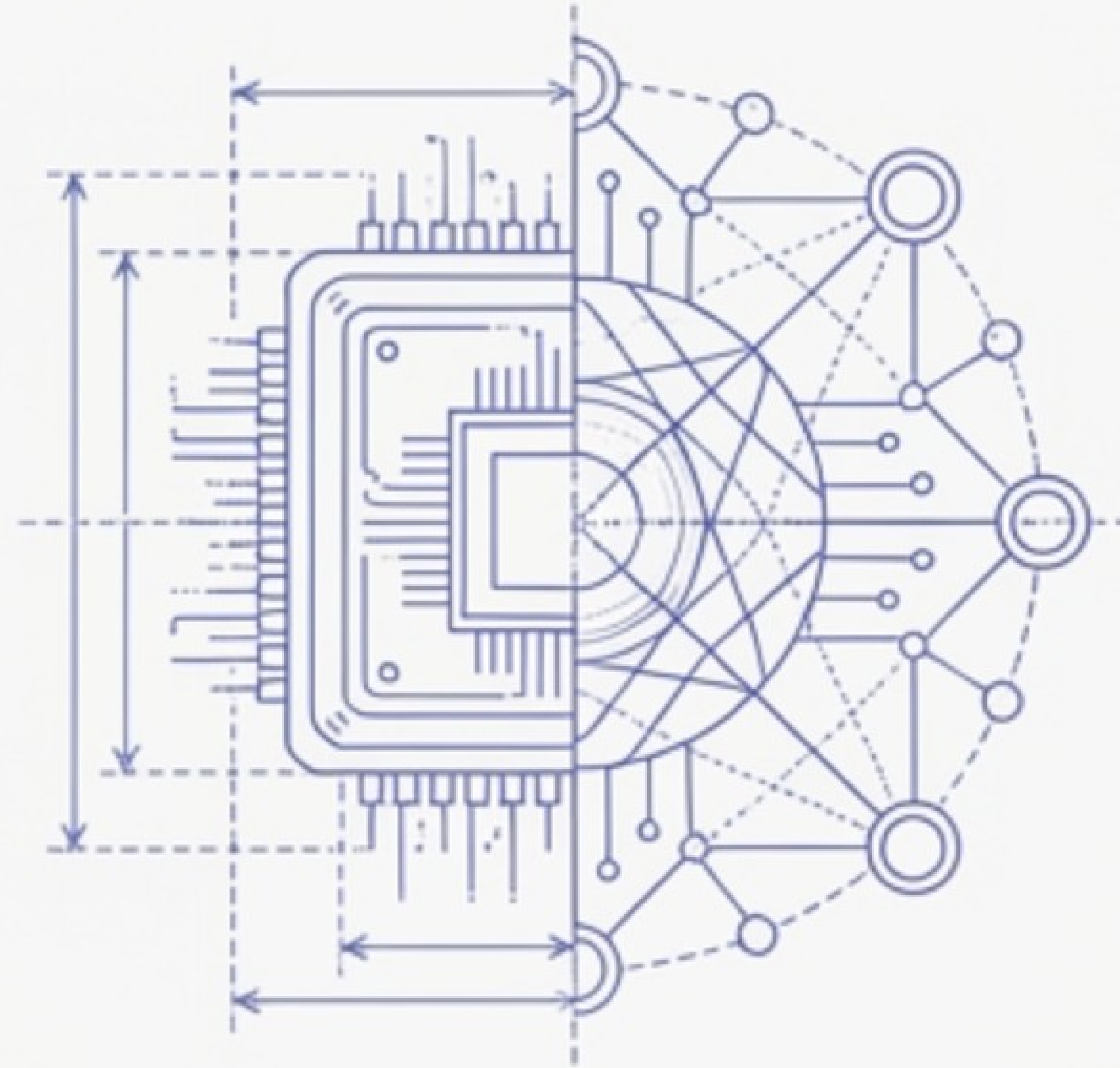


ICT Comprehensive Review & Exam Preparation Guide



Core Summary

An intensive, modular revision handbook covering the entire spectrum of Information and Communication Technology (ICT) concepts, from hardware evolution to cybersecurity protocols. Designed for rapid information retention and competitive exam success.

