Introduction to Computer System

SARCAR Sayan
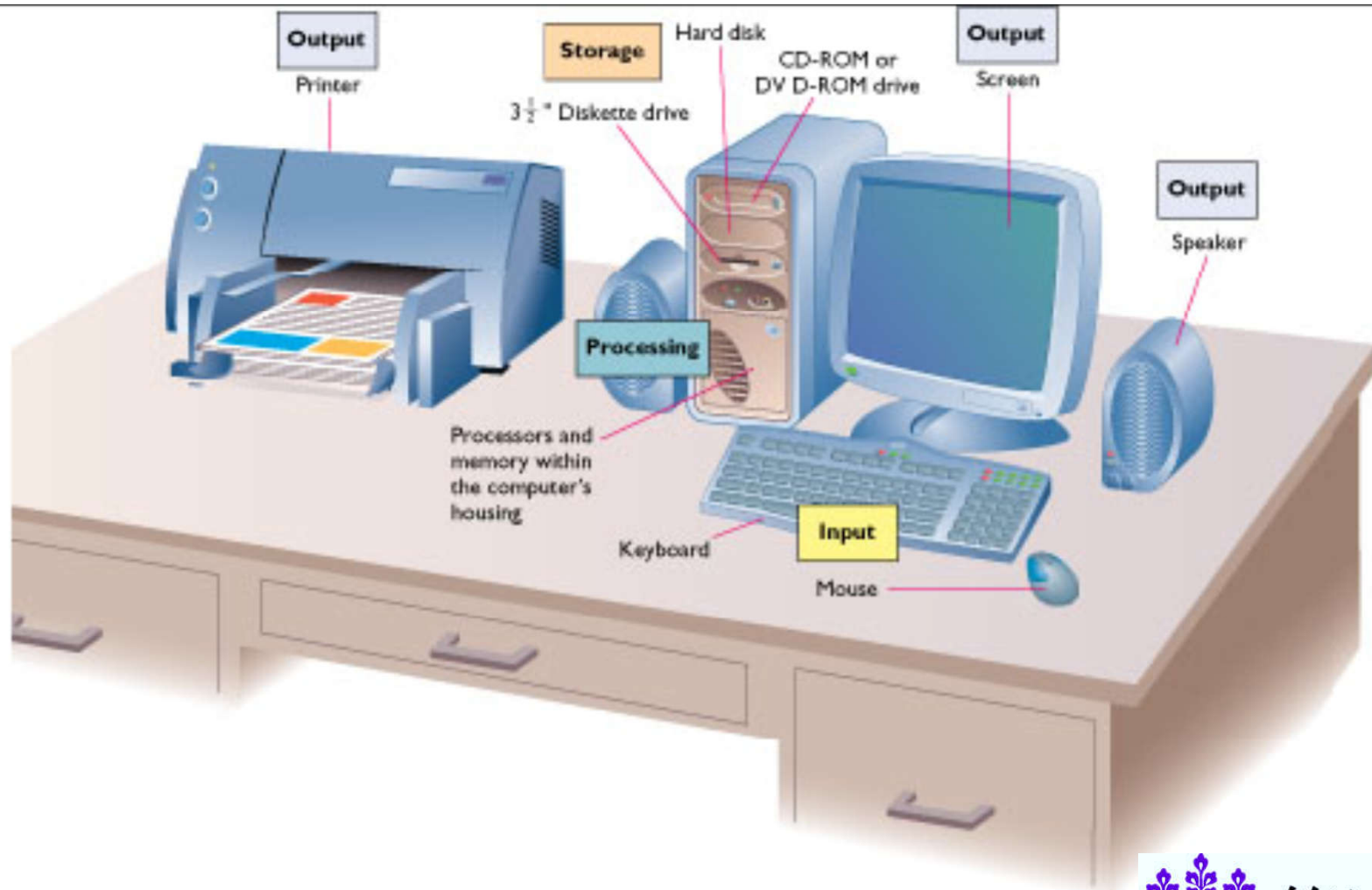
Faculty of Library, Information, and Media Science
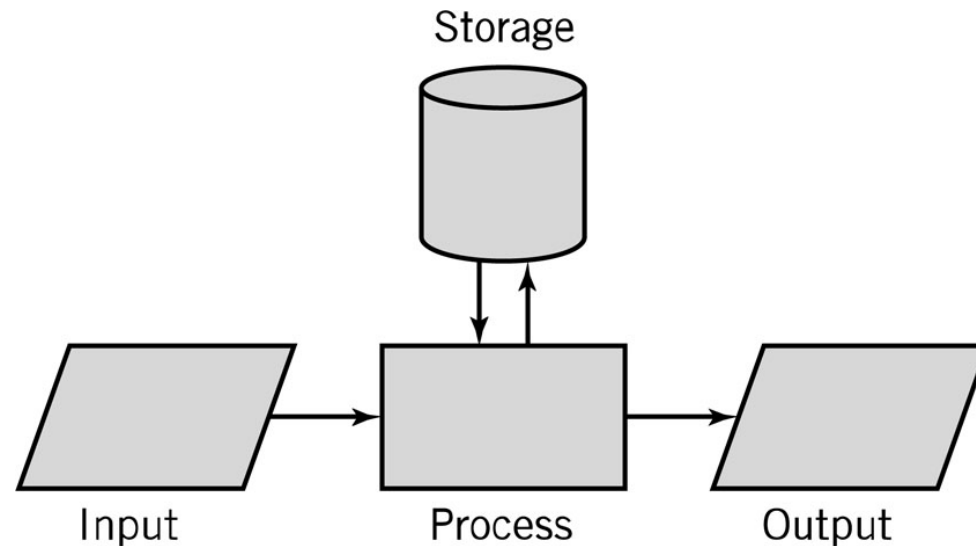
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Contents

