

Let's Start

- OSI Model
- TCP/IP Model
- Networking Protocols
- MAC/IP Address
- Types of Network Devic
- Network Topology
- Port
- LAN/MAN/WAN/PAN/CAN
- Networking Modes
- All Command

Networking

"हर लड़ाई जीतना ठीक नहीं है, कुछ लड़ाईं हार भी जाना चाहिए ताकि युद्ध जीता जा सके"

OSI Model Explained

Er. Sujay Sir

PLATFORM

BY – NAVIN KUMAR SINGH



BPSC

COMPUTER

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Networking

A computer network is a system that connects many independent computers to share information (data) and resources.

कंप्यूटर नेटवर्क एक ऐसी प्रणाली है जो सूचना (डेटा) और संसाधनों को साझा करने के लिए कई स्वतंत्र कंप्यूटरों को जोड़ती है।



FIRST NETWORK (ARPANET)

Advanced Research Projects Agency Network

- ARPANET was created by the US Department of Defense (DOD) in 1969.
- The first email message was sent over ARPANET in 1971 = Ray Tomlinson
- The first publicly available internet service in India was launched by state-owned Videsh Sanchar Nigam Limited (VSNL) on 15 August 1995.



Networking Models

A networking model is a set of guidelines and standards that defines how data is transmitted and received over a network. It is also known as a networking architecture or a networking blueprint.

नेटवर्किंग मॉडल दिशा-निर्देशों और मानकों का एक सेट है जो परिभाषित करता है कि नेटवर्क पर डेटा कैसे प्रसारित और प्राप्त किया जाता है। इसे नेटवर्किंग आर्किटेक्चर या नेटवर्किंग ब्लूप्रिंट के रूप में भी जाना जाता है।

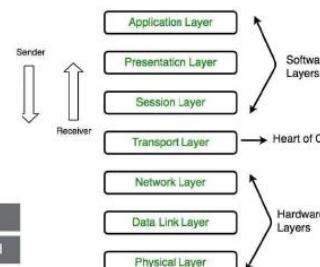
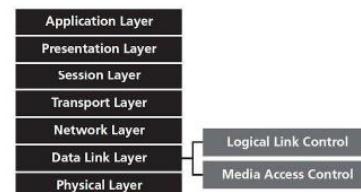
Networking**TCP/IP MODEL****OSI MODEL**

- Transmission Control Protocol/Internet Protocol → 1970
- (adopted as the protocol standard for ARPANET → in 1983)
- Open System Interconnection Model (1984)
- The OSI (Open Systems Interconnection) Model is a set of rules that explains how different computer systems communicate over a network.
- Purpose → Track the flow of data transfers in networks.

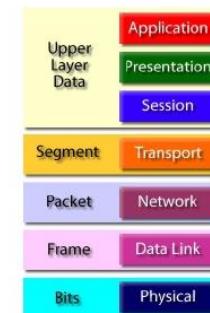
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**About OSI MODEL**

- It is a Reference model or Conceptual model.
- This model is Not practically implemented.
- OSI model contains 7 Layers.**
- Layers follow Set of rules, called Protocol

**OSI Model → Presentation Data Unit (PDU)/Protocol Data Unit**

- Physical Layer → Bits
- Data Link Layer → Frames
- Network Layer → Packets
- Transport layer → Segments
- Session Layer → Data
- Presentation Layer → Data
- Application Layer → Data



□ OSI Model → Devices Works

- 7. Application Layer → Gateway
- 6. Presentation Layer → Gateway
- 5. Session Layer → Gateway
- 4. Transport layer → Gateway
- 3. Network Layer → Router
- 2. Data Link Layer → Switch, Bridge
- 1. Physical Layer → Hub, Repeater, Modem, Cables

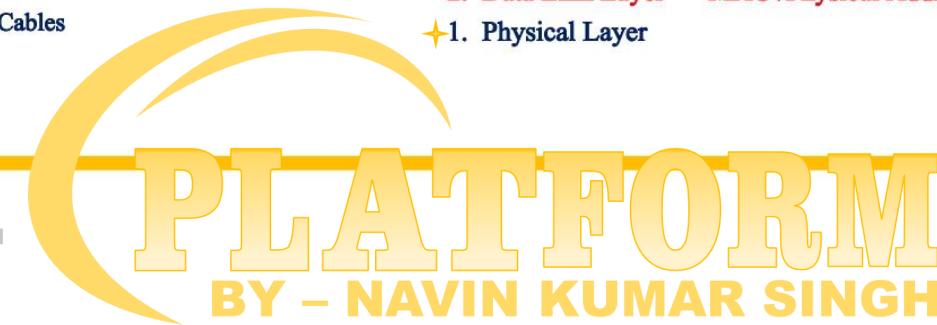
Firewall Works on which Layer

- Layer-3 (Network Layer)
- Layer-4 (Transport Layer)

□ OSI Model → Address Used

- 7. Application Layer
- 6. Presentation Layer
- 5. Session Layer
- 4. Transport layer → Port Address
- 3. Network Layer → IP /Logical Address
- 2. Data Link Layer → MAC /Physical Address
- 1. Physical Layer

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**1. About Physical Layer**

- Maintain Physical Connection
- Topology
- Networking Modes
- Bit synchronization
- Bit rate control

Physical Layer Protocols

- Digital Subscriber Line
- Integrated Services Digital Network
- Universal Serial Bus (USB.)
- Bluetooth
- Ethernet (IEEE 802.(c))

2. About Data Link Layer

- MAC Address
- Error-free transfer of data frames
- Flow Control
- Error Control

Data Link Layer Protocols

- Point-to-Point Protocol (PPP)
- Network Control Protocol (NCP)
- Serial Line Interface Protocol (SLIP)

3. About Network Layer

- Routing and forwarding the packets
- Internetworking
- Addressing

Network Layer Protocols

- ARP → Address Resolution Protocol → Find MAC Address
- RARP → Reverse Address Resolution Protocol → Find IP Address
- ICMP → Internet Control Message Protocol
- IGMP → Internet Group Messaging Protocol

4. About Transport Layer

- End-to-End layer
 - Establish connection between source and destination
 - Deals with Acknowledgement of Data
 - **Heart of OSI Model**
 - Connection Oriented Service
 - Connection Less Service
- Transport Layer Protocols**
- TCP → Transmission Control Protocol
 - UDP → User Datagram Protocol
 - SSL → Secured Socket Layer
 - TLS → Transport Layer Security

- End to end communication → Transport layer
- Process to process-delivery → Transport layer
- Host-to-Host → Transport layer
- Node-to-node → data link layer

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5. About Session Layer

- Session Management
- Synchronization
- Dialog Controller

Session Layer Protocols

- PPTP → Point-to-Point Tunneling Protocol
- PAP → Password Authentication Protocol
- NetBIOS → Network Basic Input Output System
- ASP → AppleTalk Session Protocol

6. About Presentation Layer

- Translation
- Encryption
- Decryption
- Compression

Presentation Layer Protocols

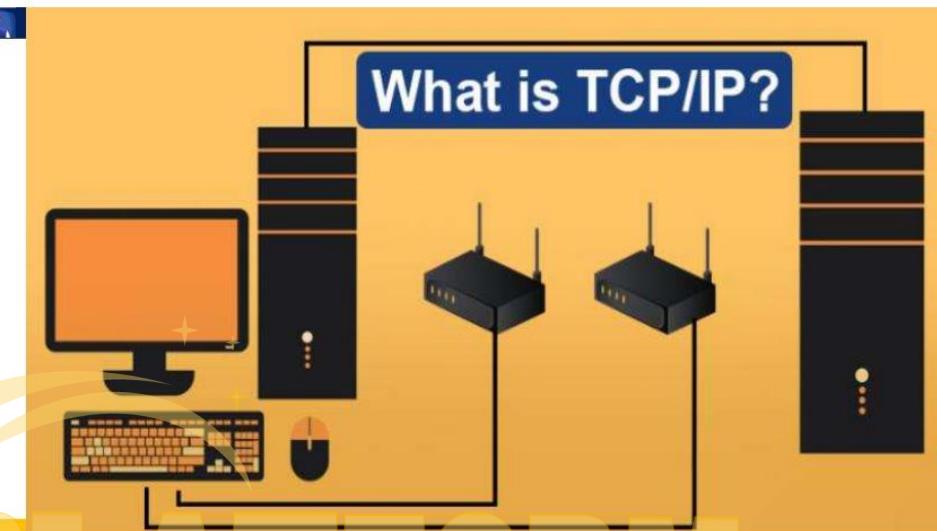
- MIME → Multipurpose Internet Mail Extensions
- NCP → NetWare Core Protocol

7. About Application Layer

- Used by → end-user software
- Mail Services
- Directory Services
- Application Layer is also called Desktop Layer

Application Layer Protocols

- HTTP → Hyper Text Transfer Protocol
- POP → Post Office Protocol
- FTP → File Transfer Protocol
- SMTP → Simple Mail Transfer Protocol
- DNS → Domain Name System

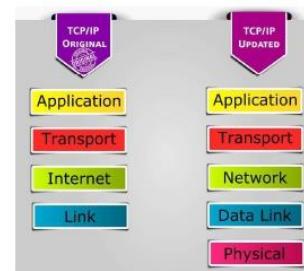


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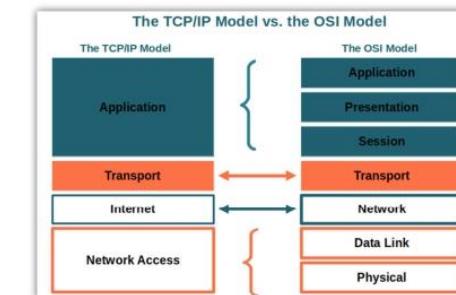
□ TCP/IP NETWORK MODEL

- Transmission Control Protocol/Internet Protocol
- TCP (Connection Oriented Protocol)
- IP (Connectionless Protocol)
- Developed in 1970's
- Standard in 1983
- Developed by US Department of Defense
- Developer Vint Cerf and Bob Kahn
- Layers (4/5)



□ TCP/IP NETWORK MODEL

- Application Layer
- Transport Layer
- Internet Layer
- Network Access Layer/Link



Session & Presentation Layer (Absent)

IEEE Standard

1. IEEE 802.1 → LAN Protocol
2. IEEE 802.2 → Logical Link Control
3. IEEE 802.3 → Ethernet
4. IEEE 802.4 → Token Bus
5. IEEE 802.5 → Token Ring
6. IEEE 802.6 → MAN
7. IEEE 802.11 → WLAN (WI-FI)
8. IEEE 802.14 → Cable Modems
9. IEEE 802.15 → PAN
10. IEEE 802.15.1 → Bluetooth
11. IEEE 802.16 → WIMAX → Worldwide Interoperability for Microwave Access

MAC ADDRESS



IP ADDRESS



VS

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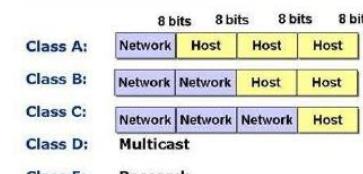
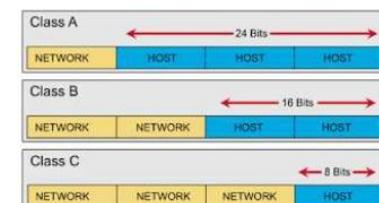
IP Address

 IP Address

- IPV-4 Address
- 32 Bit/4Byte
- IPV-6 Address
- 128 Bit/16 Byte



Table 1.



IP Address Classes

IP Address Classes

192.168.1.1 or 1.1.1.1 or 130.130.130.130

Class	Range	Network / Hosts
A	1 to 126	N.H.H.H
B	128 to 191	N.N.H.H
C	192 to 223	N.N.N.H
D	224 to 239	Reserved for Multitasking
E	240 to 254	Experimental, reserved for research

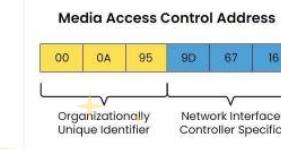
Subnet Masking

Class	Range	Example IP	Subnet Masking
A	1 to 126	1.1.1.1	255.0.0.0
B	128 to 191	128.1.1.1	255.255.0.0
C	192 to 223	192.1.1.1	255.255.255.0
D	224 to 239		Reserved for Multitasking
E	240 to 254		Experimental, reserved for research

Note: Class A addresses 127.0.0.0 to 127.255.255.255 cannot be used and is reserved for loopback and diagnostic functions.

MAC ADDRESS

- MAC Address = 48 Bit/6Byte



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Difference between IP & MAC Address

IP ADDRESS

- It can Change (Temporary)
- Identify device on Internet
- Command → ipconfig
- found on Google(What's my IP)
- Logical Address
- IPV-4 = 32 Bit = 4 Byte (Decimal Notation)
- IPV-6 = 128 Bit = 16 Byte (Hexadecimal Notation)

MAC ADDRESS

- Permanent (Can't Change)
- Address of Networking Device
- Command → getmac
- Mention in NIC Card
- NIC (Network Interface Card)
- 48 Bit = 6 Byte
- Hexadecimal Notation

□ MAC Address also called

- Physical Address
- Hardware Address
- Ethernet Address
- Burned-in address

How to change IP Address



- Switch networks
- Reset your modem
- Connect via Virtual Private Network (VPN)
- Use a proxy server
- Contact your ISP

□ Types of IP Address

- Public IP Address = ISP (Assign to) → Router
- Private IP Address = Router (Assign to) → Device

□ Private IP Address → Reserved by IANA

10.0.0.0 to 10.255.255.255
172.16.0.0 to 172.31.255.255
192.168.0.0 to 192.168.255.255
100.64.0.0 to 100.127.255.255

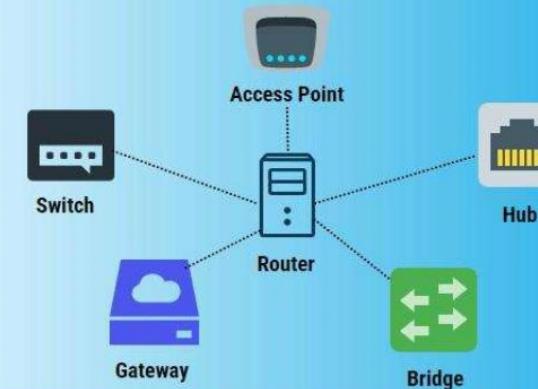
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□ IP Address

- Loop Back Address = 127.0.0.1
- Broadcast IP Address = 255.255.255.255
- [DNS → Domain Name System](#)
- Convert Domain Name into → IP Address
- [DHCP → Dynamic Host Configuration Protocol](#)
- Assign automatic IP Address to host in network

Types of Network Devices

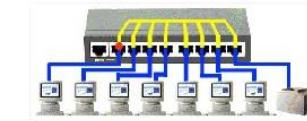


Networking Devices

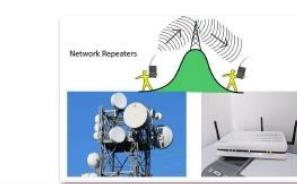
1. HUB = Physical Layer
2. Repeater = Physical Layer
3. Switch = Data Link Layer
4. Bridge = Data Link Layer + Physical Layer
5. Router = Network Layer
6. Gateway = All 7 Layer
7. Modem = Physical/Data Link Layer
8. Firewall = Network Layer

Networking Devices

1. **HUB** = Dumb Device, Broadcast Message



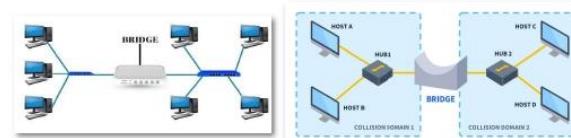
2. **Repeater** = Regenerate Signal, Active Hub



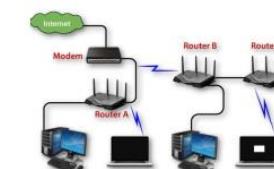
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3. **Bridge** = Same Protocol, MAC Address



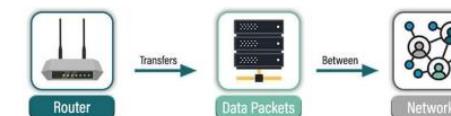
4. **Router** = IP Address, WAN, Traffic Regulate, Connect LAN



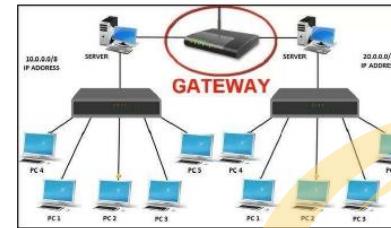
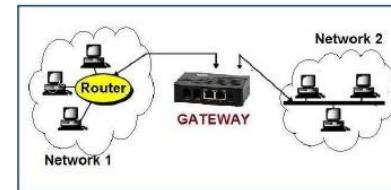
Router

1. Internetworking Device
2. Operates on Layer 3 of OSI Model
3. Works on Network Layer
4. Data Forward Packets
5. Used in LAN & WAN
6. Table Routing Table
7. Router Send data with the help of IP Address
8. Features Firewall, VPN, Traffic Monitor
9. Frequency 2.4 GHz - 5GHz

What is Router?



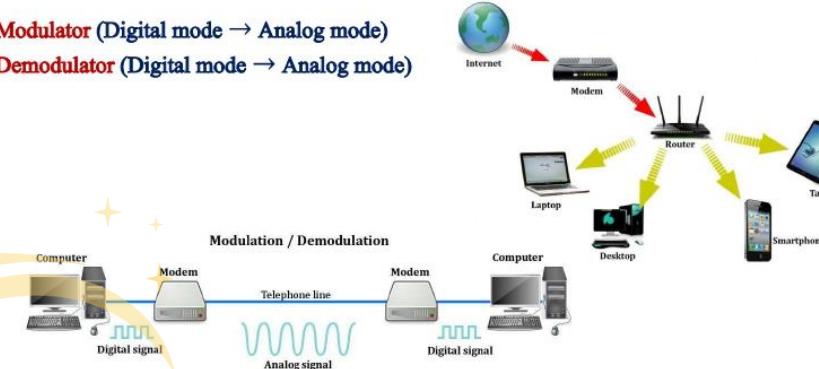
5. Gateway → Different Protocol



7. Modem → Modulator and Demodulator

Modulator (Digital mode → Analog mode)

Demodulator (Digital mode → Analog mode)

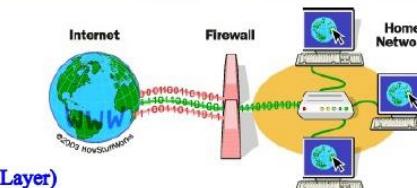


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7. Firewall = Hardware + Software

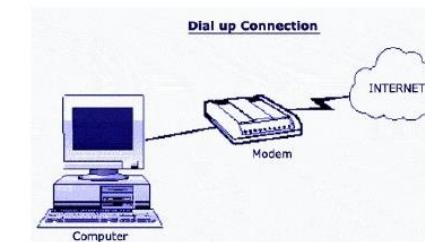
Firewall Works on which layer
Layer-3 (Network Layer) & Layer-4 (Transport Layer)



Note

Dial Up Connections → Telephone Lines → MODEM used → Slowest Connection

DSL → Digital Subscriber Line → Router used → Fastest Connection = Broadband Connection



Network Topology

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टोपोलॉजी का अर्थ क्या होता है?