Target Audience:	UGC NET Aspirants and Computer Science Students.
Document Utility:	• Chronological coverage of technological evolution. • Deep-dive technical architecture analysis. • Exam-oriented comparison tables and key definitions.

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ICT Fundamentals & Computer Generations

Core Summary: The evolution of computing is categorized into five distinct generations, marked by the transition from mechanical components to microprocessor-based logic and Artificial Intelligence.

Generation	Switching Component	Storage	Language	Examples
1st	Vacuum Tubes	Magnetic Drums	Machine (Binary)	ENIAC, UNIVAC
2nd	Transistors	Magnetic Core	Assembly/Mnemonics	IBM 1401
3rd	Integrated Circuits (IC)	Magnetic Disk	High-Level (FORTRAN)	IBM 360
4th	Microprocessor (VLSI)	Semiconductor	SQL, C++	Apple Macintosh
5th	ULSI / AI	Optical/Flash	Natural/AI	Robotics, Supercomputers

Takeaway: Exam questions frequently ask to match the specific electronic component (e.g., Vacuum Tube) to its specific Generation number.

Programming Languages & Translators

Core Summary: Programming languages act as the bridge between human intent (algorithms) and hardware execution (binary).

Key Learning Points:

- Low-Level Languages:
 - Machine Language: Pure binary (0 and 1). Directly understood by hardware.
 - Assembly Language: Uses 'Mnemonics' (short codes like ADD, MOV). Requires an Assembler.
- High-Level Languages (3GL): English-like syntax (C, Java). Requires translation.
- 4th Generation (4GL): Database query languages (SQL).
- 5th Generation (5GL): Constraint-based and AI languages (Mercury, Prolog).

The Translator Tools

Compiler:

Translates the **entire** program at once.
Lists all errors after compilation.
Faster execution time.

Interpreter:

Translates line-by-line.
Stops at the first error.
Slower execution but easier for debugging.

Definition: Source vs. Object Code

- Source Code: Human-readable instructions (Programmer written).
- Object Code: Machine-readable binary (Compiler produced).

Evolution of the World Wide Web

Core Summary: From static libraries to decentralized ecosystems.

Feature	Web 1.0 (The Static Web)	Web 2.0 (The Social Web)	Web 3.0 (The Semantic Web)
Primary Action	Read-Only	Read and Write	Read, Write, and Own
Interaction	Passive consumption.	Users create content (UGC).	Decentralized & AI-driven.
Technology	Static HTML pages.	Dynamic pages, Cloud.	Blockchain, Semantic Web.
Key Example	Britannica Online.	Facebook, YouTube.	Crypto-assets, Metaverse.

- Web 1.0 (1990s): ‘Push’ technology. Fixed information.
- Web 2.0 (2000s): The era of interaction. Platforms provide frame, users provide content.
- Web 3.0 (Future): Machine understanding (Semantic) and user ownership (Blockchain).

Takeaway: Web 1.0 connects documents; Web 2.0 connects people; Web 3.0 connects data and knowledge.

