☑ UNIT 1: Computer Hardware Basics – Quick Study Summary

◇ Basics of Motherboard

- **Motherboard**: Main circuit board (aka mobo).
- Contains: **CPU, RAM, chipset, BIOS, ports, slots**.
- Connects all components — **data & power flow** control.

◇ CMOS and BIOS

- **BIOS (Basic Input/Output System)**:
    - Firmware on ROM chip.
    - Boots system, performs **POST**, handles hardware.
- **CMOS**:
    - Stores BIOS settings (date, time, boot order, etc.).
    - Powered by CMOS battery.

◇ Working of Processor

- Executes instructions via **fetch-decode-execute** cycle.
- Measured in **GHz** (e.g., 3.2GHz = 3.2 billion cycles/sec).

◇ Types of Processors

- **Intel**: i3, i5, i7, Pentium, Celeron
- **AMD**: Ryzen, Athlon
- Types:
    - **Microprocessor** (general purpose)
    - **DSP** (Digital Signal Processor)
    - **GPU** (Graphics Processor)
    - **Multi-core** (2+ cores in one chip)

◇ Components of CPU

- **ALU**: Arithmetic & Logic operations
- **CU (Control Unit)**: Manages data flow
- **Registers**: Temporary storage
- **Cache**:
    - **L1**: Fastest, smallest, built-in

- o **L2**: On CPU chip, bigger
- o **L3**: External, shared among cores

◇ System Memory

➤ RAM (Random Access Memory)

- Temporary memory — volatile.
- Types:
  - o **DRAM**: Slower, needs refresh
  - o **SRAM**: Faster, costlier (used for cache)
  - o **VRAM**: For graphics
  - o **MRAM**: Magnetic, retains data

➤ Virtual Memory

- Disk used as RAM when RAM is full.
- Enables multitasking.

➤ Protected Memory

- Stops apps from interfering with each other.
- Increases **security** and **stability**.

◇ Storage Devices

➤ Hard Disks

- Non-volatile permanent storage.
- Types: **IDE, SATA, SCSI**
- File systems:
  - o **FAT, NTFS, HFS**

➤ RAID (Redundant Array of Independent Disks)

- Combines disks for speed/fault-tolerance.
- RAID Levels:
  - o **RAID 0** – Striping (fast, no fault tolerance)
  - o **RAID 1** – Mirroring
  - o **RAID 5** – Striping with parity (most common)
  - o **RAID 10** – Mirror + Striping

➤ *Optical Drives*

- Types: **CD-ROM, DVD-ROM, WORM, Erasable CDs**
- Used for media, backups.

➤ *Removable Storage*

- **USB Drives**, **Memory Cards**, **External HDDs**
- **Tape Drives**: Used for backup (cheap, long-term)

◇ Common Computer Ports

Port Type	Use
USB	Data transfer, charging
VGA / HDMI	Video output
PS/2	Keyboard/mouse (older PCs)
Serial	Low-speed legacy data port
Parallel	Printer/scanner (older)
Audio Jack	Mic, speakers
Ethernet	Wired network

◇ Input Devices

- **Keyboard, Mouse, Scanner, Joystick, Microphone**

◇ Display Systems

- **VGA, SVGA, AGP**
- **Monitors**:
    - CRT (old), LCD, LED, OLED

◇ Printers and Their Types

Type	Description
Dot Matrix	Impact, ribbon-based
Inkjet	Sprays ink droplets

Laser	Uses toner and laser beam
Thermal	Uses heat on special paper

🔁 QUICK RECAP CHART

Term	Meaning
BIOS	Basic input/output system
CMOS	Stores BIOS config (battery powered)
RAM	Temporary memory
RAID 5	Striping + Parity (fault-tolerant)
SATA	Modern HDD interface
USB	Universal data port
VGA/HDMI	Video output ports
Dot Matrix	Old printer type

☑ UNIT 2: Operating Systems – Quick Study Summary

◇ Basics of Operating System (OS)

- **Operating System**: Software that manages hardware and software resources.
- Acts as **bridge** between user and hardware.