- Computer components

- Detailed info of each of them

- Questions for discussions
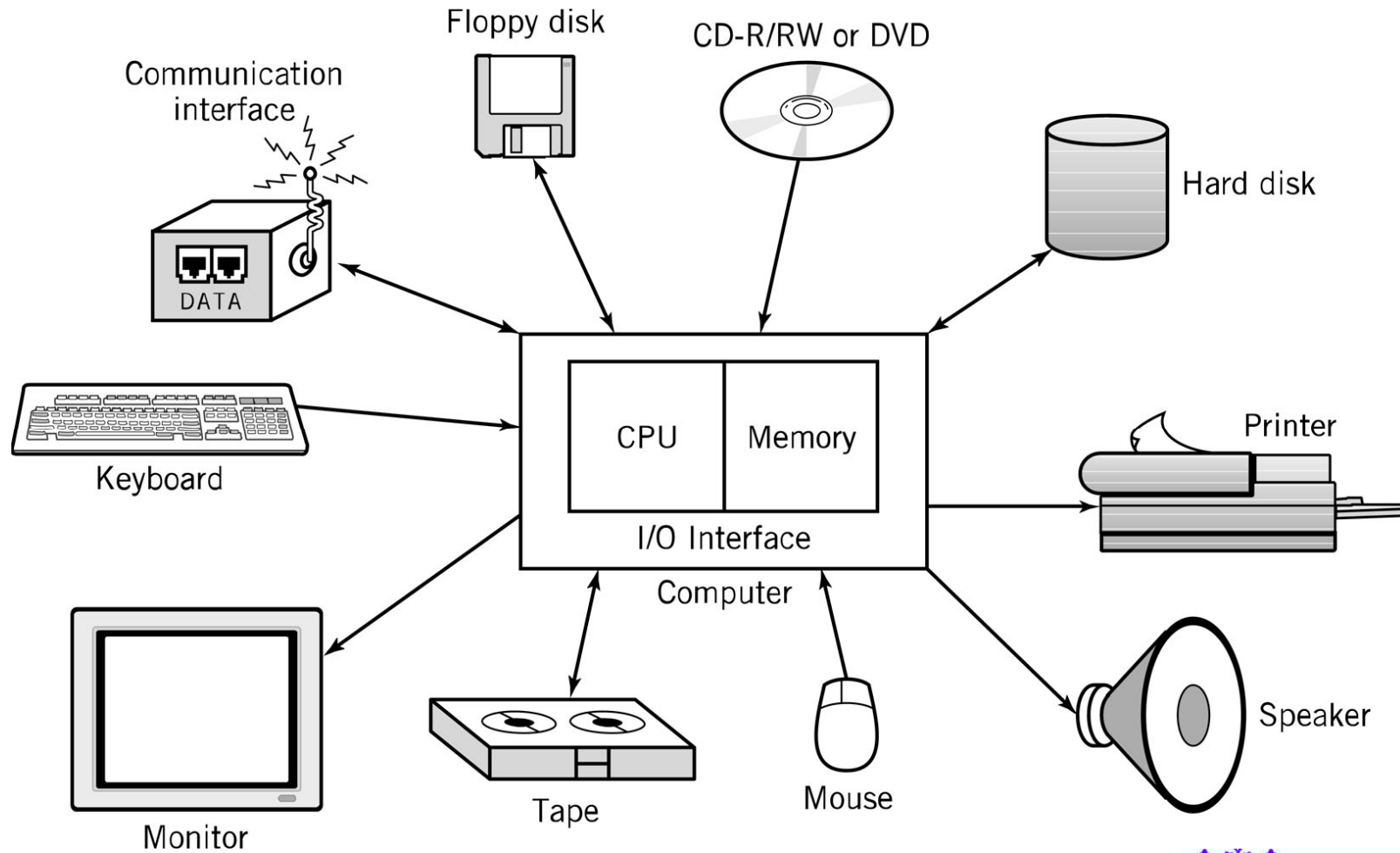
- Homework

Today's Computer

Computer Model

- Input: keyboard, mouse, scanner, punch cards
- Processing: CPU executes the computer program
- Output: monitor, printer, fax machine
- Storage: hard drive, optical media, diskettes, magnetic tape

Computer Components

Computer Components

- CPU
- Mother Board
- Memory
- Hard Disk
- Display
- Keyboard
- Mouse
- Power Supply
- Network Interface

Computer Components

CPU – Central Processing Unit (Microprocessor) consists of three parts:

Control Unit
- Execute programs/instructions: the machine language
- Move data from one memory location to another
- Communicate between other parts of a PC

Arithmetic Logic Unit
- Arithmetic operations: add, subtract, multiply, divide
- Logic operations: and, or, xor
- Floating point operations: real number manipulation

