in Computer System

- **Bit** is the basic unit of information in computing and digital communications (value of 0 or 1)

- **Byte** unit of information most commonly consists of eight bits. Historically, the byte was the number of bits used to encode a single character of text in a computer.

1 byte

1 0 1 1 0 0 1 0

1 bit

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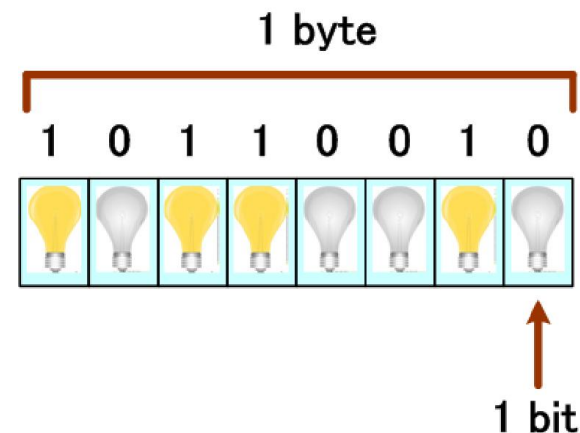
Data representation in Computer System

Bit – Byte examples

0	1 bit
1	1 bit
1011	4 bit
10100011	8 bit or 1 byte

Binary   = base 2
Decimal   = base 10

ASCII Character Code

Binary	Decimal	Character
0010 1010	42	*
0010 1011	43	+
0011 0001	49	1
0011 0010	50	2
0100 0001	65	A
0100 0010	66	B
0100 0011	67	C
0100 0100	68	D

Data Capacity

1 Kilobyte (KB)	1024 Bytes (2^{10} Bytes)
1 Megabyte (MB)	1024 Kilobytes
1 Gigabyte (GB)	1024 Megabytes
1 Terabyte (TB)	1024 Gigabytes
1 Petabyte (PB)	1024 Terabytes

Hardware

❖ **The collection of physical elements that constitute a computer system**
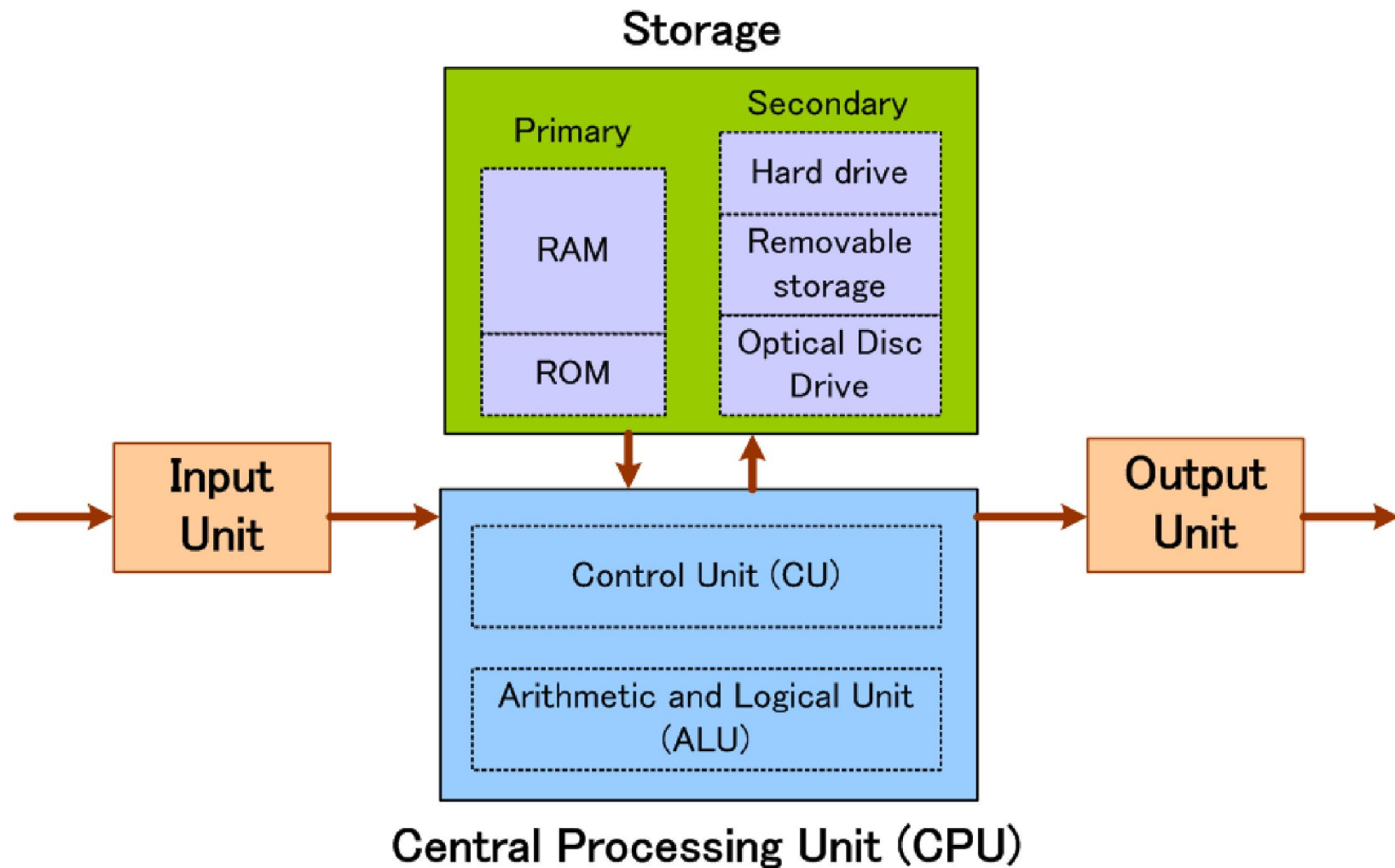
1. **Input Unit**