- Computers को आपस में जोड़ने एवं उसमें डाटा Flow की विधि टोपोलॉजी कहलाती है।

TYPES OF NETWORK TOPOLOGY

```

graph TD
    A([TYPES OF NETWORK TOPOLOGY]) --> B[Bus]
    A --> C[Ring]
    A --> D[Tree]
    A --> E[Star]
    A --> F[Mesh]
    A --> G[Hybrid]
  
```

Topology = Physical or Logical layout of a network.

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Types of Topology

1. Bus → Multipoint Connection, **LAN**, Fault Tolerance difficult
2. Star → Hub, **LAN**
3. Ring → Tokens, FDDI, **LAN**
4. Tree → Multiple Hub configure
5. Mesh → Point to Point link, Reliable, Wiring more, Router, Home Automation, Bi-directional
6. Hybrid → Combination of 2 or more Topology

Bus Topology

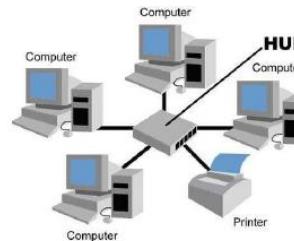
बस टोपोलॉजी एक नेटवर्क setup है जहा पर प्रत्येक device एक **single cable** के साथ जुड़ा होता है। बस टोपोलॉजी को horizontal topology के नाम से भी जाना जाता है।

- इस टोपोलॉजी का उपयोग **च्यावतर छोटे नेटवर्क** में किया जाता है।
- इस टोपोलॉजी में डेटा **एक ही direction** में travel करता है। इस टोपोलॉजी में प्रत्येक नोड drop cable के माध्यम से backbone cable से connect होते हैं।

Star Topology

Star topology एक प्रकार की नेटवर्क टोपोलॉजी है जिसमें सभी कंप्यूटर एक central device के साथ जुड़े हुए होते हैं, जिसे hub कहते हैं।

- इस टोपोलॉजी में central hub सर्वर की तरह काम करता है और जो डिवाइस होते हैं वह client की तरह काम करते हैं।
- जिसका उपयोग Airports, Hospitals, Banks, और Educational Institutes में किया जाता है।

**Ring Topology**

Ring टोपोलॉजी एक network architecture है जिसमें सभी devices एक ring के आकार में एक दूसरे से कनेक्ट होते हैं। इस टोपोलॉजी का स्ट्रक्चर ring की तरह होता है।

- इस टोपोलॉजी का उपयोग LAN (Local Area Network) और WAN (Wide Area Network) में किया जाता है।

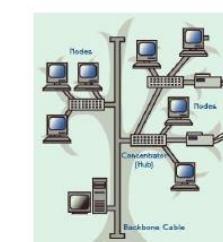


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**Tree Topology**

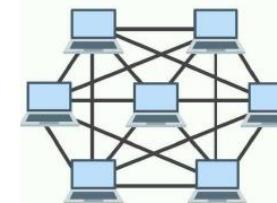
Tree Topology एक नेटवर्क टोपोलॉजी है जिसका स्ट्रक्चर पेंड (tree) की तरह होता है। इस टोपोलॉजी में सभी devices पेंड (tree) की शाखाओं (branches) से जुड़े होते हैं।

- ट्री टोपोलॉजी में सभी devices एक central device की मदद से जुड़े होते हैं।
- इस टोपोलॉजी में यदि किसी कारण central device खराब हो जाते हैं तो अन्य सभी devices भी खराब हो जायेंगे जिसकी वजह से पूरा कनेक्शन disconnect हो जाता है।

**Mesh Topology**

नेटवर्क टोपोलॉजी है जिसका उपयोग wireless network के लिए किया जाता है। इस टोपोलॉजी में सभी devices एक दूसरे से जुड़े होते हैं।

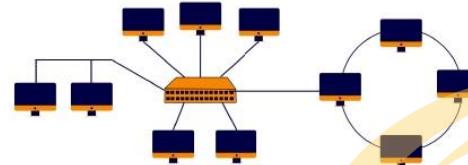
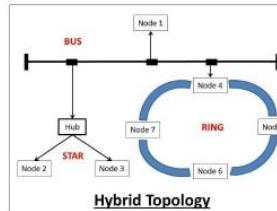
- इस टोपोलॉजी में डेटा को आसानी से ट्रांसफर किया जा सकता है और इसमें host computer की जरूरत नहीं पड़ती।



Hybrid Topology

“हाइब्रिड टोपोलॉजी एक ऐसी नेटवर्क टोपोलॉजी है जो दो या दो अधिक टोपोलॉजी से मिलकर बना होती है।”

- इस टोपोलॉजी को बस टोपोलॉजी, मेश टोपोलॉजी, रिंग टोपोलॉजी, स्टार टोपोलॉजी और ट्री टोपोलॉजी को आपस में मिलाकर बनाया जाता है।



What is Port



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नेटवर्किंग में पोर्ट क्या होते हैं**What is in a networking port**

- Used to identify the senders and receivers of messages in computer networking.
- Ports deal in = 4th Layer in OSI Model Transport Layer
- Each host can have = 65535 ports per IP address

एक कंप्यूटर प्रत्येक को एक पोर्ट नंबर निर्दिष्ट करके कई इनकमिंग और आउटगोइंग अनुरोधों को संभालने के लिए एकल भौतिक नेटवर्क कनेक्शन का उपयोग कर सकता है। संख्याएँ 0 से 65535 तक जाती हैं, जो कि 16-बिट संख्या है।

1. FTP → File Transfer Protocol = 20/21

FTP = 21 = Control Channel

FTP = 20 = Data Channel

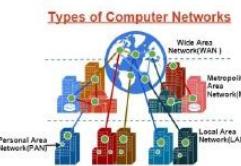
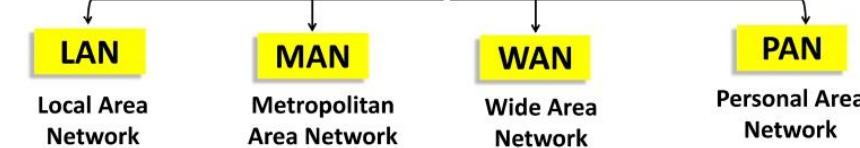
2. SFTP → SSH (Secure Shell) File Transfer Protocol = 22

3. Telnet → 23

4. SMTP → Simple Mail Transfer Protocol = 25

5. DNS → Domain Name System = 53
6. DHCP → Dynamic Host Configuration Protocol = 67/68
DHCP Server = 67 (Client Send to Server)
DHCP Client = 68 (Server Send to Client)
7. HTTP → Hypertext Transfer Protocol = 80
8. POP3 → Post Office Protocol Version 3 = 110
9. IMAP → Internet Message Access Protocol = 143
10. IRC → Internet Relay Chat = 194
11. HTTPS (S = Secure) = 443

Topic – Network Types

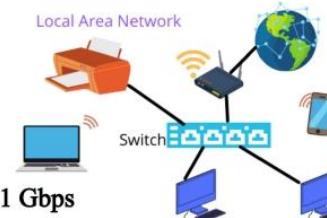


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1. LAN – Local Area Network

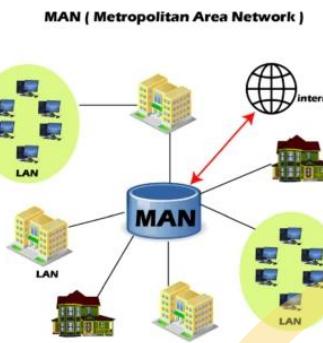
- Private Network
- Small Geographical Area
- Share Resources
- Data Transfer Speed → 10 Mbps to 1 Gbps
- Devices → Hub/Switch



- High Security
- Cable → Twisted Pair Cable / Coaxial Cable
- IEEE develop specification for LAN
- Types → Wired & Wireless
 - **Wired LAN → Cables → Ethernet = 802.3**
 - **Wireless LAN → WIFI → 802.11**

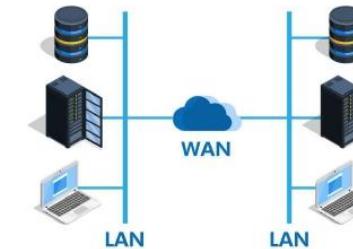
2. MAN - Metropolitan Area Network

- Cover → City
- Create → Interconnecting 2 LAN (LAN + LAN → MAN)
- Cable → Fiber Optic Cable
- Example → Cable television network
- Devices → Hub/Switch, Routers/Bridge
- Less Security



3. WAN – Wide Area Network

- WAN → Telecommunication Network
- Cover → Countries (Large Geographical Area)
- Internet is largest WAN
- Transmission medium → Satellite
- Device → Routers
- Less Security
- Firewall Required
- Example → Internet

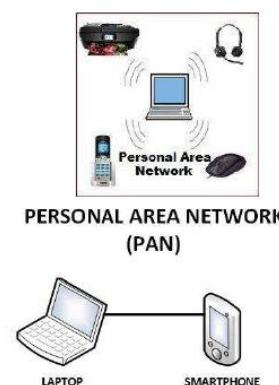


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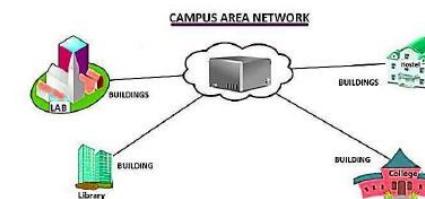
4. PAN - Personal Area Network

- Bluetooth Enable Device
- Infrared Enabled Device
- Hotspot
- Wireless Keyboard & Mouse
- Bluetooth enabled headphones
- Wireless Printers
- TV remotes
- Range → 10 metres



5. CAN – Campus Area Network

- A CAN is also known as a corporate area network (CAN)
- Group of interconnected Local Area Networks (LAN)
- Range = 1 to 5 km



Networking Types

- 1. Internet → All can Access
- 2. Intranet → Only for Employees
- 3. Extranet → b/w 2 companies

Networking Modes

- 1. Simplex → Keyboard – Monitor
- 2. Half Duplex → Walkie Talkie
- 3. Full Duplex → Mobile/Video Conferencing



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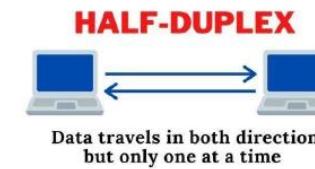
Simplex

- Radio broadcasting
- Television broadcasting
- Computer to printer
- Monitor output
- Mouse/keyboard/joystick to computer
- Fire alarm system
- Loud speaker



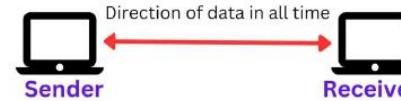
Half Duplex

- A walkie-talie
- A two-way radio that has a push-to-talk button
- Browsing the internet (requests and responses)
- Universal Serial Bus (USB)

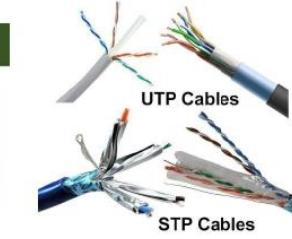


Full Duplex

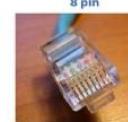
- Video calls/video conferencing
- Audio calls
- Live chats

**Full Duplex Mode****1. Twisted Pair Cable**

- Shielded Twisted Pair (STP) → Used in Factory
- Unshielded Twisted pair (UTP) → LAN Connection

RJ-11 RJ-45**(Registered Jack-11)****Er. Sujay Sir****PLATFORM**
BY - NAVIN KUMAR SINGH**RJ-11****RJ-45****(Registered Jack-11)**

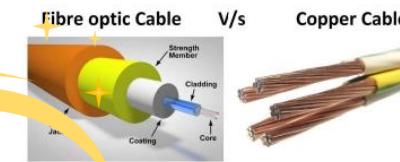
RJ-11 is the common connector for plugging a telephone into the wall and the handset into the telephone. See modular connector.

RJ-11**RJ-45****(Registered Jack-45)**

RJ45 connectors are most commonly used to connect one internet-enabled device with another network device. For example, a PC connected to a server, router, modem, smart TV, gaming console, or any device utilizing Ethernet protocol.

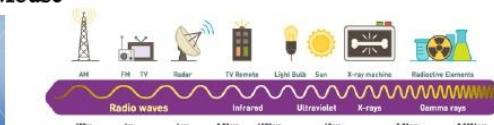
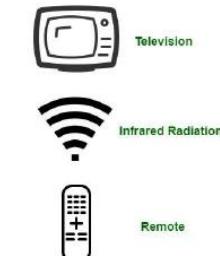
2. Co-Axial Cable → TV Cable**2. Fibre Optic Cable → Under Sea → Fastest →Broadband Connection**

- SC Connector = Subscriber Connector
- ST Connector = Straight Tip
- LC Connector = Lucent Connector
- PC Connector = ferrule connector/Fiber Channel



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Un-Guided Media**1. Radio Waves = Wireless Mouse****2. Microwaves = remote sensing, radar, microwave oven****Un-Guided Media****3. Infrared Waves = thermal imaging, astronomy, meteorology, data networking, and telecommunications**



A ping is a basic Internet command that allows a user to test and verify whether a given destination IP address exists and can accept requests in computer network administration. Ping is also used for diagnosis to confirm that the computer the user tries to reach is operational.

पिंग एक बुनियादी इंटरनेट कमांड है जो उपयोगकर्ता को यह जांचने और सत्यापित करने की अनुमति देता है कि दिया गया गंतव्य आईपी पता मौजूद है या नहीं और कंप्यूटर नेटवर्क प्रशासन में अनुरोध स्वीकार कर सकता है या नहीं। पिंग का उपयोग निदान के लिए भी किया जाता है ताकि यह पुष्टि की जा सके कि उपयोगकर्ता जिस कंप्यूटर तक पहुँचने का प्रयास करता है वह चालू है।

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Ping Command

1. Testing Network Connectivity
2. Protocol (ICMP → Internet Control Message Protocol)
3. Measured in = milliseconds (ms)
4. Lower Ping = Faster Connection



Ping Command

PING (Packet Internet Groper) command is the best way to test connectivity between two nodes, whether it is Local Area Network (LAN) or Wide Area Network (WAN)

पिंग का सबसे सरल और सबसे आम उपयोग यह सत्यापित करना है कि कोई मशीन किसी नेटवर्क संसाधन से कनेक्ट हो सकती है, चाहे वह स्थानीय हो या इंटरनेट पर।

```
Administrator: Command Prompt
Microsoft Windows [Version 10.0.19045.5247]
(c) Microsoft Corporation. All rights reserved.

C:\Windows\system32>ping google.com

Pinging google.com [142.250.196.14] with 32 bytes of data:
Reply from 142.250.196.14: bytes=32 time=37ms TTL=59
Reply from 142.250.196.14: bytes=32 time=37ms TTL=59
Reply from 142.250.196.14: bytes=32 time=38ms TTL=59
Reply from 142.250.196.14: bytes=32 time=38ms TTL=59

Ping statistics for 142.250.196.14:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 37ms, Maximum = 38ms, Average = 37ms

C:\Windows\system32>
```

NetStat Command

- Stands for = network statistics
- Show network status and protocol statistics
- Checks Network Connection for = TCP/Routing Tables, Network Interface, Network Protocol Statistics

नेटवर्क सांख्यिकी (netstat) कमांड एक नेटवर्किंग टूल है जिसका उपयोग समस्या निवारण और कॉन्फ़िगरेशन के लिए किया जाता है, जो नेटवर्क पर कनेक्शन के लिए मॉनिटरिंग टूल के रूप में भी काम कर सकता है।

```
C:\Windows\system32>netstat -an
Active Connections
Proto  Local Address          Foreign Address        State
TCP    192.168.1.8:49152      104.26.9.109:Http   ESTABLISHED
TCP    192.168.1.8:49158      207.65.35.82:Https ESTABLISHED
TCP    192.168.1.8:49160      104.26.9.109:Https ESTABLISHED
TCP    192.168.1.8:49161      69.173.146.5:Https ESTABLISHED
TCP    192.168.1.8:49170      51:Https             ESTABLISHED
TCP    192.168.1.8:49171      104.26.9.109:Https ESTABLISHED
TCP    192.168.1.8:49173      server-18-67-101-62:Https ESTABLISHED
TCP    192.168.1.8:49177      104.18.22.145:Https ESTABLISHED
TCP    192.168.1.8:49182      server-18-67-101-62:Https ESTABLISHED
TCP    192.168.1.8:49186      104.26.9.109:Https ESTABLISHED
TCP    192.168.1.8:49187      104.26.9.109:Https ESTABLISHED
TCP    192.168.1.8:49188      mac0013c6-in-fn:Https ESTABLISHED
TCP    192.168.1.8:49189      172.17.26.119:Https ESTABLISHED
TCP    192.168.1.8:49194      172.17.26.98:Https ESTABLISHED
TCP    192.168.1.8:49203      104.18.22.145:Https ESTABLISHED
TCP    192.168.1.8:49208      69.173.158.64:Https ESTABLISHED
TCP    192.168.1.8:49201      69.173.158.64:Https ESTABLISHED
TCP    192.168.1.8:49203      69.173.158.64:Https ESTABLISHED
TCP    192.168.1.8:49207      104.18.22.145:Https ESTABLISHED
TCP    192.168.1.8:49210      104.18.22.145:Https ESTABLISHED
TCP    192.168.1.8:49217      67.199.150.82:Https ESTABLISHED
TCP    192.168.1.8:49239      mac0013c6-in-fn:Https ESTABLISHED
TCP    192.168.1.8:49241      mac0013c6-in-fn:Https ESTABLISHED
```

ARP Command

1. Stands for → Address Resolution Protocol
2. Find MAC Address of destination computer?
3. IP Address → Knows

ARP stands for "Address Resolution Protocol" is a protocol for mapping an IP address to a physical MAC address on a local area network.