Registers

CPU speed is influenced by several factors:
Clock speed: Megahertz, Gigahertz
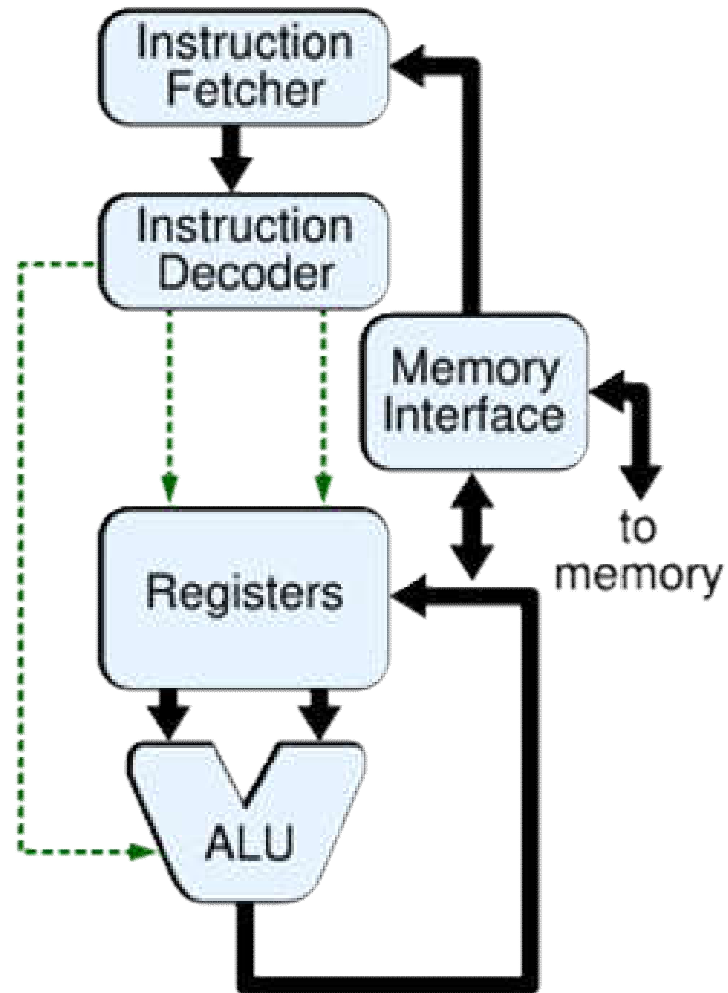Word size : 32-bit or 64-bit word sizes
Cache: Level 1, Level 2 caches
Instruction set size

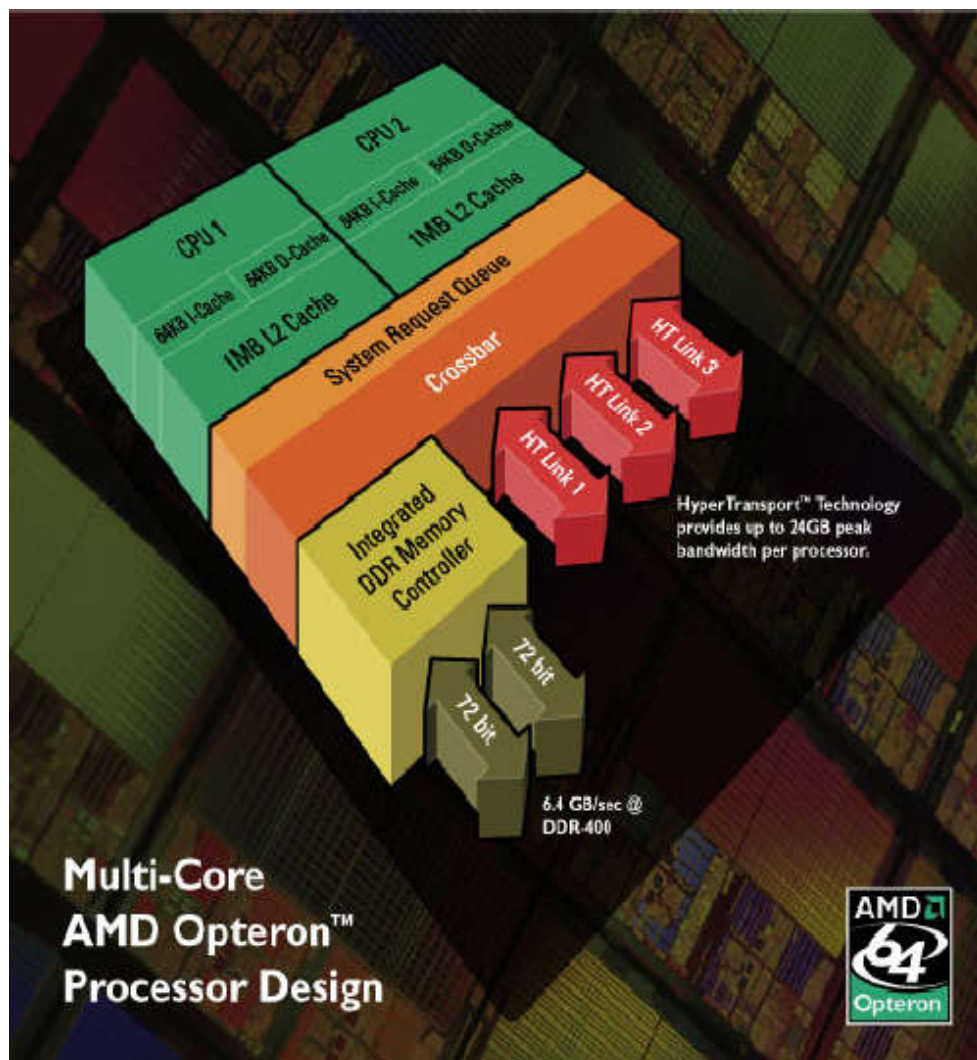Single Core/Multi Core

Processor Architecture

Multi-core Processor Architecture

CPU

- Desktop Processor: Intel (Pentium) Core 2 Duo/Quad, AMD Athelon (Dual/Quad Core)

- Mobile Processor: Intel (Centrino 2) Core 2 Duo, AMD Turion (Dual Core)

- Server Processor: Intel Xeon Quad Core, AMD Optron Quad Core, RISC (Reduced Instruction Set Computer): IBM Power PC, SUN SPARC ..