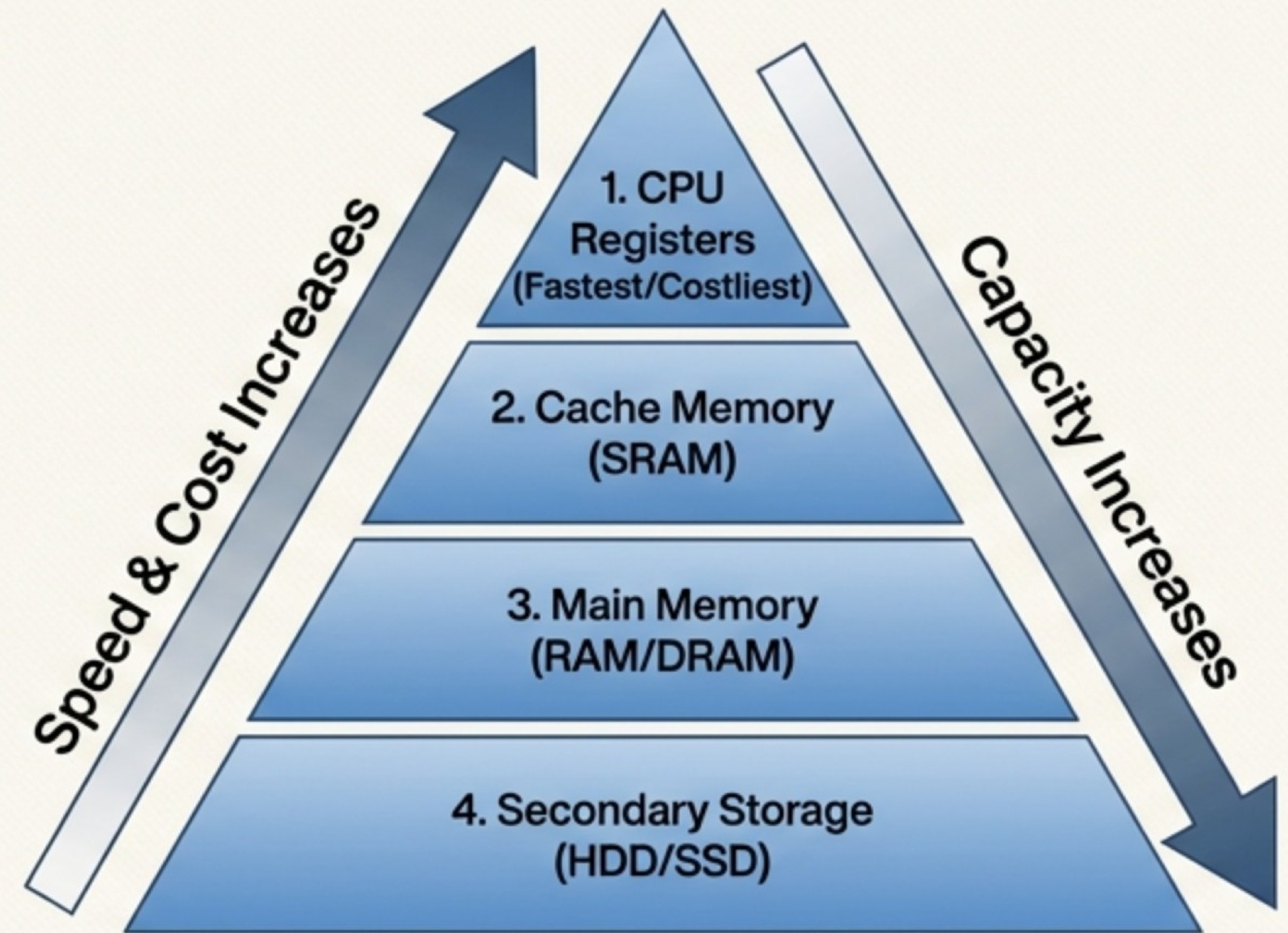
Memory Hierarchy & Storage Architecture

Core Summary

Computer memory is arranged in a pyramid based on access speed and cost.

Deep-Dive Analysis

- North Bridge vs. South Bridge: High-speed memory (RAM) connects via North Bridge. Slower storage connects via South Bridge.
- SRAM (Static RAM): Used for Cache. Faster, uses flip-flops.
- DRAM (Dynamic RAM): Used for Main Memory. Slower, uses capacitors, needs refreshing.



Definition: Volatile Memory

Memory that requires power to maintain information. Data is lost if power is cut (e.g., RAM).

Secondary Storage Technologies

Concept

Secondary storage retains data permanently (Non-volatile).