एआरपी कमांड एक टीसीपी/आईपी उपयोगिता है जिसका उपयोग स्थानीय एडेस रेजोल्यूशन प्रोटोकॉल (एआरपी) कैश को देखने और संशोधित करने के लिए किया जाता है।

```
C:\Windows\system32>arp -a
Interface: 192.168.1.8 --- 0xd
Internet Address      Physical Address      Type
192.168.1.1            20-ec-8e-ff-48      dynamic
192.168.1.2            18-ef-e0-74-fd-23      dynamic
192.168.1.4            1c-54-a2-6f-99-00      dynamic
192.168.1.12           90-24-0b-00-00-1f      dynamic
192.168.1.18           ff-44-3b-ec-8b-8f      dynamic
192.168.1.255          ff-ff-ff-ff-ff-ff      static
192.168.1.255          01-08-50-00-00-02      static
224.0.0.2              01-08-50-00-00-16      static
224.0.0.22             01-08-50-00-00-16      static
224.0.0.251            01-08-50-00-00-fc      static
224.0.0.252            01-08-50-00-00-fc      static
239.255.255.250        01-08-50-7f-ff-fa      static
255.255.255.255        ff-ff-ff-ff-ff-ff      static
```

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IP config

Used to view the IP address on the computers

```
C:\Windows\system32>ipconfig
Windows IP Configuration

Ethernet adapter Ethernet 2:

Connection-specific DNS Suffix . : fe80::1c0b:6c3a:8ba9:913e%13
Link-local IPv6 Address . . . . . : 192.168.1.8
IPv4 Address . . . . . : 192.168.1.8
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : fe80::1%13
                                         192.168.1.1
```

Getmac

Used to view the MAC address of network devices

```
C:\Windows\system32>getmac
Physical Address      Transport Name
10-FF-E8-82-5-1       \Device\Tcpip_{84787222-9BF0-4B4A-BAE-EAC465C4E9D16}
C:\Windows\system32>
```

गेटमैक (गेट मैक एड्रेस का संक्षिप्त रूप) एक सरल विंडोज नेटवर्क कमांड-लाइन उपयोगिता है जिसका उपयोग कंप्यूटर में नेटवर्क एडेटर (एनआईसी) का भौतिक पता खोजने के लिए किया जाता है।

HostName
Used to display the current name of your windows computer

- होस्टनाम कमांड का उपयोग सिस्टम के डोमेन और होस्टनाम को देखने या बदलने के लिए किया जाता है।
- होस्टनाम एक ऐसा नाम है जो कंप्यूटर को दिया जाता है और नेटवर्क से जुड़ा होता है। इसका मुख्य उद्देश्य नेटवर्क पर विशिष्ट पहचान प्रदान करना है।

```
C:\Windows\system32>hostname
DESKTOP-P90F9TD
C:\Windows\system32>
```

- Tracert**
- Stands for → Traceroute
 - This Command is used for → displaying possible routes (paths and measuring transit delays of packets)
 - Maximum → 30 Router/Hop
 - Protocol → ICMP

Traceroute, एक ऐसा ट्रूल जो आपके पास पहले से ही हो सकता है, आपके कंप्यूटर और लक्ष्य गंतव्य के बीच के पथ का पता लगाकर कुछ जानकारी प्रदान कर सकता है।

```
C:\Windows\system32>tracert /?
Usage: tracert [-d] [-h maximum_hops] [-j host-list] [-w timeout]
                [-R] [-S srcaddr] [-A] [-E] [-6]

Options:
    -d           Do not resolve addresses to hostnames.
    -h maximum_hops Maximum number of hops to search for target.
    -j host-list   Wait source route along host-list (IPv4-only).
    -w timeout     Wait timeout milliseconds for each reply.
    -R           Trace round-trip path (IPv6-only).
    -S srcaddr    Source address to use (IPv6-only).
    -A           Force using IPv4.
    -E           Force using IPv6.
    -6           C:\Windows\system32>
```

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nslookup

- Stands for → name server lookup
- Find out the → corresponding IP address of domain name system (DNS)

nslookup एक कमांड-लाइन ट्रूल है जो किसी खास डोमेन नाम का IP पता या DNS रिकॉर्ड खोजने के लिए इस्तेमाल किया जाता है। यह किसी व्यक्ति को IP पते से जुड़े डोमेन को खोजने में भी मदद करता है।

```
C:\Windows\system32>nslookup wikipedia.com
Server: Unknown
Address: 192.168.1.1

Non-authoritative answer:
Name: wikipedia.com
Addresses: 2001:df2:5e00:ed1a::3
          103.102.166.226

C:\Windows\system32>
```

- NBTSTAT**
- Used for : Troubleshooting NetBIOS issues

आप NetBIOS over TCP/IP समस्याओं का निदान करने के लिए nbtstat कमांड का उपयोग कर सकते हैं। इसके डिजाइन का मुख्य लक्ष्य NetBIOS नाम-समाधान समस्याओं को हल करने में सहायता करना है।

```
C:\Windows\system32>nbtstat
Displays protocol statistics and current TCP/IP connections using NBT
(NetBIOS over TCP/IP).

NBTSTAT [ -a RemoteName ] [ -A IP address ] [ -c ] [ -n ]
        [ -r ] [ -R ] [ -S ] [ -s ] [ interval ]

-a (Adapter status) Lists the remote machine's name table given its
IP address.
-n (names) Lists local NetBIOS names.
-p (resolved) Lists names resolved by broadcast and via WINS
-R (Reload) Purges and reloads the remote cache name table
-s (sessions) Lists sessions table containing destination IP
addresses to computer NetBIOS names.
-S (ReleaseRefresh) Sends New Release packets to WINS and then, starts Refresh
RemoteName Remote host machine name.
ID address Dotted decimal representation of the IP address.
Interval Redispays selected statistics, pausing interval seconds
between each display. Press Ctrl+C to stop redisplaying
statistics.
```

TASKKILL

1. Used for : Ending processes

- किसी प्रक्रिया को उसके नाम से समाप्त करने के लिए, टास्क्किल कमांड का उपयोग किया जाता है
- जो एक या अधिक कार्यों को समाप्त करता है।

```
C:\Windows\system32\taskkill /?

TASKKILL [/S system [/U username [/P [password]]]
          [/F|/T filter] [/PID processid | /IM imagename] [/T] [/F]

Description:
  This tool is used to terminate tasks by process id (PID) or image name.

Parameter List:
  /S system      Specifies the remote system to connect to.
  /U [domain\]user Specifies the user context under which the
                   command should execute.
  /P [password]   Specifies the password for the given user
                   context. Prompt for input if omitted.
  /FI Filter     Applies a filter to select a set of tasks.
                 Allows "+" to be used. ex. imagename eq ace*
  /PID processid Specifies the PID of the process to be terminated.
  /IM imagename  Specifies the image name of the process
                 to be terminated. Wildcard "*" can be used
                 to specify all tasks or image names.
  /T             Terminates the specified process and any
                 child processes which were started by it.
  /F             Specifies to forcefully terminate the process(es).
  /?             Displays this help message.
```

SYSTEMINFO

Used for : Displaying system information

कंप्यूटर और उसके ऑपरेटिंग सिस्टम के बारे में विस्तृत कॉन्फिगरेशन जानकारी प्रदर्शित करता है, जिसमें ऑपरेटिंग सिस्टम कॉन्फिगरेशन, सुरक्षा जानकारी, उत्पाद आईडी और हार्डवेयर गुण (जैसे RAM, डिस्क स्थान और नेटवर्क कार्ड) शामिल हैं।

```
C:\Windows\system32\sysinfoinfo

Host Name: DESKTOP-P99E9TB
OS Version: Microsoft Windows 10 Pro
OS Manufacturer: Microsoft Corporation
OS Configuration: Standard Workstation
OS Build Type: Multiprocessor Free
Registered Owner: pc
Registered Organization:
Product ID: 00331-10000-00001-0A871
Original Install Date: 13-03-2021 04:45:13
System Boot Time: 13-03-2021 04:45:13
System Manufacturer: Gigabyte Technology Co., Ltd.
System Model: M10V
System Type: x64-based PC
Processor(s): 1 Processor(s) Installed
              (1001) Intel(R) Core(TM) i4-2600 Stepping 1 GenuineIntel ~2592 MHz
BIOS Version: American Megatrends Inc. F4, 20-08-2024
Windows Directory: C:\Windows\system32
System Directory: \Device\HarddiskVolume1
System Locale: en-US\English (United States)
Input Method: 00000401
Time Zone: (UTC+00:30) Chennai, Kolkata, Mumbai, New Delhi
Total Physical Memory: 16,269 MB
Available Physical Memory: 15,781 MB
Virtual Memory: Max Size: 18,701 MB
Virtual Memory: Available: 12,459 MB
Virtual Memory: In Use: 6,242 MB
Page File Location(s): C:\pagefile.sys
Shares: 0
Logon Server: WORKSTATION\DESKTOP-P99E9TB
Mutex(s):
  11 Mutex(s) Installed.
  [01]: X85049021
  [02]: X85049021
  [03]: X85022582
  [04]: X85022582
  [05]: X85015388
  [06]: X85015388
```

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PLATFORM

BY - NAVIN KUMAR SINGH

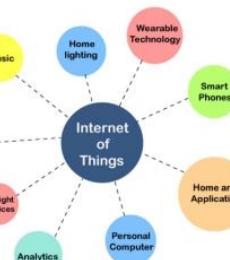


What is Internet.

- इंटरनेट, जिसे अंतर्राजाल भी कहा जाता है, दुनिया भर के कंप्यूटरों और अन्य उपकरणों को जोड़ने वाला एक वैश्विक नेटवर्क है।
- The Internet is a vast network that **connects computers all over the world**. Through the Internet, people can **share information** and **communicate from anywhere** with an Internet connection.
- It is a network of networks
- Internet is the superset of the world wide web
- Father of Internet Vint Cerf

**What is IoT (Internet of Things).**

- इंटरनेट ऑफ थिंग्स (IoT) भौतिक वस्तुओं का एक नेटवर्क है जिनमें सेंसर, सॉफ्टवेयर और अन्य तकनीकें लगी होती हैं, जो इंटरनेट के माध्यम से एक-दूसरे से जुड़कर डेटा का आदान-प्रदान करती हैं। यह स्मार्ट होम, स्वास्थ्य सेवा, परिवहन और उद्योगों सहित हमारे जीवन के कई पहलुओं में क्रांति ला रहा है।



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What is IoT (Internet of Things).

- IOT Introduced Year 1999
- IOT Introduced By Kevin Ashton
- First IOT Device Toaster
- IoT is a network of interrelated devices.**
- A thing in the internet of things can be a Person with a heart monitor implant
- Farm animal with a biochip transponder
- Automobile that has built-in sensors

There are 5 type of IoT

1. Consumer IoT
2. Commercial IoT
3. Military Things (IoMT)
4. Industrial Internet of Things (IIoT)
5. Infrastructure IoT



1. Consumer IoT

- home appliances
- voice assistance
- Night fixtures.

**2. Commercial IoT**

- healthcare industries
- transport industries
- smart pacemakers and monitoring systems

**3. Military Things (IoMT)**

- Surveillance robots
- Human-wearable biometrics

**4. Industrial Internet of Things (IIoT)**

- Manufacturing and energy sectors
- Digital control systems
- Smart agriculture
- Industrial big data



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4. Industrial Internet of Things (IIoT)

- Manufacturing and energy sectors
- Digital control systems
- Smart agriculture
- Industrial big data

**5. Infrastructure IoT**

- Primarily used for connectivity in smart cities
- Infrastructure sensors and management systems.

**Major Components of IOT (Type-5)**

1. Things or Device
2. Gateway
3. Cloud
4. Analytics
5. User Interface

Components of IoT Architecture

1. Things or Device

- Sensors and Actuators Collect Data & Give to Gateway

3. Cloud

- Data Uploaded on server

2. Gateway

- pre-processing of data (Security provide)

Components of IoT Architecture



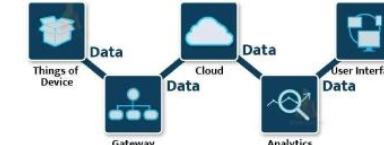
4. Analytics

- Algorithm applied on Machine Learning & AI

5. User Interface

- monitor/control the data

Components of IoT Architecture



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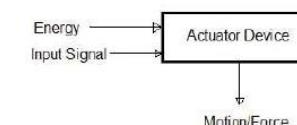
IOT Devices

- Actuators
- Sensors
- Transducers
- Embedded System
- Intelligent devices
- MCU** (Micro Controller Unit)
- MPU** (Micro Processor Unit)



1. Actuators

- Converts energy into motion



2. Sensors

Physical device that monitors and collects data from the environment around it

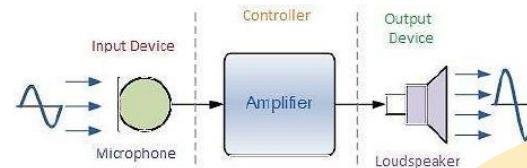
- Temperature Sensors
- Humidity Sensors
- Pressure Sensors
- Cameras and Optical Sensors



3. Transducers

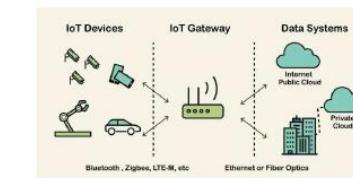
A transducer converts energy from one sort to another.

- Examples = Sensors or Actuators



IOT Gateway

- यह विभिन्न नेटवर्कों के बीच एक सेतु का काम करता है, जिससे उपकरण क्लाउड या अन्य सिस्टम से संवाद कर सकते हैं।
- Hardware device or software program.
- IoT Gateways establish communication between sensors and the cloud.



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Key functionalities of IoT Gateway

1. Establishing communication bridge
2. Provides additional security.
3. Performs data aggregation.
4. Pre processing and filtering of data,
5. Provides local storage as a cache/buffer.
6. Data computing at edge level.
7. Ability to manage entire device.
8. Device diagnostics.
9. Adding more functional capability.
10. Verifying protocols.

Types of IoT networks

1. Low-power, short-range networks → 5 Network
2. Low-power, wide-area networks (LPWAN) → 7 Network

Low-power, short-range networks (5 types of Network)

1. Bluetooth
2. NFC
3. WI-FI/802.11
4. Z-Wave
5. Zigbee/802.15.4

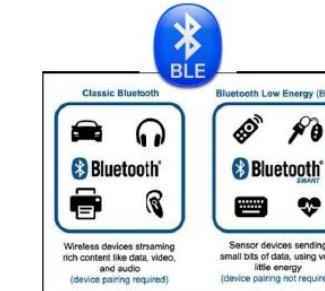
Low-power, wide-area networks (LPWAN) = 7 types of Network

1. 4G LTE IOT
2. 5G IoT
3. Cat-0
4. Cat-1
5. LoRaWAN (Long Range Wide Area Network)
6. Narrowband or NB-IoT/Cat-M2
7. Sigfox

Low-power, short-range networks = 5 Network

1. Bluetooth

- Invented by a Jaan Haartsen
- IEEE standard = 802.15.1
- Range 30 feet (10 meters)



Bluetooth Low Energy (BLE)

- Power-conserving variant of Bluetooth
- Low-power personal area network
- Bandwidth = 2.4 GHz

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2. NFC (Near-field communication)

- NFC is a set of short-range wireless technologies
- Distance of 4 cm or less to Initiate a connection
- Allows wireless data transmission over short distances using radio waves



4. Z-Wave

- Wireless communication protocol
- Used in Home Automation
- Z-Wave uses low-frequency radio bands
- Creates Mesh Network



5. Zigbee / (IEEE) 802.15.4

- ZigBee is an open, global, packet-based protocol
- Used to allow Smart Devices such as → light bulbs, sockets, plugs, smart locks, motion sensors and door sensors to communicate with each other over a "PAN" (Personal Area Network).
- Enable low-cost, low-power
- ZigBee is a Personal Area Network



Low-power, wide-area networks (LPWAN) = 7 types of Network

1. 4G LTE IoT

- LTE stands for "Long-Term Evolution"
- 4G LTE
- The successor of 3G & 2G in terms of smartphone technology is 4G



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2. 5G IoT

- Up to **20 Gigabits-per-second** (Gbps) peak data rates
- **100+** Megabits-per-second (Mbps) average data rates
- **Qualcomm** has played a major role in inventing



3. Cat-0

- LTE Category 0 or Cat 0
- Devices will save battery life
- Uplink and Downlink throughput is now reduced to **1 Mbps**

4. Cat-1

- LTE Category 1 or Cat 1
- Devices will save battery life

5. LoRaWAN

- Long range wide area network.
- LoRa modules help manage energy **consumption** in buildings by monitoring and controlling lighting.

**6. Narrowband or NB-IoT/Cat-M2**

- NB-IoT stands for NarrowBand- Internet of Things
- Also called Cat-M2.



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7. Sigfox

- Sigfox is a French global network operator.
- Sigfox is an inexpensive, reliable, low-power solution to connect sensors and devices.

**Important IOT Protocols**

- **MQTT** → Message Queue Telemetry Transport Protocol
- **HTTP** → Hypertext Transfer Protocol
- **COAP** → Constrained Application Protocol
- **DDS** → Data Distribution Service
- **AMQP** → Advanced Message Queuing Protocol.