2. **Central Processing Unit**

3. **Output Unit**

4. **Memory, Storage**

   • Primary Storage, Main Memory

   • Secondary Storage
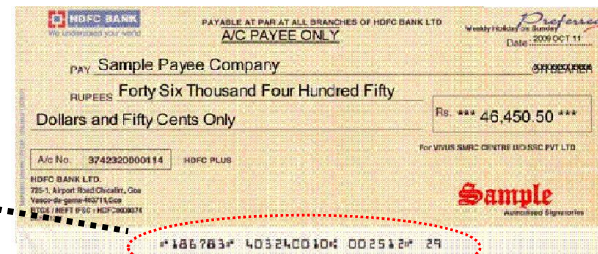
Computer Components

Input Unit

1. **Keyboard**

2. **Mouse**

3. **Touch pad**

4. **Scanner**

5. **Microphone**

6. **Fingerprint reader**
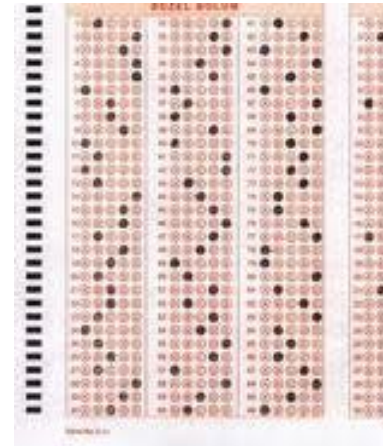
7. **Barcode reader**

Input Unit

8.   Magnetic Ink Character Recognition: MICR

9.   Optical Mark Reader: OMR

Input Unit

10.   QR code reader

11.   Contactless smart card reader

Central Processing Unit

Central Processing Unit (CPU)

- **The hardware within a computer that carries out the instructions of a computer program**

- **Performing the basic**

  - arithmetical,

  - logical, and

  - input/output

- **Microprocessor**

  - More than one processor in a chip, multiprocessor.

Central Processing Unit

- **CU: Control Unit**

  - Extracts instructions from memory and decodes and executes them calling on the ALU when necessary

- **ALU: Arithmetic Logic Unit**

  - Performs arithmetic and logical operations

Output Unit

- **Soft Copy**

    - **Monitor**

        - Cathode Ray Tube (CRT)

        - Liquid Crystal Display (LCD)

    - **Speaker**

Output Unit

Output Unit

- **Hard Copy**

  - **Printer**

    - Impact Printer : *Dot matrix printer*

    - Non-impact Printer : *Laser, Inkjet printer*

  - **Plotter**

Memory or Storage Unit

❖ **Primary / Main Memory**

- **ROM: Read Only Memory**

- **RAM: Random Access Memory**

❖ **Secondary Memory**

- **SAS: Sequential Access Storage**

- **DAS: Direct Access Storage**

Primary / Main Memory

- **ROM (Read Only Memory)**

    - Read Only (sort of)

    - Non-volatile (Requires no power to maintain data)

- **RAM (Random Access Memory)**

    - Allows stored data to be accessed directly in any random order.