Hard Disk Drive (HDD):

- Mechanism: Mechanical magnetic spinning platters.
- Structure: Tracks (Concentric circles), Sectors (Sub-divisions), Blocks.
- Pros/Cons: High capacity, durable write cycles, but slow and fragile due to moving parts.

Solid State Drive (SSD):

- Mechanism: Flash memory (NAND based). No moving parts.
- Pros/Cons: Extremely fast, lightweight, low power. More expensive per GB.

Memory Units Conversion Table

Unit	Value (Binary)	Value (Decimal)
Bit (b)	0 or 1	-
Nibble	4 Bits	-
Byte (B)	8 Bits	-
Kilobyte (KB)	2 ¹⁰ Bytes	10 ³ Bytes
Megabyte (MB)	2 ²⁰ Bytes	10 ⁶ Bytes
Gigabyte (GB)	2 ³⁰ Bytes	10 ⁹ Bytes

Sequence continues: Tera, Peta, Exa, Zetta, Yotta, Bronto, Geopbyte.

Software Ecosystem & Operating Systems

Core Summary

Software is the interface between user and hardware, divided into System Software (OS) and Application Software.

The Operating System (OS)

- The Kernel: The heart of the OS. First program loaded into RAM.
- Functions: Resource management, task scheduling.
- Types:
 - Batch OS: Groups similar jobs.
 - Real-Time OS (RTOS): Zero latency tolerance.
 - Time-Sharing: CPU switches rapidly (Context Switching).

Software Licensing Models

- Proprietary: Source code hidden. User pays (Windows).
- Open Source: Source code free/modifiable (Linux).
- Freeware: Free to use, closed source (Chrome).
- Shareware: Free trial, pay later (WinRAR).
- Firmware: Software etched into hardware (BIOS).

Takeaway: The OS manages hardware resources; without the Kernel, the hardware is inert.

Output Hardware: Printers & Displays

Printer Technologies

- Impact Printers: Physical contact with paper. Noisy. (e.g., Dot Matrix).
- Non-Impact Printers:
 - Inkjet: Sprays liquid ink via nozzles.
 - Laser: Uses static electricity and dry ink (toner).
 - Thermal: Uses heat electricity and dry ink (toner).
 - Thermal: Uses heat on treated paper.
- Metrics: Speed = PPM (Pages Per Minute).
Quality = DPI (Dots Per Inch).
Quality = DPI (Dots Per Inch).

Display Technologies

- LCD (Liquid Crystal Display): Non-emissive. Requires a backlight. Uses light polarization.
- LED (Light Emitting Diode): Backlit by diodes. Better colors than LCD.
- OLED (Organic LED): Emissive (pixels create their own light). No backlight. Thinner, better blacks, shorter lifespan.

Definition: PPI vs. DPI

- PPI (Pixels Per Inch): Resolution of a digital screen.
- DPI (Dots Per Inch): Resolution of a printed hard copy.