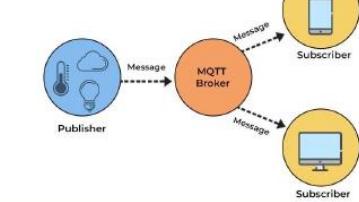
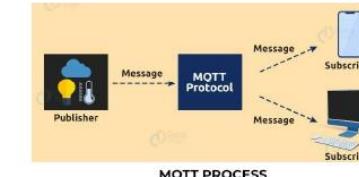
1. MQTT

- Message Queuing Telemetry Transport Protocol
- Communication Machine to Machine
- Developed by IBM
- Use Collect data & send to network
- MQTT is better than HTTP
- Commonly used as a backend for cloud platforms
- The default unencrypted MQTT port is 1883
- The encrypted MQTT port is 8883

**Protocol**

There are Four Stages of MQTT

- Connection
- Authentication
- Communication
- Termination



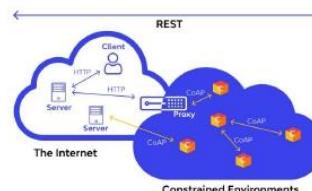
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COAP Protocol**Constrained Application Protocol**

- It is an → application layer protocol
- Introduced by the → (IETF) Internet Engineering Task Force
- Based on Client-Server Model
- COAP is designed to → Minimize energy consumption
- COAP messages are encoded in binary → format or 0/1 format.

**AMQP Protocol****AMQP (Advanced Message Queuing Protocol)**

- Used for Scalability and Modularity.
- It has guaranteed message delivery.
- AMQP protocol can bear the server broke issue on its own.
- AMQP has the property of segmentation and can process messages into slots.



Most Popular IoT Platforms

- Amazon Web Services (AWS)
- Microsoft Azure
- Oracle
- Google Cloud
- Salesforce
- Cisco Cloud
- IBM Watson
- Particle
- IRI Voracity
- ThingWorx



There are 5 types of IOT Layers → Protocols → 19

1. Physical Layer → 9 Protocols
2. Data Link Layer → 2 Protocols
3. Network Layer → 2 Protocols
4. Transport Layer → 2 Protocols
5. Application Layer → 4 Protocols

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1. Physical Layer (9 Protocols)

1. Bluetooth Low Energy (BLE)
2. Ethernet
3. Long-term evolution (LTE)
4. Near field communication (NFC)
5. Power Line Communication (PLC)
6. Radio frequency Identification (RFID)
7. WI-FI/802.11
8. Z-Wave
9. Zigbee

2. Data Link Layer (2 Protocols)

1. IEEE 802.15.4 = LR-WPAN (Zigbee)
Low-Rate Wireless Personal Area Network
2. LPWAN
Low Power Wide Area Networks

3. Network Layer (2 Protocols)

1. IPV-4 & IPV-6
2. 6LoWPAN IPv6 over Low-Power Wireless Personal Area Networks

4. Transport Layer (2 Protocols)

1. TCP (Transmission Control Protocol)
2. UDP (User Datagram Protocol)

5. Application Layer (4 Protocols)

1. MQTT (MQTT is better than HTTP)
2. COAP
3. AMQP
4. DDS

□ What is Arduino in IoT

In the context of the Internet of Things (IoT), Arduino acts as a microcontroller platform that serves as the "brain" for collecting, processing, and transmitting data from sensors.

- Arduino is a prototype platform
- Arduino is open-source
- Arduino is based on an easy-to-use hardware and software
- It consists of a circuit board
- This Circuit board includes Microcontroller & Arduino IDE (ready-made software)
- Arduino IDE uses a simplified version of → C++ Language



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- **Arduino microcontroller** एक खाली brain दिमाग है जिसमे Arduino IDE software के through coding करके या programming कर के memory upload कर सकते है इसलिए इसे open source कहते है।
- **Arduino** एक Platform है- जिन पर work कर user Hardware और software को मिला कर अपने अनुसार electronic Brain तैयार कर सके और उस electronic brain से electronic devices control कर सकते है



□ 7 elements in the open IoT architecture

1. Configuration and monitoring
2. Cloud data storage
3. Scheduler
4. Request definition
5. Request presentation
6. Service delivery and utility manager
7. Sensor middleware (X-GSN)



T H A N K
Y O U



DATABASE
MANAGEMENT
SYSTEM



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- ❖ What is a database:- Organized collection of data or information that can be accessed, updated, and managed
- ❖ What is DBMS:- DBMS stores, modifies and retrieves data
- ❖ Who created the first DBMS:- Charles Bachman
- ❖ First DBMS known as→Integrated Data Store (IDS)
- ❖ What is Which type of data can be stored in the database.
 - Image oriented data
 - Text, files containing data
 - Data in the form of audio or video
- ❖ In which of the following formats data is stored in the database management system.
Table

- ❖ What is information about data called → **Meta data**
- ❖ Who is the father of relational database → **E. F. Codd**
- ❖ The most open source DBMS → **MySQL**
- ❖ It is the first graphical query language → **QBE = Query by Example**
- ❖ It is a user interface that simplifies SQL procedures → **QBE**

Component of the DBMS

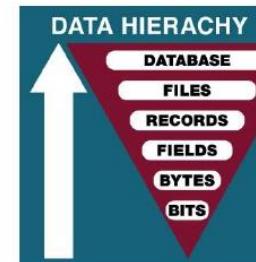
- ❑ **Hardware** → Like a hard drive, monitor, etc.
- ❑ **Software** → Provides a user interface
- ❑ **Data Manager** → Manages operations of DBMS.
- ❑ **Data** → The collection of information on the DB is known as data.
- ❑ **Data Languages** → Languages like DDL, DML, DAL, and DCL allow to perform operations like creating, modifying, storing, or retrieving data

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❑ Concept of Database

- ❖ Bits → 0/1
- ❖ Bytes/Characters → 8 Bits
- ❖ Fields → Group of Bytes
- ❖ Records → Group of Feild
- ❖ Files (table) → Group of Records
- ❖ Database → Group of File
- ❖ DBMS → Software
- ❖ RDBMS → Software



DBMS की विशेषताएं

- No Data Redundancy and Inconsistency
- Data Integrity and Security
- Realistic
- Store any Type of Data
- ACID Properties
- Easy Access
- SQL & NoSQL
- Data Sharing
- Decision making
- Data backup and recovery

Open Source of DBMS

- MySQL (OS)
- Microsoft SQL Server
- SQLite (OS)
- PostgreSQL. (OS)
- Microsoft Access
- MariaDB (OS)
- MongoDB (OS)
- Oracle
- IBM-D82
- Firebase (Google)
- Amazon DynamoDB
- Cassandra (OS)



RAID

In DBMS, RAID (Redundant Array of Independent Disks) is a method of storing data across multiple disks to enhance performance, increase data redundancy, or both.

Redundant
Array of
Independent
Drives



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Cloud Computing

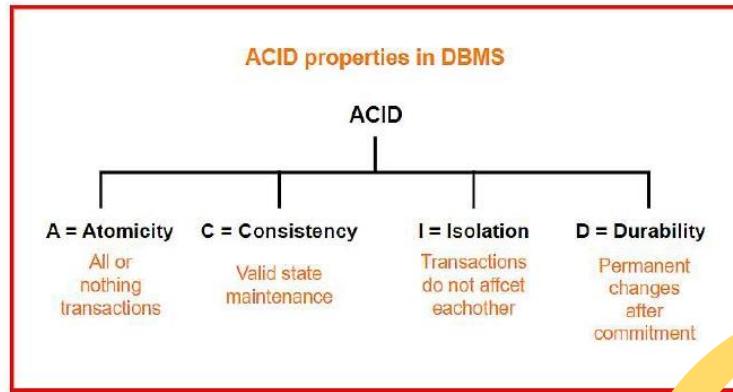
Cloud Computing is a technology that allows you to store and access data and applications over the internet instead of using your computer's hard drive or a local server.

- IaaS → Infrastructure as a service
(Network Support)
- PaaS → Platform as a service
(App & Website Hosting Space)
- SaaS → Software as a service
(Applications/Games)

 DBMS Transaction

- Transaction की चार properties होती है जिसे हम ACID Properties कहते हैं।

A - Atomicity	परमाणुता
C - Consistency	स्थिरता
I - Isolation	एकांत
D - Durability	सहनशीलता

**1. Atomicity(परमाणुता):-**

जब Transaction एक ही स्टेप में पूर्ण हो जाता है तब transaction atomic होता है।

- Yes/No, All or None

2. Consistency(स्थिरता):-

जब transaction होता है तो डेटाबेस एक state से दूसरे state में consistency होता है।
(Before & After)

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**3. Isolation (एकांत):-**

जब दो या उससे अधिक transaction एक साथ execute होते हैं तो एक transaction दूसरे transaction को प्रभावित नहीं करता है।

4. Durability(सहनशीलता) :-

जब एक transaction पूरी तरह से complete हो जाता है तो जो परिवर्तन होते हैं वह permanently सिस्टम में रहते हैं।

RDBMS

**RELATIONAL
DATABASE
MANAGEMENT
SYSTEM**



Relational Database Management System (RDBMS)

- RDBMS → Tables (Row & Column)
- DBMS → Files
- Rows → Tuples
- Columns → Attributes → Fields
- Number of Tuples → Cardinality
- Number of Attributes → Degree

Degree → 4
Cardinality → 4

The diagram shows a table representing a database schema. The columns are labeled StudentID, Name, Phone, and DOB. The table contains four rows of data. A green arrow points from the word 'Schema' to the table header. Red arrows point from 'Attributes' to the column headers. A blue arrow points from 'Tuple' to the first row of the table.

StudentID	Name	Phone	DOB
111335555	Matt	555-4141	06/03/70
111224444	Troy	556-9123	01/02/76
999775555	Sean	876-5150	10/31/81
444668888	Christy	219-7734	02/14/84

Database Administrator (DBA)

- A database administrator, or DBA, is responsible for maintaining, securing, and operating databases and also ensures that data is correctly stored and retrieved.
- In addition, DBAs often work with developers to design and implement new features and troubleshoot any issues.

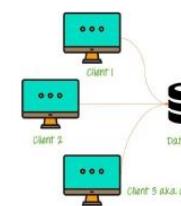
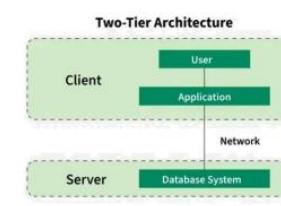
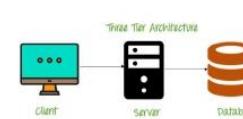
• DBMS में डेटाबेस एडमिनिस्ट्रेटर (Database Administrator - DBA) वह व्यक्ति होता है जो किसी संगठन के डेटाबेस सिस्टम के डिजाइन, स्थापना, प्रशासन और रखरखाव के लिए जिम्मेदार होता है, और यह सुनिश्चित करता है कि डेटा की स्थिरता, गुणवत्ता और सुरक्षा बनी रहे।

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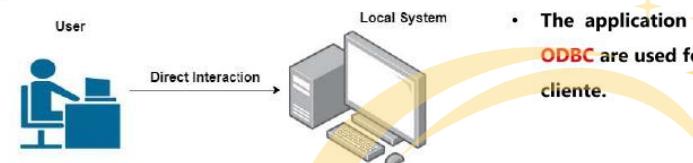
DBMS Architecture

Architecture

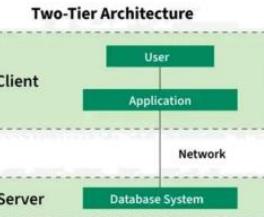
**Database Architecture****1. Single tier****2. Two tier****3. Three tier**

1. Single tier architecture
(local database system)

- Database is directly available to the user.
- Programmers communicate directly with the database for quick response.
- 1-Tier architecture is used for development of the **local application**
- Any request made by client **doesn't require a network connection** to perform the action on the database.


2. Two tier architecture

- Database system is present at the server machine.
- Whenever client machine makes a request to access the database present at server using a query language like SQL
- It includes an **Application layer** between the user and the DBMS.
- The application connection interface such as **JDBC**, **ODBC** are used for the interaction between server and cliente.



- ODBC** → Open Database Connectivity
- JDBC** → Java Database Connectivity

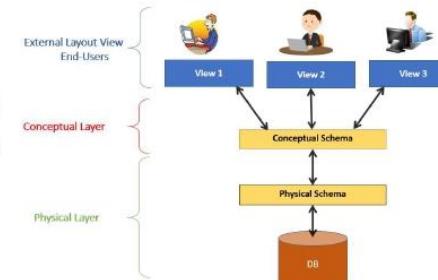
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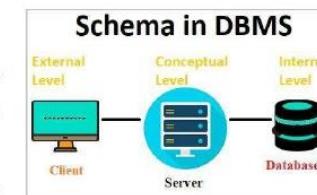
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3. Three tier architecture
This architecture has three levels

- ❖ External level (View) → Client
- ❖ Conceptual level (Logical) → Server
- ❖ Internal level (Physical) → Database

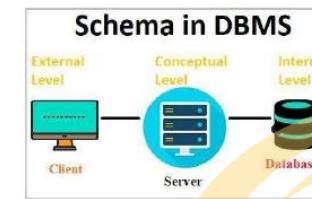

❖ External Level/ View Level → Client

- This layer is Closest to the user.
- The user **doesn't need to know the database schema details** such as data structure, table definition etc.
- User is only concerned about data which is what returned back.



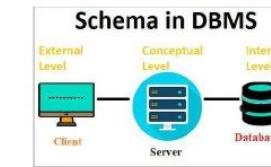
❖ **Conceptual level/ Logical Level → Server**

- The conceptual schema **describes the structure** of the whole database.
- The conceptual level does not care for how the data in the database is actually stored.
- Database **constraints and security** are also implemented in this level of architecture.
- Programmers and database administrators work at this level.



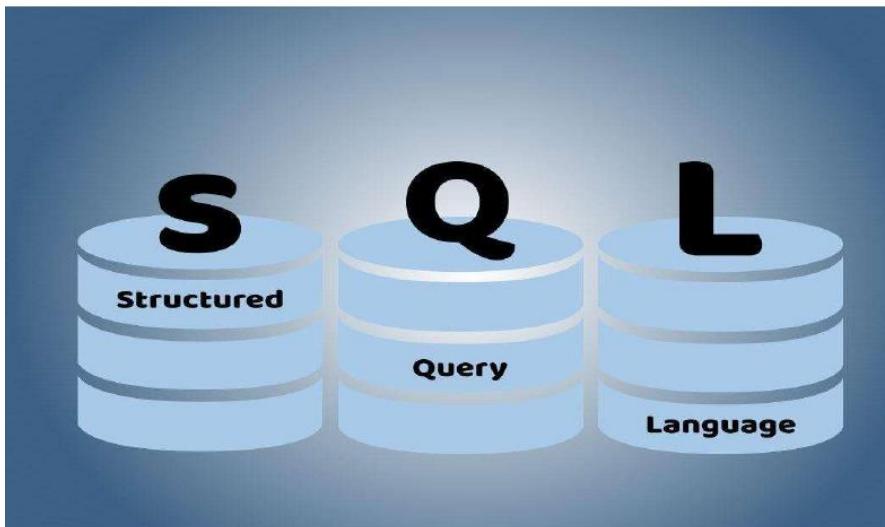
❖ **Internal Level/Physical Level → Database**

- This level describes how data is actually stored in the database.
- In this, data is stored in the **external hard drives** in the form of bits or data is stored in files and folders.
- This level also discusses **compression and encryption techniques**.
- This is the lowest level of the architecture.**
- This level is used to describe complex low- level data structures in detail.



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SQL


- SQL** is standard language for accessing and manipulating database
- SQL Old Name SEQUEL (Structured English Query Language)**

- SQL was initially developed at IBM by Donald D. Chamberlin and Raymond F. Boyce
- SQL is → **ANSI** standard language, (American National Standards Institute)
- ISO → International Organisation for standardization.





- SQL was developed by → IBM Corporation
- SQL was developed by → Donald Chamberlin and Raymond Boyce
- Old name → SEQUEL → Structured English QUery Language
- SQL Server is owed and developed by → Microsoft Corporation
- SQL was first commercially distributed by → Oracle
- Structure query language is → not case sensitive
- Every SQL statements should ends with a → semicolon ;

- Dr. E F. Codd is the Father of relational databases. Management System.

□ SQL comes in 4th Generation Language

- 1 Gen → Machine / Binary = 0/1
- 2 Gen → Assembly Language
- 3 Gen → High Level Language → Fortran, Basic, C, C++, Java
- 4 Gen → SQL, FoxPro, Access, Oracle, Focus, MATLAB
- 5 Gen → Prolog, Lisp, Mercury, OPS5

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SQL Advantages



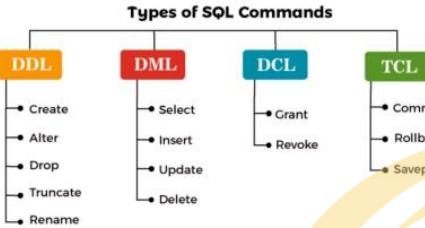
- High speed
- No coding needed
- Well defined standards → ISO and ANSI
- Portability → Used in laptops, PC, Mobile Phones
- Interactive Languages → Interact with database
- Multiple data view

Important SQL Command

1. SELECT → extracts data from a database
2. UPDATE → updates data in a database
3. DELETE → deletes data from a database
4. INSERT INTO → inserts new data into a database
5. CREATE DATABASE → creates a new database
6. ALTER DATABASE → modifies a database
7. CREATE TABLE → creates a new table
8. ALTER TABLE → modifies a table
9. DROP TABLE → deletes a table
10. CREATE INDEX → creates an index (search key)
11. DROP INDEX → deletes an index

Type of SQL Languages**5 Types of SQL Language**

1. **(DDL)** → Data Definition Language
2. **(DML)** → Data Manipulation Language
3. **(DCL)** → Data Control Language
4. **(TCL)** → Transaction Control Language
5. **(DQL)** → Data Query Language

**1. (DDL) → Data Definition Language**

- DDL is used to create, modify, and delete database structures
- Define schema of Database

Drop → Delete a whole database/table

Truncate → Deletes all rows of a table deletes the data inside a table, but not the table itself.

(DDL) Commands

- ❖ Create
- ❖ Alter
- ❖ Drop
- ❖ Truncate
- ❖ Rename

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2. (DML) → Data Manipulation Language

- **delete** → delete one or more rows of a table + Where clause is used
- **truncate** → delete one or more rows of a table (faster than delete) + Where clause is not used
- **drop** → drop whole table/table lost
- **Alter (DDL)** → add, delete, modify, rename the attributes of the relations.
- **Update (DML)** → update existing records in a database.