◇ Functions of Operating System

1. **Process Management** – Executes, schedules, manages processes.
2. **Memory Management** – Allocates/deallocates memory (RAM).
3. **File System Management** – Manages files, directories, access.
4. **Device Management** – Controls I/O devices via drivers.
5. **Security & Access Control** – User accounts, passwords, permissions.
6. **User Interface** – CLI (Command Line) or GUI (Graphical Interface).

◇ Client vs Server Operating System

Feature	Client OS	Server OS
Purpose	Desktop use	Manages network & services
Examples	Windows 10, macOS, Linux	Windows Server, Red Hat, Ubuntu Server
Supports multiple users?	No	Yes
Services	Minimal (print, file sharing)	Advanced (Active Directory, DNS, DHCP)

◇ Command Line Basics (CLI)

- Text-based interface.
- Useful for:
    - **File operations** (copy, delete, rename)
    - **System diagnostics**
    - **Script automation**
- Examples: dir, cd, mkdir, rm, ping

◇ Files & Directories

- **File**: Logical unit of storage.
- **Directory (Folder)**: Container for files/subdirectories.
- Structure: **Tree-based hierarchy**
- File Naming:
    - Max length depends on OS.
    - Extensions: .exe, .txt, .sys, .dll

◇ System Files

- Important files required for boot and OS operation.
- Examples: ntoskrnl.exe, boot.ini, IO.sys, config.sys

◇ Boot Process Overview

1. **BIOS runs POST**

2. **Bootloader loaded from boot sector**
3. OS kernel is loaded into memory
4. OS takes over and initializes user environment

◇ Device Drivers

- Software that helps OS communicate with hardware.
- Each hardware needs a driver (e.g., printer, graphics card).
- Types:
  - o **Kernel-mode drivers** – Core operations
  - o **User-mode drivers** – For user-level apps/devices
- If a driver is missing or corrupt → device won't function.

⮂ QUICK RECAP TABLE

Concept	Description
OS	Software managing hardware/software
Client OS	For end-user systems
Server OS	Manages network services
CLI	Command-line interface
Boot Process	Steps to load OS
System File	Essential OS/boot files
Directory	Folder that holds files/subfolders
Device Driver	Interface between hardware & OS

☑ UNIT 3: Computer Principles & Black Box Model of the PC – Quick Study Summary

◇ Memory and Processor (Basics)

- **Processor (CPU)**:
    - Executes instructions using **ALU** + **Control Unit**.
    - Works via **Fetch → Decode → Execute** cycle.
- **Memory**:
    - Holds data temporarily (RAM) or permanently (ROM/HDD).
    - Interacts with processor during execution.

◇ Address and Data Buses

- **Data Bus**: Carries actual data between CPU & memory.
- **Address Bus**: Carries memory addresses.
- **Control Bus**: Manages control signals.
- Wider bus → faster and more efficient communication.

◇ Stored Program Concept

- Introduced by **John von Neumann**.
- Both program and data are stored in memory.
- CPU fetches instructions one-by-one for execution.

◇ Physical Components of a PC

- **CPU, RAM, ROM, HDD/SSD, PSU, Motherboard, Ports**
- **Peripherals**: Mouse, keyboard, monitor, printer, etc.
- All components interact via buses on the **motherboard**.

◇ Basic Electrical Safety

- Turn off power before opening PC.
- Use **anti-static wrist strap** to prevent ESD.

- Never touch circuit boards directly with bare hands.

◇ Motherboards and Design

- Contains: **CPU socket**, RAM slots, **chipsets**, expansion slots.
- Connects internal and external components.
- Types of slots: PCI, AGP, PCIe

◇ Dismantling and Rebuilding a PC

Steps to Dismantle:

1. Power off and unplug.
2. Ground yourself.
3. Remove case panel.
4. Disconnect components (RAM, HDD, cables, etc.)

Rebuilding:

1. Insert motherboard → screw in.
2. Install CPU, RAM, PSU.
3. Connect storage, cables, GPU, etc.
4. Close panel and power on.