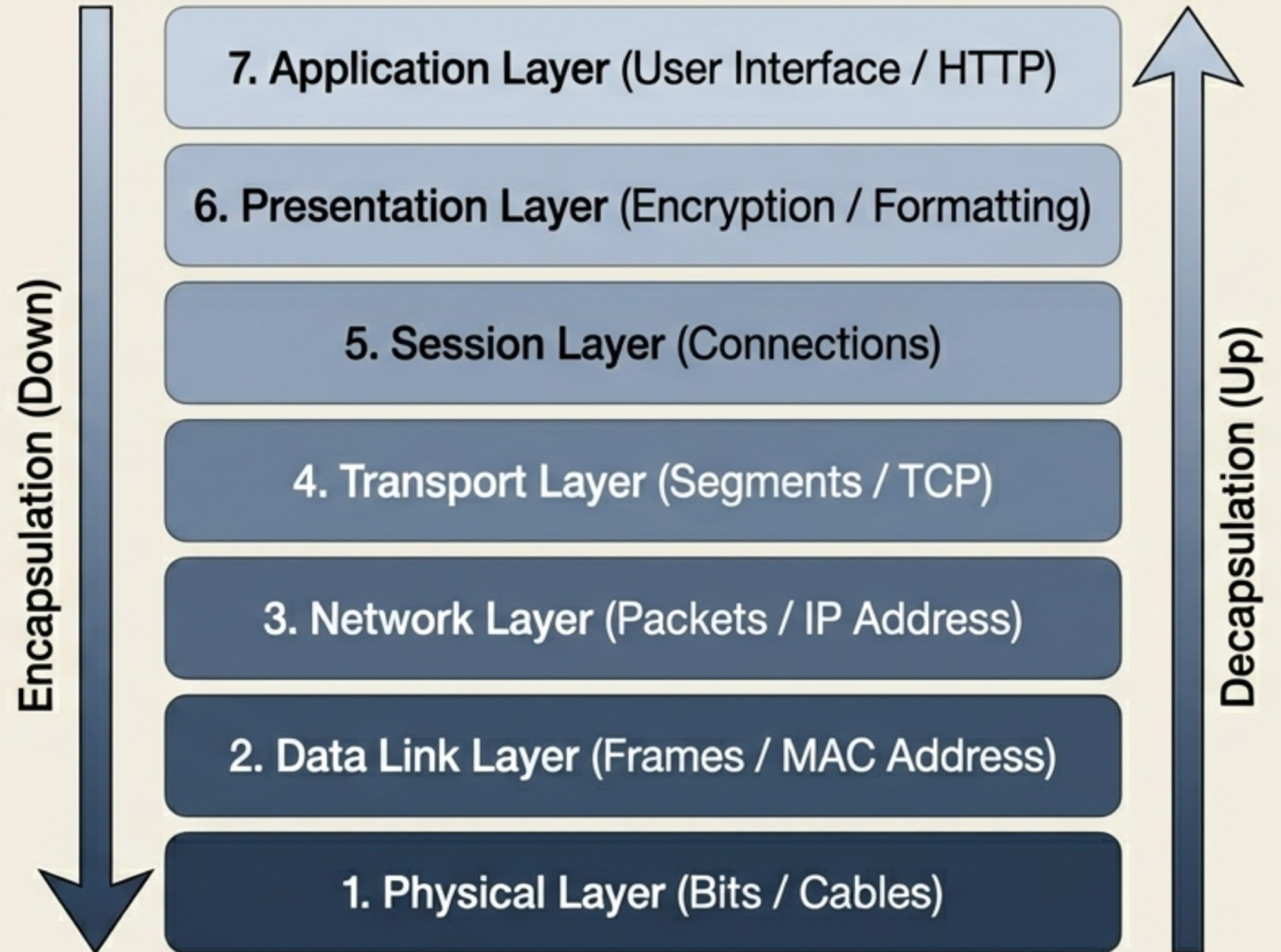
Internet Architecture & Network Models

Core Summary

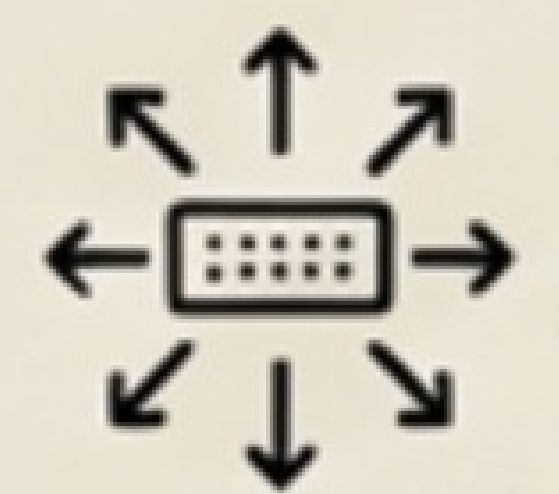
The OSI Model (Open Systems Interconnection) is the conceptual framework describing global network communication.

Definition Box: Network Scope

- The OSI Model (Open Systems Interconnection).
- Intranet: Private (Local).
- Extranet: Intranet + Authorized Outsiders.
- Internet: Global public network.