(DML) Commands

- ❖ Insert
- ❖ Update
- ❖ Delete
- ❖ Select

3. (DCL) → Data Control Language

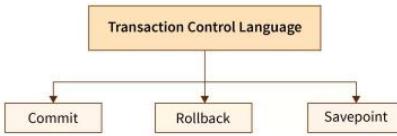
- The **GRANT** command is used for permitting the users whereas the **REVOKE** command is used for removing the authorization.

(DCL) Commands

- 1. Grant
- 2. Revoke

4. (TCL) → Transaction Control Language

- 1. **Commit** → Permanent → save changes
- 2. **Rollback** → undo
- 3. **Save Point** → creates point within the groups of transactions in which to rollback

**5. (DQL) → Data Query Language**

- **Select** → the select command is used to select data from a database.

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**SQL QUERY ORDER**

- **SELECT** → fields
- **FROM** → tables
- **WHERE** → conditions
- **GROUP BY** → fields
- **HAVING** → conditions on aggregate fields
- **ORDER BY** → fields

SQL Operators

[SQL Arithmetic Operators](#)

Operators	Description
+	Add
-	Subtract
*	Multiply
/	Divide
%	Modulo

[SQL Bitwise Operators](#)

Operator	Meaning
&	Bitwise AND
	Bitwise OR
^	Bitwise exclusive OR / Bitwise XOR
~	Bitwise inversion (one's complement)
<<	Shifts the bits to left / Bitwise Left Shift
>>	Shifts the bits to right / Bitwise Right Shift

Postgres Structured Query Language

- PostgreSQL, also known as Postgres.
- PostgreSQL is Free & Open-Source RDBMS.
- PostgreSQL is used as → Data Warehouse for Web Applications, Mobile Applications.
- PostgreSQL is an Advanced version of SQL.
- It is written in C language
- it is the default database for macOS Server
- It is used by Uber, Netflix, Instagram.



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- PostgreSQL is a powerful
- PostgreSQL is open source
- PostgreSQL is object-relational database system
- PostgreSQL offers data types to store IPv4, IPv6, and MAC addresses
- PostgreSQL used Client/Server model of communication
- Maximum length of a table name in PostgreSQL 64 Characters


NoSQL Database:

- SQL is used when we have structured data in the form of tables, if all data are stored in unstructured manner in that case we use NoSQL Databases

Example:

- | | |
|-------------|-------------------|
| • MongoDB | • CouchBase |
| • DynamoDB | • Neo4J |
| • Cassandra | • Amazon SimpleDB |
| • CouchDB | |



About NoSQL Database

- Benefit of NoSQL **Easy Schema Evolution**
- **MongoDB** handle complex queries/handling large volumes of data
- No any support to ACID
- Not require Fix Schema
- Distributed Database

RDBMS Software	NoSQL Database Software
PostgreSQL	MongoDB
MySQL	DynamoDB
Microsoft SQL server	Cassandra
SQLite	CouchDB
SQL Server Express	CouchBase
Sequel Pro	Neo4J
+ MariaDB	Amazon SimpleDB
Db2 Express-C	HBase
CUBRID	
Firebird	

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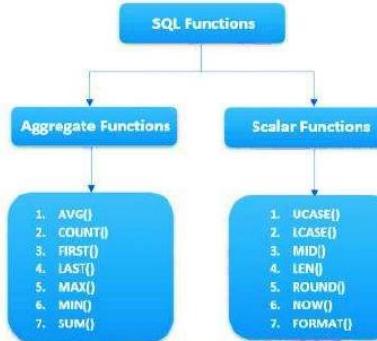
SQL QUERY Group By & Having

Having Clause

- It is used for applying some extra condition to the query
- Having cannot be used without Group By clause
- The having clause can contain aggregate functions
- It restrict the query output by using some conditions
- The Having clause was added to SQL because the **WHERE** keyword **cannot be used with aggregate functions**.
- The SQL Having clause is used if we need to filter the result set based on aggregate functions such as **MIN()** and **MAX ()**, **SUM()** and **AVG()**, and **COUNT()**.

SQL Function there are 2 types

- 1. SQL aggregate functions
- 2. SQL Scalar functions



1. SQL Aggregate Functions

- SQL aggregate functions return a single value, calculated from values in a column

- COUNT() — returns the number of rows
- SUM() — returns the sum
- AVG() — returns the average value
- MIN() — returns the smallest value
- MAX() — returns the largest value
- FIRST() — returns the first value
- LAST() — returns the last value

7 SQL aggregate Functions

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2. SQL Scalar Functions

- UCASE() — Converts a field to upper case.
- LCASE() — Converts a field to lower case.
- MID — Extract characters from a text field.
- LEN() — Returns the length of a text field.
- ROUND() — Rounds a numeric field to the number of decimal specified.
- NOW() — Returns the current date and time.
- FORMAT() — Formats how a field is to be displayed.

SQL Scalar Functions 7

Round Functions In SQL

- | | |
|---|--|
| 1. <code>SELECT ROUND(35.4458, 2);</code>
35.4500 | 6. <code>ROUND(748.58,-4)</code>
0 |
| 2. <code>SELECT ROUND(125.9152, -2);</code>
100.00 | 7. <code>ROUND(235.415, 2)</code>
235.420 |
| 3. <code>SELECT ROUND(153.467, 0);</code>
153.000 | |
| 5. <code>SELECT ROUND(65.726, -1);</code>
70 | |
| | -1 means multiple of 10 |
| | -2 means multiple of 100 |
| | -3 means multiple of 1000 |



8. **SELECT ROUND(12.3456, 2, 1);**

12.3400

9. **SELECT ROUND(-23.456, 2, 1);**

-23.450

- (result is rounded = 3rd parameter is 0)

- (result is truncated = 3rd parameter is non-zero)

10. **SELECT ROUND(125.315, 1);**

125.300

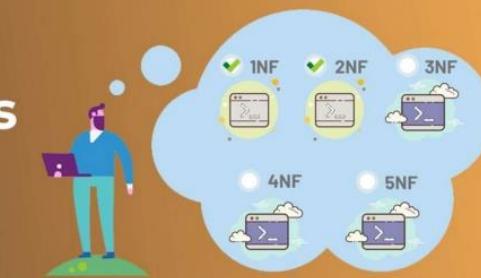
11. **SELECT ROUND(125.315, -1);**

130.000

12. **SELECT ROUND(125.315, -2);**

100.000

Normal Forms In DBMS



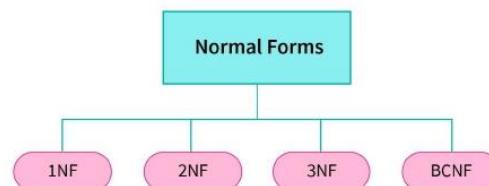
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Normal Forms in Database :-

Normalization is the process of removing redundancy and unwanted data.



Advantages of Normalization

1. Reduced Data Redundancy
2. Improved Data Consistency
3. Simplified Database Maintenance
4. Improved Query Performance

Disadvantages of Normalization

1. It is very time-consuming
2. Careless decomposition may lead to a bad database design
3. Increased Complexity
4. Increased Storage Space

Why Normalization

→ There are 3 Problems

1. Insertion Anomaly
2. Deletion Anomaly
3. Updation Anomaly

1. Insertion Anomaly

- If you want to "insert" a name and ID of a new student, you cannot do it until you don't have his branch name and branch code.
- This is called Insertion Anomaly.

S_ID	S_NAME	Branch Name	Branch Code
1.	John	CS	101
2.	Brat	CS	101
3.	Siemen	Electrical	106

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2. Deletion Anomaly

- If you want to "delete" a student name, then the branch name and code will also be deleted. The deleted branch name and code cannot be recovered again.
- This is called Deletion Anomaly

S_ID	S_NAME	Branch Name	Branch Code
1.	John	CS	101
2.	Brat	CS	101
3.	Siemen	Electrical	106

3. Updation Anomaly

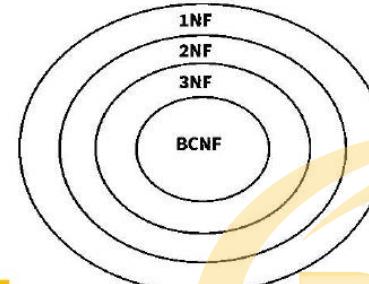
- If you want to "update" the branch name of John from CS to Civil, the update for Brat will also happen. Thus, multiple updations of single data occur
- This is called Updation Anomaly.
- A simple solution to the above problems is to reduce the dataset into two tables using Normalization in DBMS in the following way.

Table 1		
S_ID	S_NAME	Branch Code
1.	John	101
2.	Brat	101
3.	Siemen	106

Table 2	
Branch Code	Branch Name
101	CS
106	Electrical

There are 7 Normal Forms in Database

1. 1NF
2. 2NF
3. 3NF
4. BCNF (Boyce-Codd Normal Form)
5. 4NF
6. 5NF
7. 6NF



Normal Forms in Database

- 1NF → Atomic Values/ ER Model
2NF → Fully Functional Dependency on Primary Key
3NF → Non Transitive Dependency
BCNF → Boyce-Codd normal form
 - Advance version of 3NF
 - Eliminate all redundancy
 - Candidate Key
 - 3.5 NF
4NF → Tables does not have any multivalued dependencies
5NF → Join Dependency
6NF → Based on the concept of domain-key normal form (DKNF)

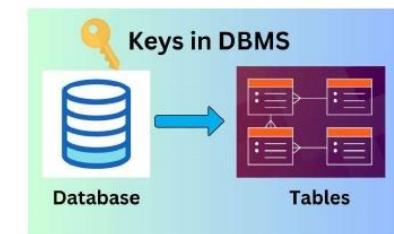
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Database Keys

1. Super Key
2. Candidate Key
3. Primary key
4. Alternate key
5. Composite Key
6. Foreign Key



1. Super Key

- A super key is a group of single or multiple keys which identifies rows in a table.
- The super key would be Roll no, Mobile no, Name etc.

SUPER KEY

Roll No	Name	Phone No
1	John	788545465
2	Kamal	784544665
3	Jorge	785265565

2. Candidate Key

- Candidate key is a minimal Super key.
- It can uniquely identify a tuple
- Candidate key are distinct set of attributes from which primary key can be selected

(Emp_Id)
(Emp_SSN)
(Email_id)

Emp_SSN	Emp_Id	Emp_name	Emp_email
11051	01	John	john@email.com
19801	02	Merry	merry@email.com
19801	03	Riddle	riddle@email.com
41201	04	Cary	cary@email.com

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3. Primary key

- One of the candidate key
- The Primary Key can't be a duplicate.
- A table cannot have more than one primary key.
- The primary key field cannot be null.

Candidate Key

StudID	Roll No.	First Name	Last Name	Email
1	21	Tom	Cox	abc@gfg.org
2	22	John	Butler	xyz@gfg.org
3	23	Alice	Peterson	mno@gfg.org

Primary Key Alternate Key

4. Alternate keys

- Out of all candidate keys, only one gets selected as Primary key, remaining keys are known as Alternate keys

Candidate Key

StudID	Roll No.	First Name	Last Name	Email
1	21	Tom	Cox	abc@gfg.org
2	22	John	Butler	xyz@gfg.org
3	23	Alice	Peterson	mno@gfg.org

Primary Key Alternate Key

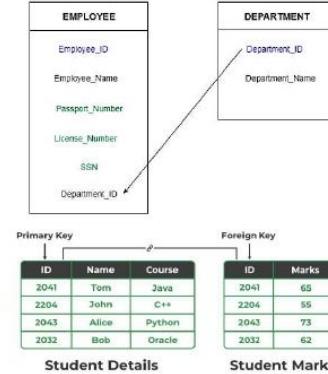
5. Composite Key

- When there is no primary key → Join attributes and create a primary key.
- Or Collection of primary key
- Also called Compound key
- ATM Card + PIN
- Username + OTP on mobile



6. Foreign key

- Foreign keys are the column of the table which is used to point to the primary key of another table.
- In the Employee table, Department id is the foreign key and both the tables are related.
- Used to link 2 tables together.
- Purpose of Foreign Key Maintain Referential Integrity of data
- Foreign Key can take null value.



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7. Surrogate key

- Surrogate key also called a synthetic primary key
- It is generated when a new record is inserted into a table automatically by a database that can be declared as the primary key of that table
- It is generated automatically
- The most common format for the surrogate key is a **sequential number** that identifies a table row.
- Mainly used in case of Merger of 2 companies

7. Surrogate key

Surrogate key						
Can't be used as a search key						
Is always unique						
Applies uniform rules to all records						
Does not change with time						
Requires an additional column in a table						

@databasetown						
ID	Employee_ID	SSC	First Name	Last Name	Job Title	Email
1	1	01A	John	Doe	Manager	johndoe@example.com
2	2	02B	Jane	Doe	Developer	janedoe@example.com
3	3	03C	Jim	Smith	Designer	jimsmith@example.com

Different Types of Keys**Student**

Roll_no	Name	Class	Phone_no	Registration_no
1	Andrew	5	9854672256	695
2	Andrew	6	9955512456	564
3	Augusto	5		567

Primary Key

Unique Key

Unique Key

Primary Key	Unique Key
Primary Key can't accept null values.	Unique key can accept only one null value.
By default, Primary key is clustered index and data in the database table is physically organized in the sequence of clustered index.	By default, Unique key is a unique non-clustered index.
We can have only one Primary key in a table.	We can have more than one unique key in a table.
Primary key can be made foreign key into another table.	In SQL Server, Unique key can be made foreign key into another table.

ER Model in DBMS



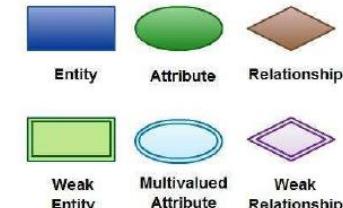
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ER Model

- An ER model, or Entity-Relationship model, is a high-level conceptual data model used to represent the structure of a database.
- ER model stands for Entity-Relationship model.
- It describes the structure of a database with the help of a diagram.
- ER model is used to represent real-world objects.
- E-R model specifically deals with entities and their relations.

Symbol Name	Symbol	Represents
Rectangles		Represents Entity
Ellipses		Represents Attribute
Diamonds		Represents Relationship
Lines		Links Attribute(s) to entity set(s) or Entity set(s) to Relationship set(s)
Double Ellipses		Represents Multivalued Attributes
Primary Key		Represents Key Attributes / Single Valued Attributes



ER Model

Three Components of ER Model

1. Entity
2. Relationship
3. Attribute

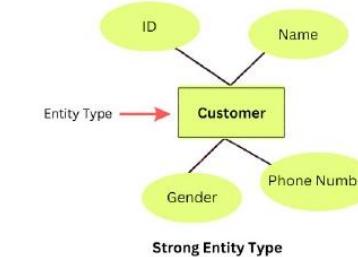
Entity & Types

A definable thing-such as a person, object, concept or event-that can have data stored about it.



Strong Entity

- A strong entity is an entity that is **not dependent** on any other entity.
- It has a primary key, or a table includes a primary key.



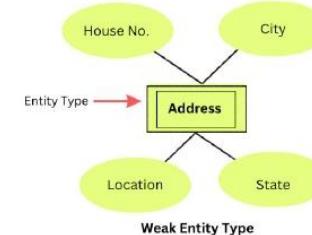
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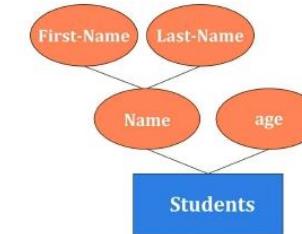
Weak Entity

- An entity that cannot be uniquely identified by its own attributes and relies on the relationship with other entity is called weak entity.
- The weak entity is represented by a double rectangle .



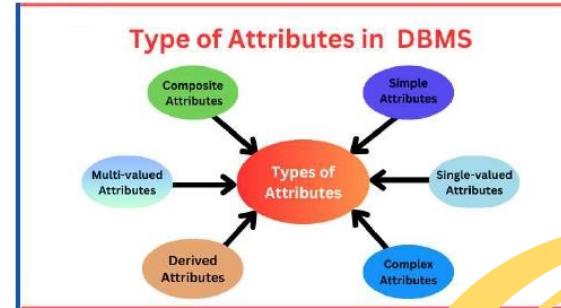
Attributes

- A property or characteristic of an entity. Often shown as an oval or circle.



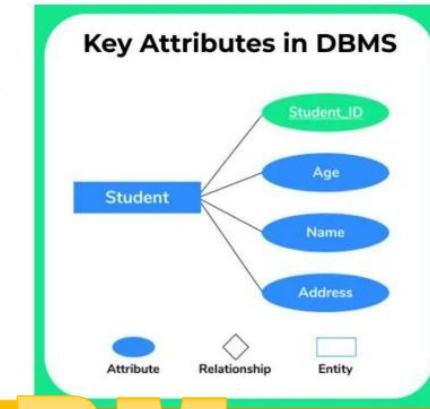
There are 6 types of Attributes

1. Key attribute
2. Composite attribute
3. Single value attribute
4. Multivalued attribute
5. Derived attribute
6. Stored Attributes



1- Key Attribute

- The key attribute represents the **primary key** column or columns in the dimension table.
- Text of key attribute is **underlined**



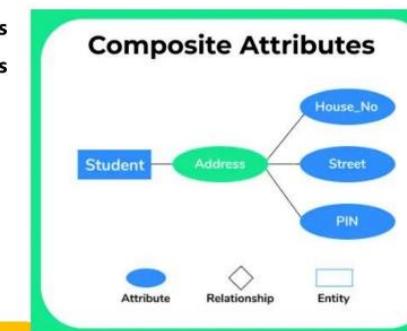
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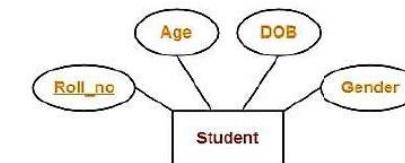
2- Composite attribute

- ❖ An attribute that is a **combination** of other attributes.
- ❖ Student address is a composite attribute as an address is composed of other attributes such as pin code, state, country



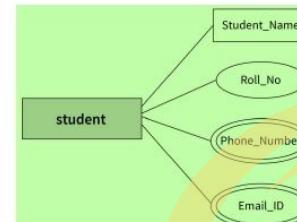
3- Single value attribute

- ❖ Those attributes which can have exactly **one value** are known as single valued attributes.
- ❖ For example, the **DOB** of a student can be a single valued
- ❖ **Gender** because one person can have only one gender.