    - Store data and instruction temporarily to be calculated by CPU

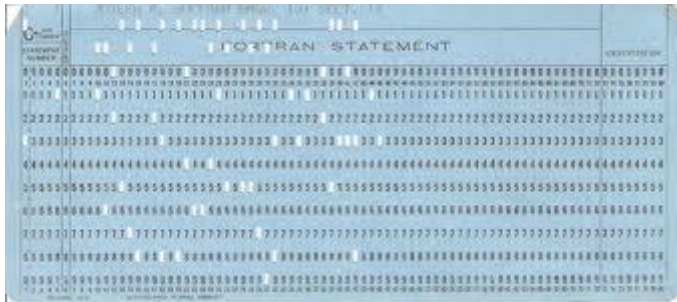   - Volatile (Requires power to maintain data)

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SAS: Sequential Access Storage

➤ **A class of data storage devices that read their data in sequence.**

➤ **Slower access to non serial data.**

Examples

- **Paper Tape**

- **Punch Card**

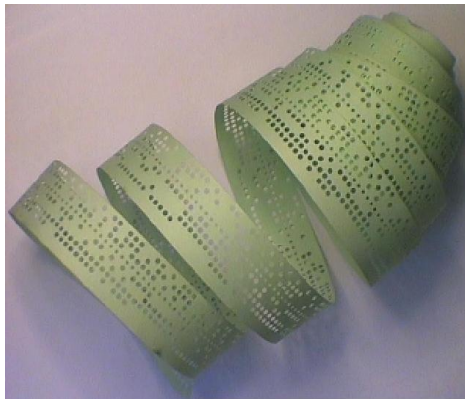- **Magnetic Tape**

SAS: Sequential Access Storage

Punch Card

Magnetic Tape

Paper Tape

DAS: Direct Access Storage

➢ **Relatively low access time relative to its capacity**

➢ **The access methods: Sequential, Indexed and Direct.**

- **Magnetic**

  - Hard Disk

  - Diskette or Floppy Disk

- **Optical**

  - Compact Disc (CD)

  - Digital Versatile Disc (DVD)

  - Blu-ray Disc (BD)

- **Solid State**

  - USB Flash Drive

  - Solid State Drive (SSD)

Magnetic Disk Details

- **Sector:** smallest unit of data that can be read or written from a disk. Typically, sectors are 512 bytes in size, but other sizes including 1024 and 2048 are common.

- **Cluster:** A cluster is the smallest unit of data that a file system can allocate for a file. (e.g. 512 – 4,096 bytes for NTFS)
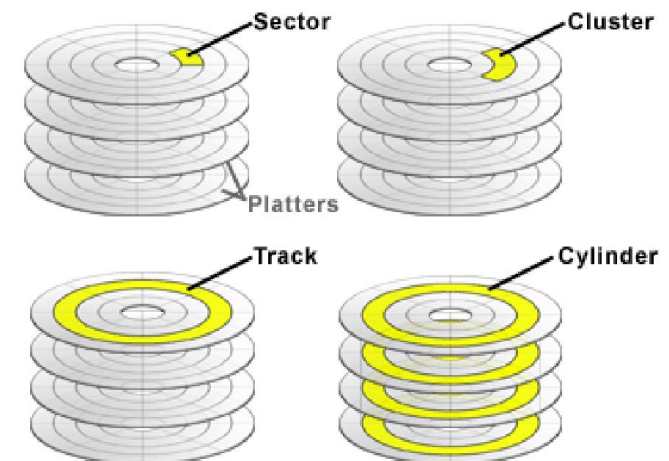
- **Track:** A track is a concentric ring of sectors on a platter.

- **Cylinder:** A cylinder is a group of tracks in all the platters

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CD and DVD

- The data is stored on the disc with a laser or stamping machine, and can be accessed when the data path is illuminated with a laser while spinning.

- CD storage capacity: 650 – 870 MB

- DVD storage capacity: 4.7 – 17 GB

- **CD-ROM**	- **DVD-ROM**	- **DVD-RW**
- **CD-R**	- **DVD-R**	- **DVD+RW**
- **CD-RW**	- **DVD+R**	- **DVD-RAM**

Blu-ray Disc

- Optical disc storage medium designed
  to supersede the DVD format.

- Blu-ray Disc uses a 405 nm "blue" laser diode.

- **Single layer: 25 GB**

- **Double layer: 50 GB**

- **Triple layer (BDXL): 100 GB**

- **BD-R (Blu-ray Disc Recordable)**

- **BD-RE (Blu-ray Disc Rewritable)**

Solid State Storage

- No Moving part

- Faster as data can be retrieved directly from various locations

- More expensive per unit of storage than HDDs.

- i.e. USB Memory, SD Card, Solid State Drive (SSD)