- Atom Processor

Memory

ROM: For BIOS (Basic Input Output System)

CMOS RAM: Battery-backed memory used to store system specific parameters required by the system BIOS to boot. It also stores the system clock information.

Cache: Static RAM attached to the CPU and used for storing current data. L1, L2, L3 Cache

RAM: Dynamic RAM and used for storing Data and programs which disappear after task completed or power turned off

Size: ex. 512MB, 2 GB ..
Speed: ex. 533MHz, 667 MHz ..
Type: ex. DDR2/3 SDRAM (Double Data Rate Synchronous RAM)
Packaging: DIMM, SIMM…

Hard Disk

- Magnetic storage device. It stores data by magnetizing particles on a disk.
- Used to store operating system, application software, utilities & data.
- Metal, plastic, or glass platter(s)
- 2 magnetic surfaces/platter
- 1 or more platters per spindle
- 3,600 – 15,000 rpm
- 1 head/platter
- Head(s) move in and out
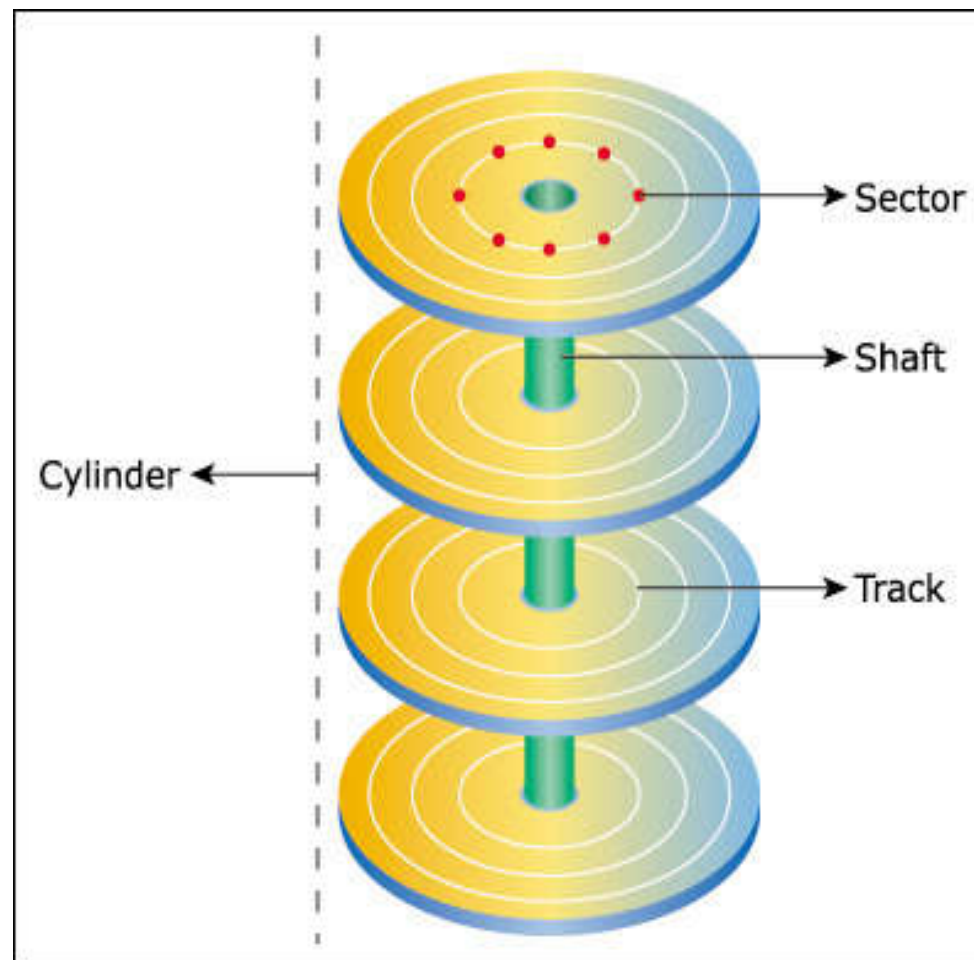
Hard Disk

Tracks-
- Circular areas of the disk
- Length of a track on circumference of disk
- Over 1000 on a hard disk
- Data first written to out most track