◇ POST (Power-On Self Test)

- Runs when PC powers on (part of BIOS).
- Tests:
  - CPU
  - RAM
  - Disk drives
  - Keyboard
- If POST fails → beeps or error codes.

◇ Boot Sequence Steps

1. **POST** runs

2. BIOS looks for **bootable device**
3. Bootloader loads **OS kernel**
4. Control handed over to OS

◇ Real Mode Architecture

- Used by older Intel CPUs (8086, 80286).
- CPU can access only **1 MB memory**.
- No protection, direct access to hardware.

◇ Interrupts

- Signals from hardware/software to CPU.
- **Types**:
    - ○ **Hardware Interrupt** (e.g., keyboard press)
    - ○ **Software Interrupt** (system calls)
- Helps CPU multitask and respond quickly.

⟳ QUICK RECAP TABLE

Term	Description
Stored Program	Program + data in memory
Data Bus	Carries actual data
Address Bus	Sends memory location
Motherboard	Central circuit hub
POST	Power-On Self Test by BIOS
Real Mode	Basic CPU mode, 1MB limit
Interrupt	Signal to CPU to stop & handle task
Boot Process	POST → BIOS → OS

☑ UNIT 4: Enterprise & Active Directory Infrastructure – Quick Study Summary

◇ Enterprise Infrastructure Overview

- **Enterprise Infrastructure** = Framework combining:
    - **Servers, clients, storage, network, security, services**
- Goal: Centralized **management**, **security**, and **access** across large organizations.

◇ Enterprise Infrastructure Architecture

Main Components:

- **Client systems**: End-user machines
- **Server systems**: Provide centralized services
- **Directory services**: For authentication (e.g., AD)
- **Security**: Firewalls, antivirus, policies
- **Networking**: Switches, routers, LAN/WAN

◇ Introduction to Active Directory (AD)

- **AD = Directory Service** by Microsoft
- Stores **users, groups, devices, policies**
- Enables **central management, authentication, SSO**

◇ Key AD Concepts

Term	Description
Kerberos	Authentication protocol (uses tickets)
LDAP	Protocol for accessing directory info
TGT	Ticket Granting Ticket for Kerberos
Forest	Top-level container with one or more domains
Domain	Logical group of network objects
OU	Organizational Unit (sub-container in domain)
Site Topology	Physical structure (based on location, IP)

◇ Trust Relationships in AD

- Enable **access across domains** and forests.
- **Types**:
  - One-way
  - Two-way
  - Transitive / Non-transitive

◇ Managing AD Objects

AD Objects:

- **User** – account with login access
- **Group** – collection of users/devices
- **Computer** – systems joined to domain
- **OU** – organizational container
- **Domain** – top-level AD object

Operations:

- **Create, modify, move, delete** objects via ADUC (GUI) or PowerShell

◇ Group Policy (GPO) Overview

- Controls **user/device settings** across the domain.

GPO Structure:

- Linked to **sites, domains, or OUs**
- Contains **security settings, restrictions, update rules**

◇ GPO Security Settings

Setting	Purpose
Password Policies	Length, complexity, history, expiry
Account Lockout	Lock after X wrong attempts
Timeout Settings	Auto logoff after inactivity
USB Enable/Disable	Manage USB access
Screen Saver Settings	Enforce screen lock
Audit Logging	Track user actions
Windows Updates	Auto-download/install settings
User Restrictions	App usage limits, network rules

◇ GPO Application Process

- **Creation → Linking → Enforcing**
- Applied in the following order:
  - Local
  - Site
  - Domain
  - OU
    (LSDOU Rule)
- **Loopback processing**: Overrides user GPO based on computer GPO.
- **Precedence**: Last applied GPO takes priority (unless enforced).

◇ Fine-Grain Password Policy (FGPP)

- More **granular control** over passwords.
- Applied to specific users/groups (not domain-wide).