Network Devices & Transmission Media



Hub

'Dumb' device. Broadcasts to all ports. Low security.



Switch

Intelligent. Uses MAC Addresses to send data to specific recipient (Unicast).



Router

Connects different networks. Uses IP Addresses to find paths.



Repeater

Regenerates weak signals.



Modem

Modulates/Demodulates (Analog <-> Digital).

Guided (Wired)

- Fiber Optic: Light signals. Total Internal Reflection. Fastest/Secure.
- Twisted Pair/Coaxial: Copper electricity.

Unguided (Wireless)

- Radio/Microwave: WiFi, Bluetooth. Subject to interference.

Addressing Table	Description	Format	Permanence
MAC Address	Physical Hardware ID	48-bit Hexadecimal	Permanent
IP Address	Logical Network ID	32-bit (IPv4)	Changeable

Web Navigation: Browsers, Search Engines & Protocols

Core Summary

Accessing the web requires a tool (Browser), a directory (Search Engine), and an address book (DNS).

- Web Browser: Application to view content (Chrome, Safari).
- Search Engine: Database indexing the web (Google, Bing).
- URL Structure:
Protocol://Domain_Name/Path

Takeaway

Takeaway: You type a Domain Name; the DNS converts it to an IP Address; the Browser uses HTTP to fetch the site from that IP.

Key Protocols

- HTTP/HTTPS: HyperText Transfer Protocol (Secure). Standard for transferring pages.
- DNS (Domain Name System): The “Phonebook”. Translates Domain Names (google.com) to IP Addresses.
- FTP: File Transfer Protocol.
- SMTP: Simple Mail Transfer Protocol (Email).

Cybersecurity Threats (Malware)

Virus	Worm	Trojan Horse	Ransomware	Phishing
Malicious code attaching to a host file. Requires user action to spread.	Self-replicating program. Does NOT need a host or user action. Consumes bandwidth.	Disguised as legitimate software. Creates “backdoors”. Does not replicate.	Encrypts user data and demands payment for the key.	Social engineering via email to steal credentials. (Voice = Vishing, SMS = Smishing).

Definition: SQL Injection

A web attack where malicious SQL statements are inserted into entry fields to manipulate the backend database.

Cybersecurity Actors (Hackers)

Core Summary: Hackers are categorized by their ethical stance and intent.

The Hacker Classification Table			
Hat Color	Type	Intent	Description
White Hat	Ethical Hacker	Protection	Authorized testing to fix vulnerabilities.
Black Hat	Cracker	Malice	Unauthorized access for theft or destruction.
Grey Hat	Hybrid	Curiosity/Ego	Violates laws to find flaws, usually non-malicious.
Red Hat	Vigilante	Aggressive Defense	Hunts Black Hats to destroy their systems.
Blue Hat	Vengeful	Revenge	Amateurs driven by personal vendettas.
Green Hat	Neophyte	Learning	"Script Kiddies" or learners.

Definition: Denial of Service (DoS)

An attack where a machine is flooded with traffic to make it inaccessible to intended users.

Computational Logic: Number Systems & MS Excel

Number Systems

- Base Conversions: Decimal (10), Binary (2), Octal (8), Hexadecimal (16).
- Hexadecimal: Used for MAC addresses/Colors. Digits 0-9 and A-F.
 - Logic: 4 Binary bits = 1 Hex digit.

MS Excel Fundamentals

- Cell Referencing:
 - Relative Reference (A1): Changes when copied.
 - Absolute Reference (\$A\$1): The '\$' locks the row/column. Does not change when dragged.
- Key Functions:
 - =SUM()
 - =IF(Condition, True, False)
 - =AVERAGE()

Course Takeaway: Helvetica Now Display

ICT is the integration of Hardware (Generations/Memory), Software (OS/Languages), and Networks (OSI/Internet). Mastery requires understanding data flow from physical bits to logical spreadsheets and securing that flow against threats.