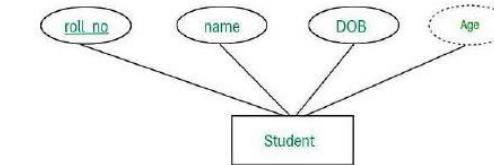
4- Multivalued attribute

- ❖ It is an attribute that can have **more than one value** associated with the key of the entity.
- ❖ **Phone number of a student:** Landline and mobile.
- ❖ **Email ID of a student:** Personal email ID and college email ID.



5- Derived attribute

- ❖ Derived attributes are those that may be computed from other attributes.
- ❖ If the **age** of a student in a database is not known, the age could be derived from the date of birth of the student in the database.
- ❖ In the ER model, the derived attributes are represented by a dashed oval.



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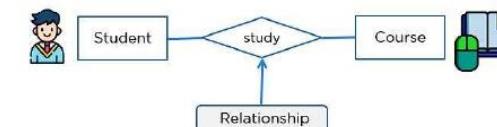
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6- Stored attribute

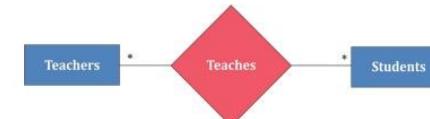
- ❖ Values of stored attributes remain constant and **fixed** for an entity instance.
- ❖ Help in deriving the derived attributes
- ❖ **Date of birth** attribute has a fixed and constant value throughout the life of an entity
- ❖ Age attribute can be derived from the Date of Birth attribute
- ❖ Hence, the **Date of Birth attribute** is a stored attribute.

Relationship

- A relationship is used to describe the relation between entities.



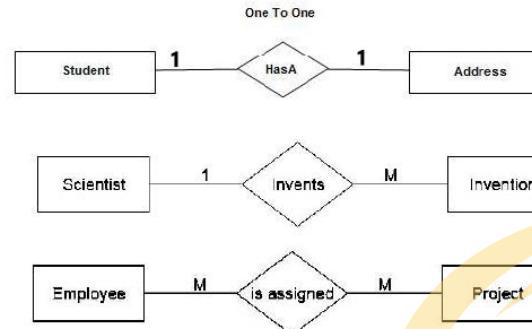
- Diamond or rhombus is used to represent the relationship





There are 3 types of cardinal relationships

1. one-to-one
2. one-to-many
3. many-to-many



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Database Schema

👉 डेटाबेस स्कीमा परिभाषित करती है कि रिलेशनल डेटाबेस में डेटा को किस प्रकार व्यवस्थित किया जाता है; इसमें तार्किक बाधाएं शामिल होती हैं, जैसे तालिका नाम, फ़ील्ड, डेटा प्रकार और इन संस्थाओं के बीच संबंध।

- A database schema defines how data is organized within a relational database.
- This is **Structure of a Database**
- This includes table names, fields, data types and the relationships between these entities.
- Process of database schema design is also known as **Data Modeling**

- A database schema is considered the "**blueprint**" of a database
- **Skeleton of the database.**
- **DDL** is used to create a Database Schema
- A database schema is the **logical representation of a database**
- The schema does not physically contain the data itself.

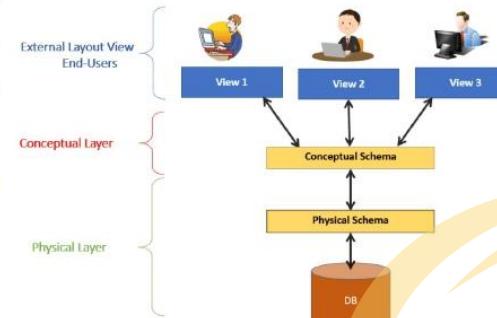
Types of Database Schema

1. Physical Schema
2. Logical Schema
3. View Schema

1. Physical Database Schema

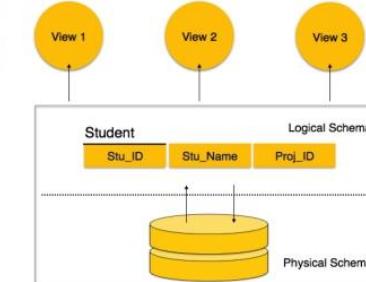
👉 A physical database schema specifies how the data is stored physically on a storage system or disk storage in the form of **Files and Indices**.

👉 Designing a database at the physical level is called a **physical schema**.

**2. Logical Database Schema**

👉 It defines the views, integrity constraints, and table. It defines how the data is stored in the form of tables and how the attributes of a table are linked together.

👉 ER modelling is used here.

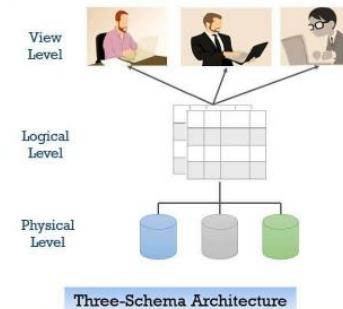


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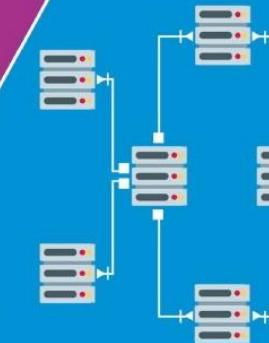
3. View Schema

👉 This schema generally describes the end-user interaction with the database systems.



CODD's Rule

DBMS



Codd's 12 Rules

- Codd's rule in DBMS also known as Codd's 12 rules.
- It is a set of **thirteen rules** (numbered 0 to 12)
- It defines a database to be a correct Relational Database Management System (RDBMS)
- If a database follows Codd's 12 rules, it is called a True relational database management system.
- These rules ensure consistency, accessibility, and integrity of data within the database.

Codd's 12 Rules

- **Rule 0: The Foundation Rule**
- **Rule 1: Information Rule**
- **Rule 2: Guaranteed Access Rule**
- **Rule 3: Systematic Treatment of Null Values**
- **Rule 4: Active/Dynamic Online Catalog based on the relational model**
- **Rule 5: Comprehensive Data SubLanguage Rule**
- **Rule 6: View Updating Rule**

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Codd's 12 Rules

- **Rule 7: Relational Level Operation (High-Level Insert, Update and delete) Rule**
- **Rule 8: Physical Data Independence Rule**
- **Rule 9: Logical Data Independence Rule**
- **Rule 10: Integrity Independence Rule**
- **Rule 11: Distribution Independence**
- **Rule 12: Non Subversion Rule**

SQL Constraints

- In a database table, we can add **rules to a column** known as **constraints**.
- These rules **control the data** that can be stored in a column.
- For example, if a column has **NOT NULL** constraint, it means the column cannot store **NULL values**.
- These constraints are also called **integrity constraints**.

SQL Constraints

- Constraints are used to **limit the type of data** that can go into a table.
- This ensures the **accuracy and reliability** of the data in the table.
- If there is any **violation** between the constraint and the data action, the **action is aborted**.

There are 7 types of SQL Constraints

1. **NOT NULL** Constraint. → **NOT NULL** values cannot be null
2. **UNIQUE** Constraint. → **UNIQUE** values cannot match any older value
3. **PRIMARY KEY** Constraint. → **PRIMARY KEY** used to uniquely identify a row
4. **FOREIGN KEY** Constraint/Referential Integrity Constraint → **FOREIGN KEY** references a row in another table
5. **CHECK** Constraint. → **CHECK** validates condition for new value
6. **DEFAULT** Constraint. → **DEFAULT** set default value if not passed
7. **CREATE INDEX** Constraint → **CREATE INDEX** used to speedup the read process

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SQL Views

- Views in SQL are considered as a **virtual table**.
- To create the view, we can **select the fields** from one or more tables present in the database.
- A view is actually a **composition of a table** in the form of a predefined SQL query.
- Database views are created using the **CREATE VIEW** statement

Topics of Discussion

- Pointers
- Cursors
- Locks
- Triggers
- Joins

Pointers In Database

- Database pointers allow **fast and predictable** accesses of data.
- It can be used together with the **relational data model** without risking a violation of the integrity of the database

Cursors In Database

- **Cursor** is a database object that allows us to retrieve and manipulate **each row one at a time**

Cursor Functions

Active Set

7369	SMITH	CLERK
7566	JONES	MANAGER
7788	SCOTT	ANALYST
7876	ADAMS	CLERK
7902	FORD	ANALYST

Current row



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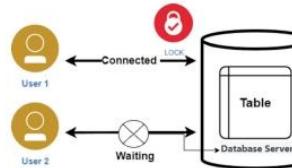
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- Cursors are used when working with **complex queries** that return **large amounts of data**.
- Cursors provide a way to process the data **row by row**
- The purpose of the cursor is to **update one row at a time**.
- Cursors are very helpful in all kinds of databases like Oracle, SQL Server, MySQL, etc.
- Cursor is a **Temporary Memory or Temporary Work Station**

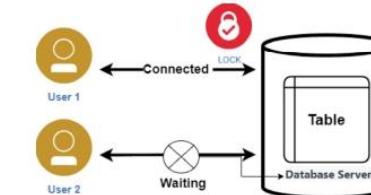
- A database cursor can be thought of as a **pointer to a specific row** within a query result.
- A cursor is a **control structure** in SQL
- A cursor is created to **retrieve and manipulate data, row by row**.
- A cursor in SQL is a database object used to **retrieve and manipulate data row, by row, rather than fetching an entire result set at once**.

Locks in Database

- Locks are used to maintain integrity & consistency in transaction
- The lock is a mechanism associated with a table for restricting unauthorized access to the data.
- It is mainly used to solve the concurrency problem in transactions.



- We can apply a lock on row level, database level, table level, and page level.
- The main problem with database locks is that they block.
- Blocks can delay multiple transactions, impacting overall application performance and user experience.

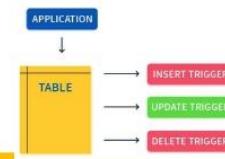


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Triggers In Database

- A database trigger is procedural code that is automatically executed in response to certain events.
- The trigger is mostly used for maintaining the integrity of the information on the database.
- It is a stored procedure & is activated ("triggered") in response to a particular event in a database.
- For example, when a new record (representing a new worker) is added to the employees table, new records should also be created in the tables of the taxes, vacations and salaries



Types of SQL Triggers

- Row-level triggers
- Statement-level triggers

Joins in SQL

- SQL Join is used to combine two or more tables
- In the process of joining, rows of both tables are combined in a single table.
- By using SQL Joins, we promote database normalization.

There are 5 Types of Join

- ANSI standard SQL defines five types of JOIN

 - Inner join/Simple join / Equi Join
 - Left outer join (Outer Join) ($A \bowtie B$)
 - Right outer join (Outer Join) ($A \bowtie\! B$)
 - Full outer join (Outer Join) ($A \bowtie\!\! B$)
 - Cross join/Cartesian Join ($A \times B$)

Inner Join

- The result table consist of only common rows.
- The Inner join is also referred as Equijoin.

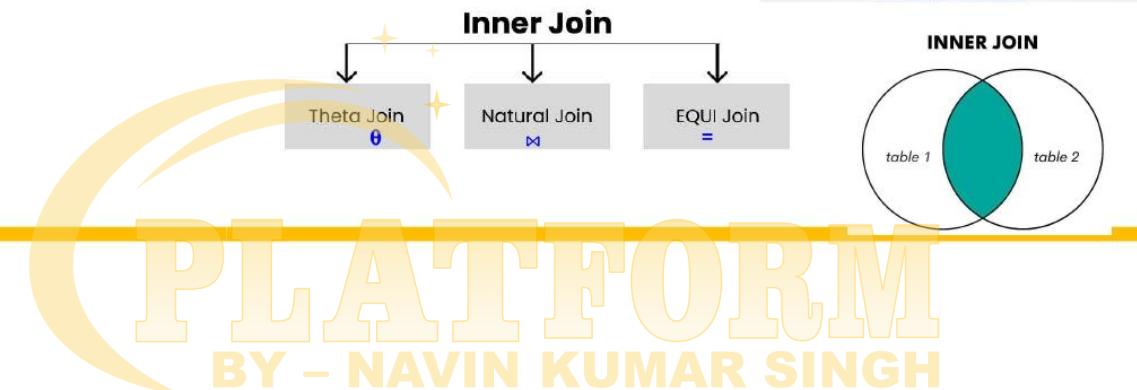
TABLE 1

Products	Price
Kiwi	\$6
Onions	\$3
Tomatoes	\$7

TABLE 2

Products	Quantity
Kiwi	10
Onions	6
Broccoli	5

INNER JOIN



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Theta Join θ

- It is also called Conditional Join
- A theta join could use any operator other than the "equal" operator.

Name	Salary
John Doe	2500
Richard Miles	4000

(a) Marketing relation

Name	Salary
Jane Doe	3000
John Smith	3500

(b) Production relation

M.Name	M.Salary	P.Name	PSalary
John Doe	2500	Jane Doe	3000
John Doe	2500	John Smith	3500

(c) Result

Equi Join =

- An Equi Join is a join operation in SQL that combines two tables based on a matching column between them.
- It uses the equality (=) symbol to compare the data between two columns

R		S		select * from R,S where R.key = S.key			
rid	key	sid	key	rid	R.key	sid	S.key
0	6	3	7	0	6	5	6
1	8	5	6	1	8	7	8
2	7	7	8	2	7	3	7

Natural Join ☰

- Used to join tables on the basis of a common column Natural Join (DO)

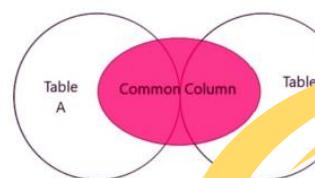
R	A	B
	1	2
	4	5

S	B	C
	2	3
	6	7

R NATURAL JOIN S

A	B	C
1	2	3

NATURAL JOIN



2-Left Outer Join

- The result table contains all the rows from the first table

TABLE 1

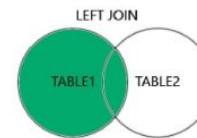
Products	Price
Kiwis	\$6
Onions	\$3
Tomatoes	\$7

TABLE 2

Products	Quantity
Kiwis	10
Onions	6
Broccoli	5

LEFT JOIN

Products	Price	Quantity
Kiwis	\$6	10
Onions	\$3	6
Tomatoes	\$7	Null



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3-Right Outer Join

- The result table contains all the rows from the second table

Table 1

Products	Price
Kiwis	\$6
Onions	\$3
Tomatoes	\$7

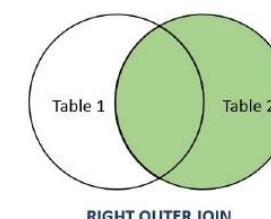
RIGHT JOIN

Table 2

Products	Quantity
Kiwis	10
Onions	6
Broccoli	5

RIGHT OUTER JOIN

Products	Price	Quantity
Kiwis	\$6	10
Onions	\$3	6
Broccoli	Null	5



4-Full Outer Join

- The result table contains all the rows from both the tables

TABLE 1

Products	Price
Kiwis	\$6
Onions	\$3
Tomatoes	\$7

FULL JOIN

TABLE 2

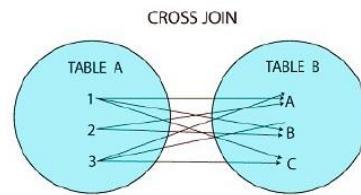
Products	Quantity
Kiwis	10
Onions	6
Broccoli	5

Products Price Quantity

Products	Price	Quantity
Kiwis	\$6	10
Onions	\$3	6
Broccoli	Null	5
Tomatoes	\$7	Null

5-Cross Join / Cartesian Join

- Returns the cartesian product of table's rows



CROSS JOIN

Meals	MealName	DrinkName
Omlet	Orange Juice	
Fried Egg	Orange Juice	
Sausage	Orange Juice	

Drinks	MealName	DrinkName
Orange Juice	Omlet	Tea
Tea	Fried Egg	Tea
Coffee	Sausage	Tea

```
for u in range(0, 1000):
    print('Thank you!')
```

**Thank
you**

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Programming Language

GENERATION	LANGUAGES
1. Generation Language	Machine Language (Binary Language)
2. Generation Language	Assembly Language (Mnemonics)
3. Generation Language	C, C++, JAVA, FORTRON, COBOL, BASIC, PASCAL (Software)
4. Generation Language	Peri, Python, Ruby, SQL, MatLab (Database Language)
5. Generation Language	Mercury, OPSS, LISP and Prolog (AI/Robots/Machine)



Advantages of OOPS



- Re-usability
- Data Redundancy
- Code Maintenance
- Security
- Design Benefits
- Better productivity
- Easy troubleshooting
- Flexibility
- Problems solving

OOPS (Object-Oriented Programming)



Bind means data & functions

- Founder → Alan Kay = 1960s
- First OOPS Language → **Simula** (1967)
- First pure OOPS Language → SmallTalk (1970's)

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List of OOPS Languages



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1. Java
2. Python
3. C++
4. C#
5. JavaScript
6. PHP
7. Go
8. Ruby
9. Visual Basic
10. Simula
11. Smalltalk



1. Semi-object-oriented programming language → C++

2. _____ is one of the greatest and most in-demand programming languages for object oriented programming. → Java

3. Building Block of Object-oriented Programming → Classes & Objects

4. Which language is 100% object-oriented → Java

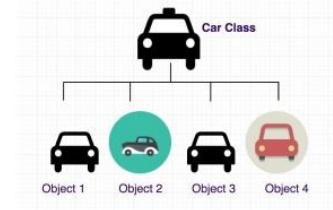
Pillars of OOPS

1. Classes
2. Objects
3. Abstraction
4. Polymorphism
5. Inheritance
6. Encapsulation



Objects

- An object can be defined as a data field that has unique attributes and behavior
- The object is an instance of a class
- Object is a physical entity



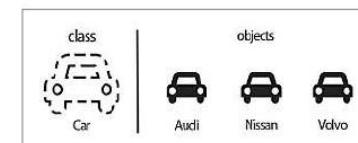
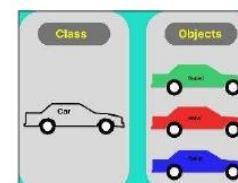
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Class