◇ Workstation Addition to Domain

- **Windows Clients**: Added via System settings or CLI.
- **Non-Windows Clients**: Use tools like Samba, LDAP plugins.

◇ Integrating Additional Auth Methods

- **Biometric (Fingerprint)**, **Smart Card**, **RSA tokens**
- Used for **MFA (Multi-Factor Authentication)**

◇ Single Sign-On (SSO)

- Login once → access multiple services.
- Simplifies user experience, improves security.

◇ AD Hardening Guidelines

- Regularly patch systems
- Enforce **strong password policies**
- Restrict **admin privileges**
- Enable **auditing**
- Disable **unused accounts**
- Use **secure protocols** (e.g., LDAPS)

🔁 QUICK RECAP TABLE

Concept	Meaning
AD	Microsoft directory service
Domain	Logical boundary for objects
OU	Sub-group for organizing objects
Kerberos	Secure ticket-based authentication
LDAP	Protocol to read AD information
GPO	Set of rules applied to users/computers

TGT	Ticket from Kerberos for session access
SSO	Login once, access many services
FGPP	Specific password rules for groups/users

☑ UNIT 5: Cloud Computing – Quick Study Summary

◇ What is Cloud Computing?

- **Definition**: Delivering computing services (servers, storage, databases, software) over the internet ("cloud").
- **Goal**: On-demand access, pay-as-you-go, scalable IT resources.

◇ Key Cloud Concepts

- **On-demand self-service**
- **Broad network access**
- **Resource pooling**
- **Rapid elasticity**
- **Measured service (billing by usage)**

◇ Types of Clouds

Cloud Type	Description
Public Cloud	Services delivered over internet (e.g., AWS, Azure)
Private Cloud	Used exclusively by one organization
Hybrid Cloud	Mix of public + private
Community Cloud	Shared by several organizations

◇ Cloud Service Models

Model	Description	Examples
IaaS	Infrastructure as a Service (virtual servers, storage)	AWS EC2, Google Compute Engine
PaaS	Platform as a Service (runtime, databases, tools)	Heroku, Google App Engine
SaaS	Software as a Service (apps over internet)	Gmail, Office 365, Dropbox

◇ Multi-Tenancy Model

- **Single software instance** serves multiple users (tenants).
- **Each user's data is isolated** but runs on shared infrastructure.

◇ Cloud Deployment Models

Model	Key Features
Private	Internal use only, high control/security
Public	Shared infrastructure, low cost
Hybrid	Combines public/private flexibility
Community	Shared infra for common-purpose groups

◇ Security Design & Architecture

- Focus on **data confidentiality, integrity, availability (CIA)**.
- Ensure **secure architecture** across all layers: application, network, storage.

◇ Cloud Security Reference Model

- Security is layered:
    - **Data layer**: encryption, backups
    - **Application layer**: authentication, input validation
    - **Host layer**: hardened VMs
    - **Network layer**: firewalls, VPNs
    - **Physical layer**: secure data centers

◇ Cloud Identity and Access Management (IAM)

☑ *Identity Provisioning*

- Process of **creating, updating, and deleting user identities**.

☑ *Authentication*

- Verifying user identity (passwords, biometrics, tokens).

☑ *Authorization*

- Granting specific access rights (based on roles, policies).

☑ *Key Management*

- Safe **generation, storage, and distribution** of encryption keys.

◇ Infrastructure & Virtualization Security

- **Hypervisor** is a key risk point (runs multiple VMs).
- Risks:
    - VM escape
    - Resource contention
    - Insecure API access

◇ Understanding Cloud Security

Concept	Description
Security Boundary	Defines scope of responsibility (provider vs user)
Security Mapping	Matches controls to assets
Brokered Access	Access via intermediary (e.g., CASB)
Storage Location	Data residency matters (laws, compliance)
Encryption	Protects data in transit & at rest
Auditing & Compliance	Ensures legal & regulatory standards are met
Identity Protocols	OAuth, SAML, OpenID Connect for identity federation

🔁 QUICK RECAP TABLE

Term	Meaning
Cloud Computing	Internet-based computing services
SaaS / PaaS / IaaS	Application / Platform / Infrastructure layers
Public/Private Cloud	Shared vs exclusive cloud access
Multi-Tenancy	Shared software with isolated users
IAM	Identity and Access Management
Hypervisor	Virtualization platform controller
Encryption	Protects data confidentiality
SSO	Single login for multiple services
OAuth / SAML	Federated identity protocols

☑ UNIT 6: Cloud Computing – Quick Study Summary

◇ What is Cloud Computing?