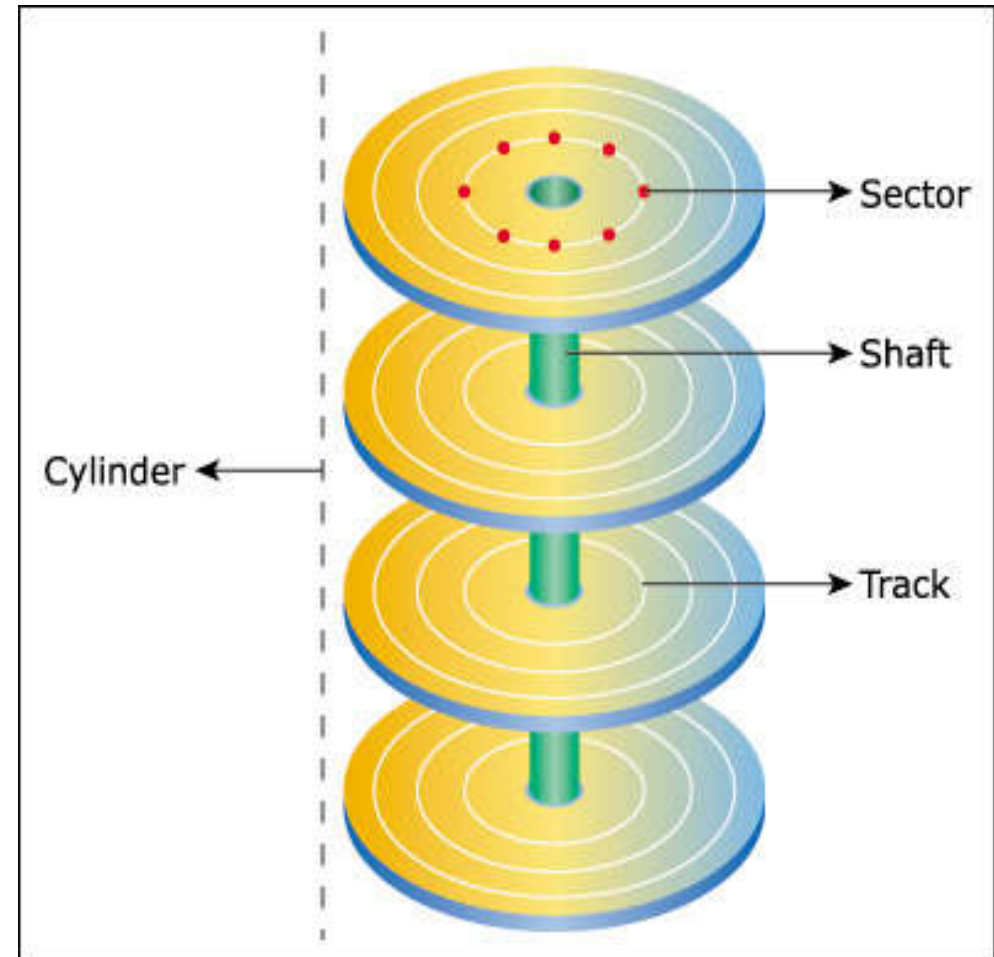Sectors-
- Divides tracks sections

Cylinders-
- Logical groupings of the same track on each disk surface in a disk unit

Clusters-
- Groups of sectors used by operating system
- 64 sectors in one cluster

Data stored in blocks (pages) of .5 to 8 KB

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Hard Disk

IDE: Obsolete, also called PATA (Parallel Advanced Technology Attachment), I/O Rate: 16 MB/s originally later 33, 66, 100 and 133 MB/s ,

SATA (Serial ATA): Used in Desktops/Laptops, I/O Rate: 1.5/3 Gbps, 5400/7200 RPM

SCSI (Small Computer System Interface): Used in Servers, 10/15K RPM, I/O Rate: 160/320 MB/s

SAS (Serial Attached SCSI): Used in Servers, 10/15K RPM

I/O Rate: 3 Gbps

FC (Fiber Channel): I/O Rate 4 Gbps, Expensive and used in Storage

iSCSI: I/O Rate 4 Gbps, Expensive and used in Storage

Solid State Drive: non-volatile flash memory

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Hard Disk

Low-level format: organizes both sides of each platter into tracks and sectors to define where items will be stored on the disk.

Partitioning: divide hard disk into separate areas called partitions; each partition functions as if it were a separate hard disk drive.

High-level format: defines the file allocation table (FAT) for each partition, which is a table of information used to locate files on the disk.

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Mother Board

Holds CPU, memory, PCI bays, etc

FC-PGA Socket for Intel Pentium®III or Celron® processors

ATX power supply connector

Fan header

One AGP slot
VL-bus

AC' 97-2 Channel Audio CODEC on board

Six PCI Slots

Standard IrDA header
Wake on LAN header
CNR slot

Two USB connectors
PS/2 mouse port connector

PS/2 keyboard port connector

Fan header

Three 168-pin DIMM sockets support SDRAM modules

Intel 815 + ICH2
Secondary IDE connector

Primary IDE connector

Floppy port connector

Fan header
2 USB headers

Standard/EPP/ECP parallel port connector
16550 fastUART compatible serial port connector (COM2)
VGA connector
MIDI/GAME port
Line out ,Line in , MIC in

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CD/DVD Drive

CD (Compact Disk)

- Capacity is 700 to 800 MB
- Optical storage device. Data is read from CD by a laser.
- Stores data as light and dark spots on the disk surface.
- They have an unlimited life-span.
- RO & RW CDs
- I/O Rate is Nx where 1x is 150KB/s, Read & Write speeds are not same, upto 52x speeds available

DVD (Digital Video Disk)

- 4.7 GB
- RO & RW DVDs
- I/O Rate is Nx where 1x is 1.35MB/s, Read & Write speeds are not same, upto 20x speeds available

Blu Ray

- Upto 50 GB
- User Blue Laser

Adapters (Expansion Cards)

- Use PCI Bus – Peripheral Components Interconnect (32/64 bit, Data Transfer Rate: 133 MB/s)

- Mini PCI – used in laptops, 32 Bit, 33 MHz

- PCI Express – Replacing PCI, 32/64 Bit, Data Transfer Rate: 8 GB/s

- Adapters (Often Integrated on Motherboard)
    - Video
    - Sound
    - Network Interface Card (NIC)
    - Modem
    - TV Tuner

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Power Supply

- SMPS (Switched Mode Power Supply)

- AC mains input is converted to DC voltage which feeds the Motherboard, drives and other devices.