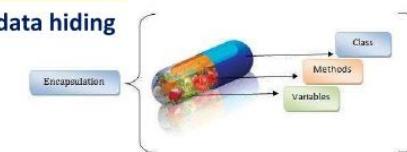
- A class is a group of similar objects

Example → Car, Pen, Chair, Computer, Watch



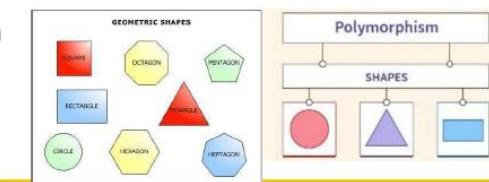
Encapsulation → (Data Hiding & Data Abstraction)

- Data encapsulation, also known as data hiding



Polymorphism

- making more than one form

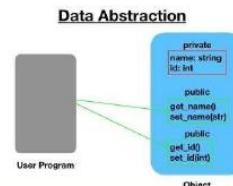


Data Hiding

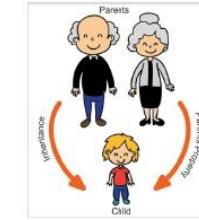
Technique for protecting the data within a class from unwanted access and preventing unneeded intrusion from outside the class

 **Data Abstraction**

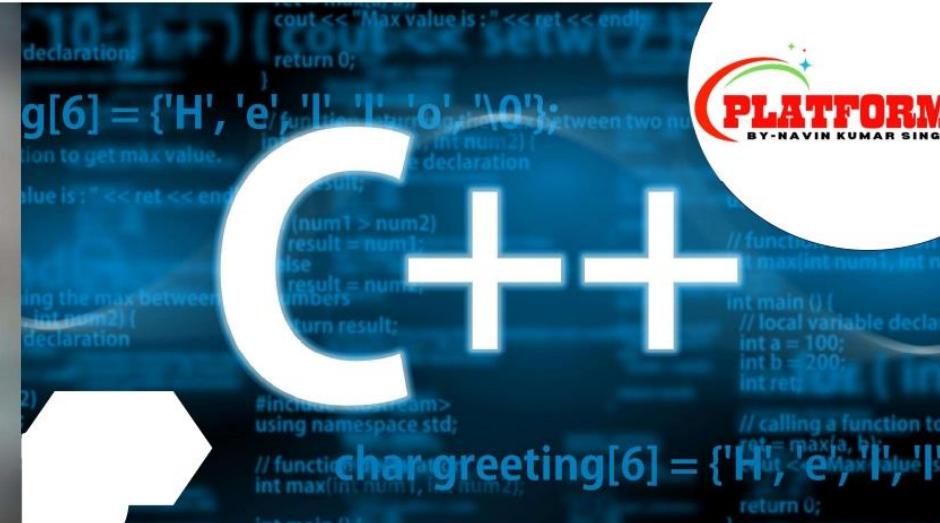
displaying only essential information and hiding the details

 **Inheritance**

One class inherits the attributes and methods of another class



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 C++

- Level = High Level Language
- Type = General-purpose Language
- Designed by = Bjarne Stroustrup
- Year = 1979 (Invented)
- Year 1983 (First Version released)
- Semi Object Oriented Language
- Based on = Modular Programming
- Applications / Used in = video games, embedded systems, IoT device, AI applications

 C++ supports the object-oriented programming = 4 pillar

1. Abstraction
2. Polymorphism
3. Inheritance
4. Encapsulation

The Four Pillars

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**PLATFORM**
BY - NAVIN KUMAR SINGH C++

- C++ Created at → Bell Laboratories
- Compiled or Interpreted → Compiled
- Earlier it was called as → C with classes / C with Objects
- C++ is Object Oriented or Not → Partial/Semi Object Oriented Language

C

C is a procedural with no support for objects and classes

C++

C++ is a combination of procedural and object-oriented programming languages.

Compiler Used in C++

- Turbo C++
- Code Block
- Dev C++
- Borland C++
- Microsoft Visual C++
- GCC (GNU Compiler Collection)

What is IDE.?

Integrated Development Environment

- 1) Source Code Editor
- 2) Build Automation Tools
- 3) Debugger
- 4) Compiler/Interpreter

// Simple C++ program to display "Hello World"

```
using namespace std; → Namespace
#include<iostream> → Library
int main() → Execution starts from here
{
    cout<<"Hello World"; → Output
}
return 0; → No return anything
```

Display

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Add two Numbers in C++ program

```
include <iostream>
using namespace std;
int main() {
    int num1, num2, sum;
    cout << "Enter the first number: ";
    cin >> num1;
    cout << "Enter the second number: ";
    cin >> num2;
    sum = num1 + num2;
    cout << "Sum of the two numbers is: " << sum;
    return 0;
}
```

Enter the first number: 2

Enter the second number: 3

Sum of the two numbers is:5

Comments in C++

Comments

// Single line comment

/* Multi-line comment */

DATATYPES IN C++ PROGRAMMING

By using these datatypes we can declare a variable.

1. **Integer**-int = Example = 1,2,3
2. **Float**-float = Example = 1.1,2.2,3.4
3. **Double**-double = Example = 3.3333
4. **Characters**-char = Example = a-z, A-Z, All Symbols
5. **Boolean** bool = Example = 0(False), 1(True) - Not present in C



TYPE MODIFIERS IN C++



It modifies the Range of datatypes

1. **Short**-Range will be less = 2 bytes
2. **Long**-Range will be more = 8 bytes
3. **Unsigned**-Accept only positive values
4. **Signed**-Accept both positive & negative values



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C++ Programming

- **iostream** provides = basic input and output services for C++ programs
- **Namespace** = provide a way to avoid name collisions
- **cout** = used to display output to the screen 65

main function

main function

- starting point for program execution
- controls program execution
- return value from the main() function is used by the runtime library
- source code begins execution

Cin & cout

- character input
- character output
- cin is an **object** of the **input stream**
- cout is an **object** of the **output stream** that is used to show output



Structure in C++

- A structure is a collection of various types of related information under one name
- The keyword used for the structure is "struct."
- Structure members have public access by default

Structure in C++

```
struct stud_id
{
    char name[20];
    int class;
    int roll_number;
    char address[30];
};
```

```
class Test{
private:
    int x;
protected:
    int y;
public:
    int z;
};
```

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**Classes in C++**

- Class in C++ is the building block that leads to Object-Oriented programming
- The keyword used for the class is "class."
- Class members have private access by default

Access Specifiers in C++

- Access Specifiers का प्रयोग करके data hiding को प्राप्त कर सकते हैं
- C++ में, access specifiers तीन प्रकार के होते हैं
 - Public** = public members को program में कही से भी access किया जा सकता है
 - Private** = private members को direct access नहीं किया जा सकता
 - Protected** = protected members को derived class के द्वारा access किया जा सकता है

C++ LOOP

C++ LOOP

- 1) For Loop
- 2) While Loop
- 3) Do While Loop

1. loop is a control structure
2. execute a block of code multiple times
3. we did not have loops = iterative method to print a repetitive block of statements

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C++ Without LOOP

```
#include <iostream> using namespace std;
int main()
{
    cout << Good morning \n";
    cout << Good morning \n";
}
```

```
Good morning
Good morning
Good morning
Good morning
Good morning
```

C++ With LOOP

```
include <iostream>
using namespace std;
int main()
{
    for (int i=1; i <= 5; i++)
    {
        cout << Good morning \n";
    }
    return 0;
}
```

```
Good morning
Good morning
Good morning
Good morning
Good morning
```

For Loop

- Loop is an entry controlled loop
- Condition specified by us is verified before entering the loop block
- we use For loops when we know the number of times the body of the loop needs to run

```
for(initialization expression; test expression; update expression)
{
    // statements to execute in the loop body
}
```

While Loop

- Loop is an entry controlled loop
- Condition specified by us is verified before entering the loop block
- while loops in circumstances when beforehand we do not know the precise number of times the body of the loop needs to run.

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While Loop

```
#include <iostream>
using namespace std;
int main()
{
    int i = 0; // initialization expression
    while (i < 5) // test expression
        cout << "Good morning\n";
    i++; // update expression
}
return 0;
}
```

```
Good morning
Good morning
Good morning
Good morning
Good morning
```

Do While Loop

- Loop is an exit controlled loop
- Test condition is verified after the execution of the loop
- Body executes at least once, regardless of the test condition, whether it is true or false

Do While Loop

```
#include <iostream>
using namespace std;
int main()
{
    int i = 2; // initialization expression
    do
    {
        cout <<< "Good morning\n";
        i++; // update expression
    } while (i < 1); // test expression
    return 0;
}
```

Good morning



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C++ Loop Control Statement

- 1. break statement** • Break statement **stops the entire process** of the loop
- 2. continue statement** • Continue statement only **stops the current iteration** of the loop
- 3. goto statement** • Goto statement is also known as **jump statement** = used to transfer control to the other part of the program

Keywords in C++

C++ Keywords					
asm	continue	float	new	signed	try
auto	default	for	operator	sizeof	typedef
break	delete	friend	private	static	union
case	do	goto	protected	struct	unsigned
catch	double	if	public	switch	virtual
char	Else	Inline	register	template	void
class	enum	int	return	this	volatile
const	extern	long	short	throw	while

Keywords in C++

- Keywords are **reserved words** that have predefined meanings.
- Keywords meaning is already defined by **Compiler**.
- Cannot be used as an **Identifier**.
- Cannot be used as **Variable name**.

There are a total of 95 Keywords in C++

Keywords in C++ = 95

- 32 Keywords **present** in C
- 30 Keywords **not present** in C
- 33 Keywords **not essential**

auto	double	int	struct	asm	private
break	else	long	switch	catch	public
case	enum	register	typedef	class	protected
char	extern	return	union	delete	template
const	float	short	unsigned	friend	this
continue	for	signed	void	inline	throw
default	goto	sizeof	volatile	new	try
do	if	static	while	operator	virtual

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Operators in C++

- Arithmetic Operators
- Relational Operators
- Logical Operators
- Bitwise Operators
- Assignment Operators
- Misc Operators

Arithmetic Operators = 7

+	Adds two operands
-	Subtracts second operand from the first
*	Multiplies both operands
/	Divides numerator by de-numerator
%	% Modulus Operator and remainder of after an integer division
++	Increment operator, increases integer value by one
--	Decrement operator, decreases Integer value by one

Relational Operators = 6

<code>= =</code>	Checks if the values of two operands are equal or not, if yes then condition becomes true.
<code>!=</code>	Checks if the values of two operands are equal or not, if values are not equal then condition becomes true.
<code>></code>	Checks if the value of left operand is greater than the value of right operand, if yes then condition becomes true.
<code><</code>	Checks if the value of left operand is less than the value of right operand, if yes then condition becomes true.
<code>>=</code>	Checks if the value of left operand is greater than or equal to the value of right operand, if yes then condition becomes true.
<code><=</code>	Checks if the value of left operand is less than or equal to the value of right operand, if yes then condition becomes true.

Logical Operators = 3

<code>&&</code>	Called Logical AND operator. If both the operands are non-zero, then condition becomes true.
<code> </code>	Called Logical OR Operator. If any of the two operands is non-zero, then condition becomes true.
<code>!</code>	Called Logical NOT Operator. Use to reverses the logical state of its operand. If a condition is true, then Logical NOT operator will make false.

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Bitwise Operators = 6

<code>&</code>	Binary AND Operator copies a bit to the result if it exists in both operands.
<code> </code>	Binary OR Operator copies a bit if it exists in both operands.
<code>^</code>	Checks if the value of left operand is greater than the value of right operand, if yes then condition becomes true.
<code>~</code>	Binary XOR Operator copies the bit if it is set in one operand but not both.
<code><<</code>	Binary Ones Complement Operator is unary and has the effect of 'flipping' bits.
<code>>></code>	Binary Left Shift Operator. The left operand's value is moved left by the number of bits specified by the right operand.

Assignment Operators = 11

<code>=</code>	Simple assignment operator, Assigns values from right side operands to left side operand.
<code>+=</code>	Add AND assignment operator, it adds right operand to the left operand and assign the result to left operand.
<code>-=</code>	Subtract AND assignment operator, It subtracts right operand from the left operand and assign the result to left operand.
<code>*=</code>	Multiply AND assignment operator, It multiplies right operand with the left operand and assign the result to left operand.

Assignment Operators = 11

/ =	Divide AND assignment operator, It divides left operand with the right operand and assign the result to left operand.
% =	Modules AND assignment operator, It takes modulus using two operands and assign the result to left operand.
<< =	Left shift AND assignment operator.
>> =	Right shift AND assignment operator.
& =	Bitwise AND assignment operator.
^ =	Bitwise exclusive OR and assignment operator.
=	Bitwise inclusive OR and assignment operator

Misc Operators = 7

- **Sizeof** operator = Size of variable
- Conditional operator (?) X: Y = If Condition is true then it Returns value of X otherwise returns value of Y.
- Comma operator (,) = sequence of operations
- .(dot) and -> (arrow) = reference purpose
- Casting operators = convert one data type to another
- Pointer operator (&) = returns the address of a variable
- Pointer operator (*) = pointer to a variable

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How many operators are supported by C++

– 45 Operators

Using keywords as an identifier causes in C++

– Syntax error

Programming language which uses both object-oriented programming and functional programming paradigms is

– Scala

There are how many relational operator are offered by C++

– 6 Operators

A procedure for solving a problem in terms of actions and their order, is called as – **Algorithm**

An object in a class is often called – **Instance**

How many storage specifiers are there in a C++ – **5 Storage specifiers**

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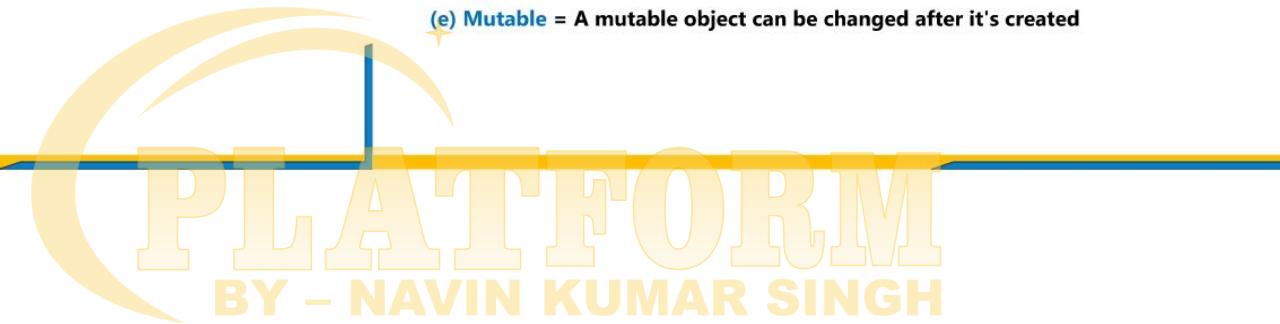
5 Storage specifiers

1. Automatic
2. Register
3. Static
4. External
5. Mutable

Storage specifiers

- (a) **Automatic** = default storage class
- (b) **Register** = allocates memory in register than RAM
- (c) **Static** = initialized only once and exists till the end of a program, default value 0
- (d) **External** = Visible to all the programs
- (e) **Mutable** = A mutable object can be changed after it's created

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- The string that contains zero characters is called? – **Empty string**
- Syntax errors are called – **Compile Time Error**
- Sequence of characters delimited by quotation marks is called – **String literals**
- Microsoft's object- oriented primary programming languages includes – **Visual Basic**
- Writing a keyword while as While in C++ program causes a – **Syntax error**
- In C++, the original class is called – **Base Class**

TOPIC

PLATFROM
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Scope Resolution Operator in C++

A hand-drawn style illustration of a person's hands resting on a purple laptop keyboard. The laptop screen shows a dark interface with some code or data visible.

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Scope resolution operator is denoted by?
:: (Symbol)

त्रुटियों के प्रकार - Type of error

- Syntax errors/Compile-time errors
- Logic errors/Semantic errors
- Run-time errors/Exceptions
- Interface errors

Syntax errors/Compile-time errors

- जब आप अपने लैपटॉप या कंप्यूटर में किसी प्रोग्राम कोड को लिखते हैं और गलती से किसी सिंटेक्स का उपयोग करना भूल जाते हैं तो आपको सिंटेक्स एरर का मैसेज मिलता है।
- ये सिंटेक्स (.:>) जैसे भी हो सकते हैं
- कम्पाइलर इन्हीं की पहचान करता करता है है और और उन्हें डिबगिंग ट्रूल्स का उपयोग करके ठीक किया जा सकता है।

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Logic errors/Semantic errors

- लॉजिकल एरर तब आता है जब कोड के एलोरिथ्म में कोई समस्या होती है।
- लॉजिकल एरर होने पर प्रोग्राम का कोड आपको एक गलत आउटपुट प्रदान करता है
- या प्रोग्राम काम करना बंद कर देता है

Run-time errors/Exceptions

- रन टाइम एरर आपको तब दिखाई देगा जब कोई व्यक्ति प्रोग्राम का उपयोग करता है और कंप्यूटर उसका पता लगाता है।
- उदाहरण के लिए, अपर्याप्त मेमोरी अक्सर रनटाइम त्रुटि को ट्रिगर कर सकती है।

Interface errors

- जब आपको इंटरफ़ेस एरर दिखाई देता है इसका मतलब आपके एपीआई (Application programming interface) में डिसकनेक्ट शामिल है।
- इसका मतलब है की एपीआई में एक से ज्यादा भाषाएँ हैं जो एरर उत्पन्न कर रही हैं।



Programming in C++

1. General Purpose programming language.
2. It is a procedural + object oriented language.
3. This is case sensitive.
4. We need compiler in this.
5. Files save in extension = .cpp
6. Editors to write a programme = Turbo C, Code Blocks
7. In C++ compiler, mouse pointer is visible (Mouse pointer is not visible in C compiler)



Difference Between C & C++

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Difference b/w C & C++

1. **C = Procedural Oriented**
C++ = Object Oriented
2. **C = Function Driven approach**
C++ = Object oriented approach
3. **C = Case Sensitive**
C++ Case Sensitive
4. **C=Compiler Required**
C++=Compiler Required
5. **C = printf (Output Function), scanf (Input Function)**
C++ cout (Output Function), cin (Input Function)

5. **C = printf (Output Function), scanf (Input Function)**
C++ cout (Output Function), cin (Input Function)
6. **C = Function & Data are separately written**
C++ = Function & data can be written in a single block = Class
7. **C = 2 function use to allocate a memory = malloc(), calloc()**
C++ = To allocate a memory use = "new" operator
8. **C = Released the memory by using = free() function**
C++ = Released the memory by using = delete function

9. C = Inheritance is not supported

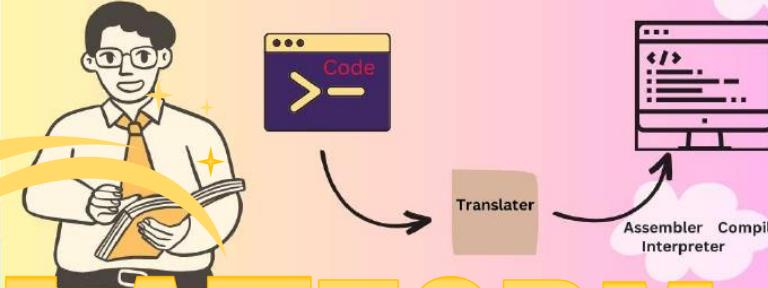
C++ = Inheritance is supported

10. C = Overloading & Information Hiding = Not Supported

C++ = Overloading & Information Hiding = Supported

What is Compiler Interpreter and Assembler

Oh now i
understand
0 and 1

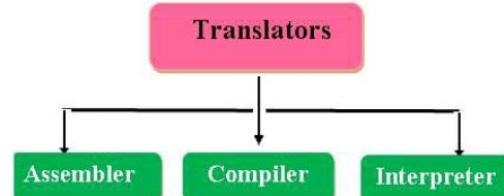


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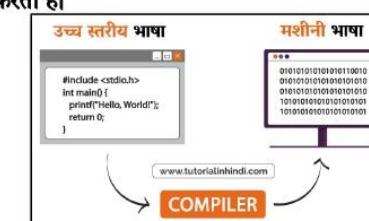
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Compiler, Assembler और Interpreter



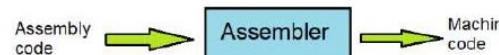
What is Compiler ?