- **Cloud Computing** = Delivering computing services (like servers, storage, apps) over the internet.
- Based on **on-demand access**, **scalability**, **pay-per-use model**.
- Users don't manage hardware — handled by the **cloud provider**.

◇ Characteristics of Cloud Computing

Characteristic	Description
On-demand self-service	Users can provision resources as needed
Broad network access	Services available over internet or private network
Resource pooling	Shared resources serve multiple customers
Rapid elasticity	Quick scale-up or scale-down
Measured service	Usage metered and billed accordingly

◇ Cloud Service Models

Model	What It Provides	Examples
IaaS	Virtualized hardware (VMs, storage)	AWS EC2, Azure VM

PaaS	Platforms to build & deploy apps	Heroku, Google App Engine
SaaS	Ready-to-use applications over internet	Gmail, Office 365

◇ Types of Clouds

Type	Description
Public Cloud	Services over public internet (shared infra)
Private Cloud	Dedicated to one organization (secure)
Hybrid Cloud	Combines public + private
Community Cloud	Shared between organizations with common needs

◇ Cloud Architecture

- Core Components:
    - **Client devices** (mobile, desktop)
    - **Cloud services** (apps, compute, storage)
    - **Cloud platform** (runtime, tools)
    - **Infrastructure** (networks, servers)

◇ Cloud Cube Model (Jericho Forum)

Helps assess cloud deployment across **4 dimensions**:

Dimension	Options
Internal/External	Inside or outside organization's firewall
Proprietary/Open	Vendor-owned or open standards
Perimeterised/De-perimeterised	Secured internally or open to internet
Insourced/Outsourced	Managed in-house or by provider

◇ Multi-Tenancy

- Multiple users share the same infrastructure.
- **Tenant isolation** is key for security.
- Saves cost and improves resource use.

◇ Identity and Access Management (IAM)

Ensures **only authorized users** access resources.

Component	Purpose
Authentication	Confirms identity (e.g., password, fingerprint)
Authorization	Grants specific access rights
Auditing	Tracks access logs and actions
User Provisioning	Adds, updates, disables accounts

◇ Cloud Security Reference Model

Focuses on securing all layers:

- **Data Security**: Encryption, masking
- **Application Security**: Firewalls, WAFs
- **Platform Security**: OS hardening
- **Network Security**: VPNs, secure APIs
- **Physical Security**: Data center protection

◇ Identity Federation & Protocols

Protocol	Use Case
SSO (Single Sign-On)	One login for multiple services
OAuth	Delegated access without password sharing
SAML	Federated identity using XML
OpenID	Decentralized identity system

◇ Cloud Encryption

- Protects **data at rest**, **in transit**, and **in use**.
- Requires:
  - Key management
  - Access control
  - End-to-end encryption
- **Homomorphic encryption**: Compute on encrypted data without decrypting.

◇ **Cloud Governance**

- Set of **rules, policies, and controls** for secure cloud usage.

Governance covers:

- User roles & access
- Data location and ownership
- Regulatory compliance (e.g., GDPR)
- SLA monitoring and enforcement

🔁 QUICK RECAP TABLE

Concept	Meaning
IaaS / PaaS / SaaS	Service models for infra, platform, software
Cloud Cube Model	Framework with 4 dimensions (Jericho Forum)
Multi-Tenancy	Multiple users on shared infra
IAM	Manages identity & access
OAuth / SAML	Federated identity protocols
Encryption	Secures data in cloud
Cloud Governance	Control and compliance framework