- ATX (Advanced Technology Extended)

- Generally 90 - 250 watts

Display

- CRT (Cathode Ray Tube)
    - Electron Gun & Florescent Screen
    - Single Gun for Monochrome and 3 Guns for Colour Screen

- LCD (Liquid Crystal Display)
    - About blocking light when not needed
    - TFT LCD (Thin Film Transistor LCD)
    - 19" in Desktop and 15" in Laptops

- Power Consumption
    - CRT – 110 watt
    - LCD – 30-40 watt

- Colour Depth: 65,000 colours, 24 million colours

- Resolution: 1024x768, 1280x1024, 1600x1200

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Keyboard

- 101-key Enhanced keyboard

- 104-key Windows keyboard, 3 more keys.

- Press the Key - Detect the position on the key matrix (16 bytes)

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Mouse

Mechanical

- Use two rollers (one vertical and one horizontal) to track motion
- Rolled by the Track ball

Optical

- Use a tiny camera to tracking the motion
- LED (red light beamer)

IntelliMouse

- Extra wheel

Network Interface

- 10/100/1000 Integrated Network Interface

- 802.11 a/b/g/n Wireless Interface in Laptops

I/O Ports

Parallel port
- Parallel because it can move a whole byte at a time
- Mainly used for connection to a printer

Serial port (Com port)
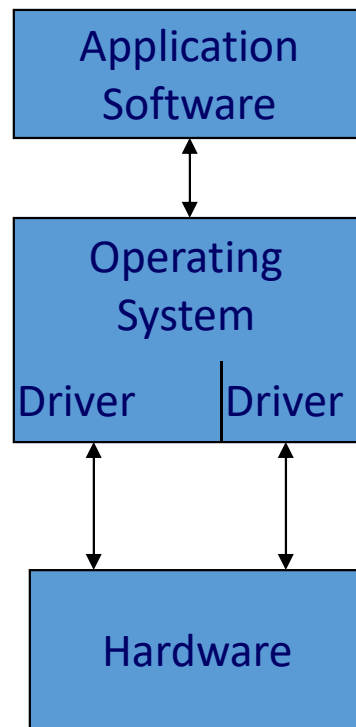- One bit at a time   -- Uses thin cable

Universal serial bus (USB) replaces those
- 4 wires (2 for power & 2 for communication)
- Upto 60 MB/s
- USB Pen Drives, Printers, External Disks, Drives etc.

Printers

- LaserJet (Mono & Color)
- Inkjet
- Dot Matrix
- Line

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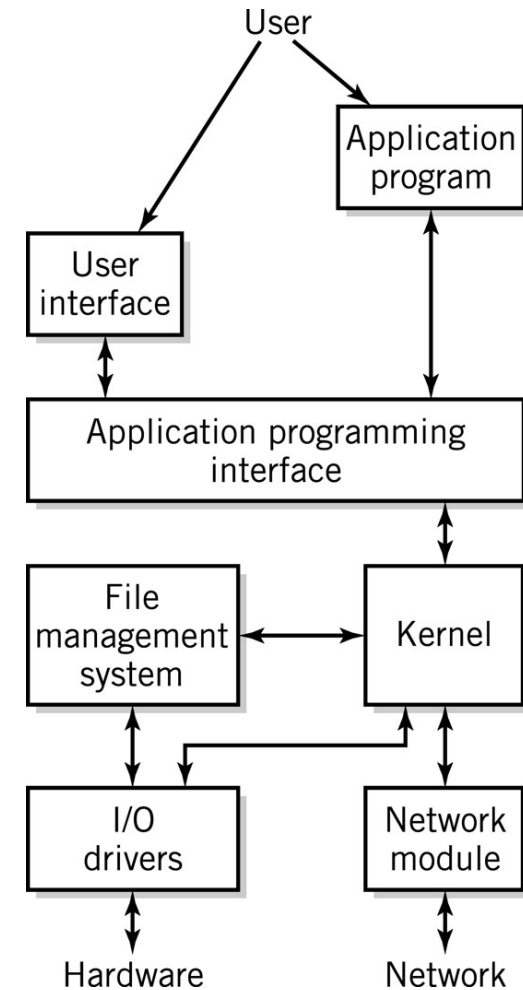*University of Tsukuba*

OS and Application Software

Software Components

Applications

Operating System
- API: application program interface
- File management
- I/O
- Kernel
  - Memory management
  - Resource scheduling
  - Program communication
  - Security
- Network Module

What is an Operating System

Operating System handles
- Memory Addressing & Management
- Interrupt & Exception Handling
- Process & Task Management
- File System
- Timing
- Process Scheduling & Synchronization

Examples of Operating Systems
- Single-user, Single-task: PalmOS
- Single-user, Multi-task: MS Windows and MacOS
- Multi-user, Multi-task: UNIX, Windows Server 2003/2008

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Application Software

Application Software performs a task
for the user

- Word – letters, memos
- Internet Explorer - Browser
- Outlook – Mail Client

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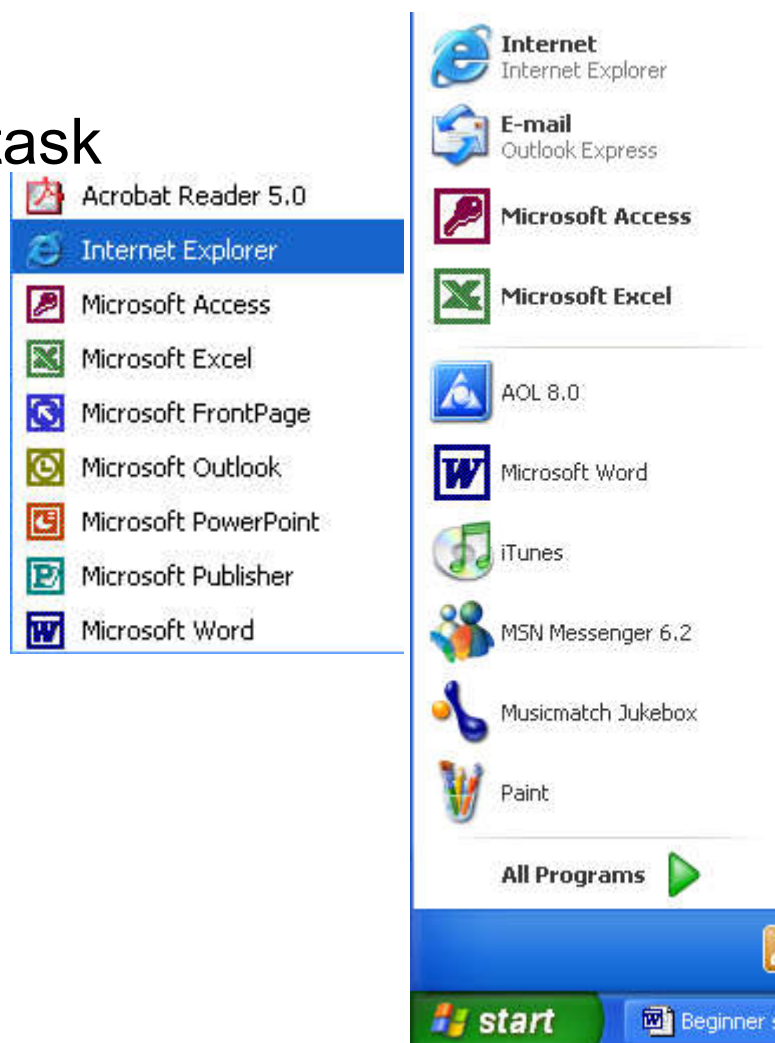
OS & Application Software

Desktop
- OS: Windows (Vista/XP), Linux, Dual Boot
- Applications: MS Office, CAD Package, Compilers …

Application Servers
- OS: Windows (2000, 2003, 2008 Server), Linux, UNIX (HPUX, Solaris, AIX, IRIX etc.)
- Applications: NAG, Matlab, AutoCAD, Ideas, Oracle ..

Internet Servers
- OS: Windows, Linux
- Mail: Send mail/Postfix on Linux or Exchange on Windows
- DNS: Windows or Linux DNS Server
- Web: Apache on Linux or IIS on Windows
- Proxy: Squid on Linux or ISA on Windows
- Authentication: LDAP on Linux or Active Directories on Windows

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Computers: Clients and Servers

- In a client/server network arrangement, network services are located in a dedicated computer whose only function is to respond to the requests of clients.

- The server contains the file, print, application, security, and other services in a central computer that is continuously available to respond to client requests.

Server

Client   Client   Client

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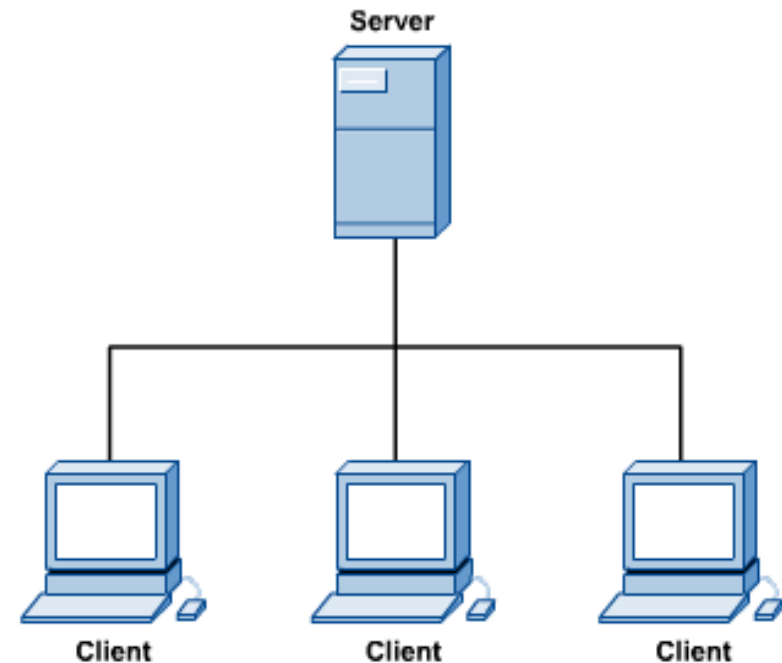
Servers

- Desktop Server

- Dual Processor (Dual/Quad Core) Server

- Quad Processor (Dual/Quad Core) or higher SMP Server

- Parallel Cluster using Dual/Quad Processor (Dual/Quad Core) servers clustered upto several Hundred Processors

- Processor: Core 2 Duo/Athlon (Desktop), 64 Bit Intel Xeon (Quad Core), 64 Bit AMD Optron (Quad Core), Intel 64 Bit Itanium, RISC

- OS: Linux, UNIX, Windows

- RAM: 4 GB or Higher

- Disk: Multiple 300 GB SAS

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Servers

Rack & Blade Servers
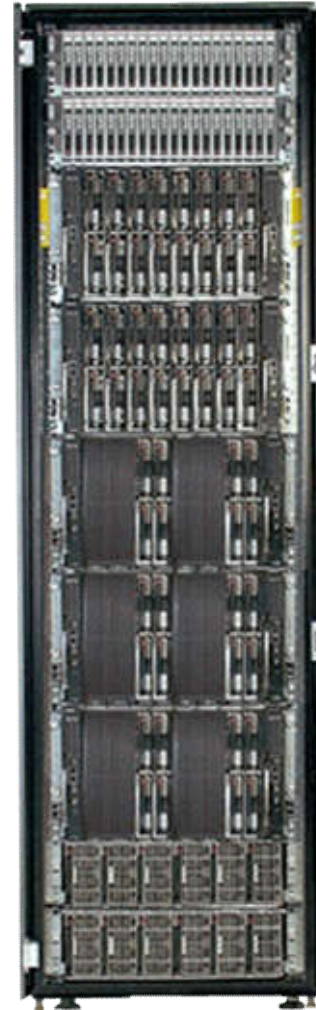
Workstations

- Application Specific Low-End Server

- Dual/Quad Processor (Dual/Quad Core)

- Processor: 64 Bit Intel Xeon, 64 Bit AMD Optron, Intel 64 Bit Itanium, RISC

- OS: Linux, UNIX, Windows

- RAM: 8 GB or Higher

- Disk: Multiple 300 GB SAS

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Clients

- Desktop

- Laptops

- Handhelds: PDA

- Processor: Core 2 Duo, Athlon

- OS: Windows, Linux, Dual Boot

- RAM: 2 GB

- Disk: 250 GB SATA

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Storage

- DAS (Direct Attached Storage)

- NAS (Network Attached Storage)

- SAN (Storage Area Network)

- Storage can be few GBs to several TBs

- Disk Types

    - SATA

    - Ultra SCSI

    - SAS

    - FC Disk
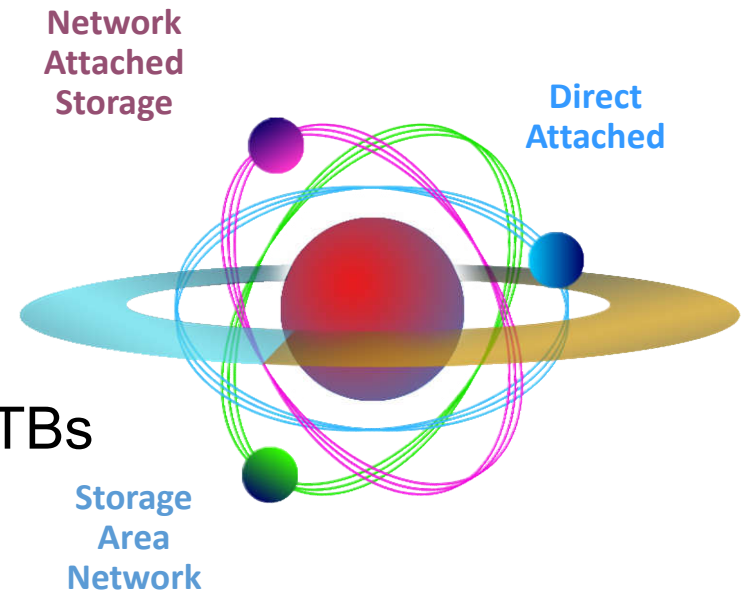
Backup

Single DAT Tape Drive (Internal/External)

- 80/160 GB Tapes

- Native data transfer rate of up to 24.65 GB/hr

SDLT Tape Drive (Internal/External)

- Single/ Multiple Drives and Slots

- 300/600 GB Tapes

- Native data transfer rate of up to 259 GB/hr

LTO-4 Tape Drive (Internal/External)

- Single/ Multiple Drives and Slots

- 800/1600 GB Tapes

- Native data transfer rate of up to 432 GB/hr

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Data Centre Management

Infrastructure:
- Split/Precision Air Conditioning
- UPS, Generator, Network, Raised Floor, False Ceiling, Glass Partition
- Building Management System (Fire Alarms, Physical Security)

Tier 1: Very Basic
Tier 2: Proper Infrastructure but not enough Redundancy
Tier 3: N + 1 Redundancy
Tier 4: 1+ 1 Redundancy

Questions to ponder

- Define Computer

- What do you think about the main driving force behind improving efficiency in terms of computing power and size?

- What is your project/research area? What are the hardware/software you deal with in your research? Explain with example.

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Q & A

Please write any feedback regarding class to
sayans@slis.tsukuba.ac.jp
Sub: Informatics class feedback

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