- कम्पाइलर एक language translator होता है जो high level language के code को machine language में translate करता है।"
- प्रोग्रामिंग लैंग्वेज जैसे कि – C++, JAVA, C, C# आदि कम्पाइलर का प्रयोग अपने programs को translate करने के लिए करती है।



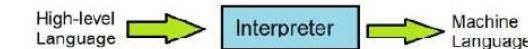
What is Assembler ?

- Assembler एक ऐसा computer program है जो assembly भाषा में लिखे गए code को machine भाषा में convert करने में मदद करता है।
- प्रोग्रामिंग लैंग्वेज जैसे कि – C++, JAVA, C, C# आदि कम्पाइलर का प्रयोग अपने programs को translate करने के लिए करती है।



What is Interpreter

- Interpreter एक कंप्यूटर प्रोग्राम होता है जो high-level लैंग्वेज में लिखे गए code को machine लैंग्वेज में बदल देता है।
- यह code को एक-एक लाइन करके मशीन लैंग्वेज में बदलता है। अगर किसी लाइन में कोई error आती है तो जब तक उस error को ठीक नहीं कर लिया जाता है तब तक यह आगे कोड को ट्रांसलेट नहीं करता है।
- इंटरप्रेटर का सबसे पहले प्रयोग 1952 में किया गया था।



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Functions in C++

There are two types of function

- Standard Library Functions:**
Predefined in C++
- User-defined Function:**
Created by users

C++ Function Overloading

Functions having the same name but different arguments are known as overloaded functions.

```
// same name different arguments
int test() {}
int test(int a) {}
float test(double a) {}
int test(int a, double b) {}
```

C++ Inline Functions

- This copies the function to the location of the function call in compile-time and may make the program execution faster.
- Create an inline function, we use the **inline** keyword

C++ Function Overloading

Functions having the **same name** but **different arguments** are known as overloaded functions.

```
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C++ Inline Functions

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- Create an inline function, we use the **inline keyword**

C++ Recursion

- A function that **calls itself** is known as a recursive function. And, this technique is known as recursion.
- To prevent infinite recursion, **if...else** statement (or similar approach) can be used

Steps for developing software?
सॉफ्टवेयर विकासित करने के चरण?

- Algorithm
- Flowchart
- Pseudocode
- Coding/Programming

Algorithm

- An algorithm in C++ is a set of steps that a program follows to complete a task.
- Algorithms are used to solve problems by sorting, searching, and manipulating data structures
- Founder =
Muhammad Ibn Musa Al-Khwarizmi
Persian mathematician
9th century

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What is the first computer algorithm?
पहला कंप्यूटर एल्गोरियम क्या है?

- Note G
- Written By (द्वारा लिखित) = Ada Lovelace (एडा लवलेस)
- 1843

Ada Lovelace

- First Computer Programmer (प्रथम कंप्यूटर प्रोग्रामर)
- English mathematician and writer (अंग्रेजी गणितज्ञ और लेखक)
- Calculate Bernoulli numbers (बर्नॉली संख्या की गणना)



Flowchart

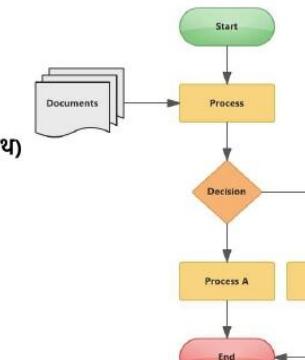
Who is the founder of flow chart?

फ्लो चार्ट के संस्थापक कौन हैं?

1921

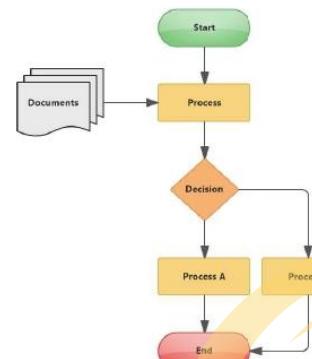
Frank and Lillian Gilbreth (फ्रैंक और लिलियन गिलब्रेथ)

A flowchart is a diagram that illustrates the steps, sequences, and decisions of a process or workflow.



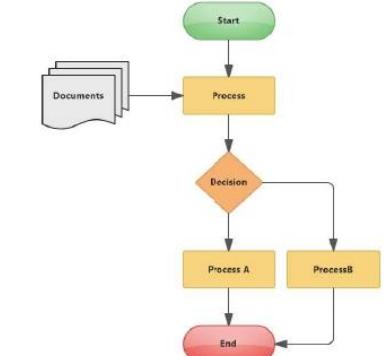
Flowchart

- प्रोग्राम की Graphical Representation को Flowchart कहा जाता है
- Old Name Flow Process Chart = 1920 =
- Frank and Lillian Gilbreth
- Presented American Society of Mechanical Engineers (ASME) = 1921
- 1949= Herman Goldstine + John von Neumann = developed a flowchart to plan computer programs



Flowchart

- 9 symbols in Flowchart**
- Terminator = Start and end
 - Input/Output
 - Processing
 - Arrow = Flow line
 - Decision Making
 - Subprogram
 - Connector
 - Hexagon
 - Document



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1. Terminator Symbol

- यह सिंबल्स Oval shape के होते हैं
- इस symbol का इसेमाल प्रत्येक flowchart के शुरुआत और अंत में किया जाता है
- इसे Start/Stop Symbol के नाम से भी जाना जाता



Terminator Symbol

2- Input/Output Symbol

- यह सिंबल्स एक parallelogram की shape में होते हैं
- INPUT, READ और PRINT जैसे कथनों को समांतर चतुर्भुज में दर्शाया जाता है



3- Processing Symbol

- यह सिंबल्स rectangle shape के होते हैं
- अधिकतर यह प्रोसेस एक से अधिक स्टेप्स के होते हैं
- इसका इस्तेमाल Mathematical calculations कार्य जैसे कि - गुणा करना, भाग करना, जोड़ना, घटाना आदि को दर्शाने के लिए किया जाता है



4- Arrow (Flow Line) Symbol

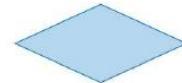
- इसका चित्र arrow (तीर) होता है
- इस arrow की दिशा ऊपर, नीचे, दायें, बाएं, कुछ भी हो सकती है
- इसका प्रयोग फ्लोचार्ट के sequence (क्रम) को प्रदर्शित करने के लिए किया जाता है



Flowline/ Arrow Symbol

5- Decision Making Symbol

- यह सिंबल्स एक डायमंड जैसी shape में होते हैं
- इसका इस्तेमाल decision (निर्णय) लेने के लिए किया जाता है
- इसमें true/false या yes/no जैसे decision होते हैं



6- Subprogram Symbol

- इसे subroutine symbol भी कहा जाता है
- जब भी हमें अपने प्रोग्राम में किसी दूसरे प्रोग्राम का रिफरेन्स बनाना पड़ता है
- तो उस समय दूसरे प्रोग्राम को दर्शाने के लिए subprogram symbol को प्रयोग किया जाता है



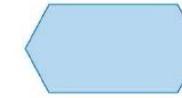
7- Connector Symbol

- इस सिंबल का इस्तेमाल फ्लोचार्ट के दो या दो से अधिक भागों को जोड़ने के लिए किया जाता है
- इसका चित्र circle (गोला) होता है



8- Hexagon Symbol

- इस सिंबल को preparation symbol भी कहा जाता है
- इसका इस्तेमाल for loop, while loop, या दूसरे loops को प्रस्तुत करने के लिए किया जाता है
- इसका चित्र hexagon (षटभुज) होता है



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9- Document Symbol

- इसका इस्तेमाल डॉक्यूमेंट को प्रदर्शित करने के लिए किया जाता है



Types of Flowchart

- Macro Flowchart = Shows only the major steps of the processes & has fewer than six steps.
- Mini Flowchart = It focuses on only a part of the macro-level Flowchart.
- Micro level Flowchart = The micro-level, or ground-level, view provides a very detailed picture of a specific portion of the process by documenting every action and decision



Pseudocode

- Pseudo Code एक text based प्रोग्राम डिजाइन लैंग्वेज है
- हमें pseudo code लिखते समय अधिक नियमों का पालन नहीं करना होता
- हम इसे अपने अनुसार किसी भी भाषा में लिख सकते हैं
- लेकिन फिर भी pseudo code को english भाषा में ही लिखना चाहिए

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Exception Handling in C++

Exception Handling in

C++ Handling

Checked
Exception

Unchecked
Exception

Error



Exception Handling in C++

- Exceptions can be handled during run-time.
- Errors compiler is sure and tells about them during compile-time
- What is Exception in C++ = A problem that arises during the execution of a program
- When an error occurs, C++ will normally stop and generate an error message.
- C++ will throw an exception (throw an error).

Keyword used for - Exception Handling in C++ = 3

1. Try = This block of code to be tested for errors while it is being executed.
2. Throw = throwThis throws an exception when a problem is detected
3. Catch = The code to handle the exception is written inside the catch block

finally Keyword in C++

- finally part of the try-catch block is always executed whether exceptions are caught or not

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C++ Pointers

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C++ Pointers

- In C++ Pointers store the memory addresses of other variables.
- In C++, the asterisk (*) symbol is used
- to declare pointers.
- * Called = Dereference operator.
- & symbol = Returns the memory address of a variable
- new = Dynamic memory allocation operator

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Unicode means? / यूनिकोड का मतलब?

Unicode is an = Universal Character Encoding Standard.

यूनिकोड एक = यूनिवर्सल कैरेक्टर एन्कोडिंग मानक है।

Character Encoding Means? कैरेक्टर एन्कोडिंग का मतलब?

- Computers do not understand the English alphabet, numbers except 0 and 1, or text symbols.
- We use Character encoding to convert these into computer language.
- कंप्यूटर अंग्रेजी वर्णमाला, 0 और 1 को छोड़कर संख्याओं या पाठ प्रतीकों को नहीं समझते हैं।
- इन्हें कंप्यूटर भाषा में परिवर्तित करने के लिए हम कैरेक्टर एन्कोडिंग का उपयोग करते हैं।

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Character Encoding Types ?
कैरेक्टर एन्कोडिंग प्रकार

ASCII = American Standard Code for Information Interchange

Unicode = Universal Character Encoding

EBCDIC = Extended binary coded decimal interchange code

Unicode Also known as.?

यूनिकोड को किस नाम से भी जाना जाता है?

UTF (Unicode Transformation Format)

UTF (यूनिकोड परिवर्तन प्रारूप)

How many bits is Unicode?

यूनिकोड कितने बिट का होता है?

1. UTF-8 = 8 Bit
2. UTF-16 = 16 Bit
3. UTF-32 = 32 Bit

Unicode Developed

- Unicode was initiated in = 1987 (यूनिकोड की शुरुआत 1987 में हुई थी।)
- Unicode Developed by (Xerox employee) = Joe Becker, Lee Collins, and Mark Davis (यूनिकोड जी बेकर, ली कॉलिन्स और मार्क डेविस द्वारा विकसित।)

Unicode Developed

- Unicode is maintained by = **Unicode Consortium** (यूनिकोड का रखरखाव = यूनिकोड कंसोर्टियम द्वारा किया जाता है)
- Unicode Consortium Founded in = 1991 (1991 में स्थापित)
- The first version of Unicode was introduced in 1991. (यूनिकोड का पहला संस्करण 1991 में पेश किया गया था।)

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American Standard Code for Information Interchange

ASCII Value	Character
0	NUL
1	SOH
...	...
32	(space)
33	!
34	"
...	...
65	A
66	B
...	...
97	a
98	b
...	...
127	DEL

ASCII

1. Stands for = **American Standard Code for Information Interchange**
2. ASCII = Common Computer Code
3. Proposal of ASCII submitted by = Bob Bemer of IBM in 1961
4. Proposal of ASCII submitted to = **ANSI (American National Standards Institute)**
5. 1963 = ASCII proposal approved
6. ASCII is = 7 BIT Code = 128 Characters = (2) Characters
7. EASCII Extended ASCII = 8 Bit Code = 256 Characters = (2) Characters

ASCII Character			
32	Space		
33	!	42 *	51 3 60 <
34	"	43 +	52 4 61 =
35	#	44 ,	53 5 62 >
36	\$	45 -	54 6 63 ?
37	%	46 .	55 7 64 @
38	&	47 /	56 8 65 A
39	'	48 0	57 9 90 Z
40	(49 1	58 : 97 a
41)	50 2	59 ; 122 z

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Multimedia

मल्टीमीडिया

What is Multimedia:

Multimedia is the integration of different types of media, such as

- Text
- Drawings
- Still images/Graphics
- Moving images (Videos)
- Audio
- Animation

Examples of Multimedia



- Multimedia is the use of computers to present text, graphics, video, animation, and audio in an integrated way.
- The term multimedia was coined by singer and artist =Bob Goldstein

Protocols for Multimedia

- RTP (Real-Time Transport Protocol)**
 - Video conferencing & live streaming. Example Zoom, Skype etc
- RTSP (Real-Time Streaming Protocol)**
 - Control media sessions between clients and servers
 - Example Netflix Movies. Play, pause, and fast forward.

Hardware components for Multimedia

- Input Devices
- CPU (Processor)
- Output Devices
- Storage Devices
- Memory (RAM)
- Graphics Card (GPU)

Examples of Computer Hardware



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Warping in Multimedia :

- Digitally manipulating an image

- Warping is the distortion of one static image to produce another static image



खींचना

Morphing in Multimedia

- Morphing is animation that changes one image slowly into another



Types Of Images

- Raster Images
- Vector Images

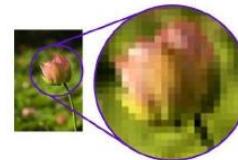


1. Raster Graphics

- Raster graphics is also called as Bitmap image
- Raster graphics render images as a collection of countless tiny squares.
- Made up of pixels

□ Examples

- BMP → Bitmap Image file
- TIFF → Tagged image file format
- GIF → Graphics Interchange Format
- PNGs → Portable Network Graphics
- JPEG files → Joint Photographic Experts Group



Software - Photoshop is based on pixels

2. Vector Graphics

- Vector Images are made from mathematical paths.
- Vector graphic is artwork made up of points, lines, and curves that are based upon mathematical equations
- Used to create graphics, logos
- How close you zoom in on the image, the lines, curves, and points remain smooth.
- The disadvantage of vector image is time consuming and also specific talent must be needed to create it.
- Software Adobe illustrator, CorelDraw

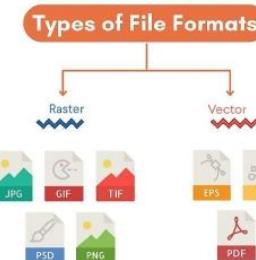


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□ Examples

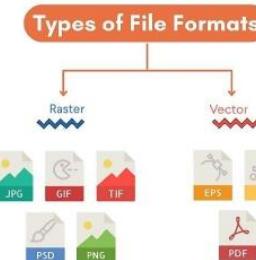
- SVG → Scalable Vector Graphics
- EPS → Encapsulated PostScript
- WMF → Windows Metafile
- PICT → Macintosh Picture
- AI → Adobe Illustrator
- PDF → Portable Document Format
- Software → Adobe illustrator, CorelDraw

**1. Rasterization**

- Process of transforming a vector (curve based) image to a rasterized (pixel based) image
- Vector Image → Raster Image

2. Vectorization

- Process of transforming a rasterized (pixel based) image to a vector (curve based) image
- Raster Image → Vector Image



Multimedia Authoring

- Multimedia Project को डेवलप करने की सुविधा को Multimedia authoring कहां जाता है।
- Authoring system software tools का एक सेट होता है।

Multimedia Authoring Software:

1. Macromedia/Adobe Flash
2. Macromedia/Adobe Director
3. Author ware
4. Quest. (FDAQ)

Audio File Extensions

- MP3 → MPEG Layer 3
- WAV → Waveform ,Audio File
- WMA → Windows, Media Audio
- FLAC → Free Lossless Audio Codec
- Vorbis

Video File Extensions

- AVI Audio Video Interleave
- MPG/MPEG → Moving Picture Experts Group
- MP4 → MPEG Layer-4
- MOV → QuickTime Movie
- WMV → Windows Media Viewer
- FLV → Flash video

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Images File Extensions

- JPEG/JPG → Joint Photographic Experts Group
- PNG → Portable Network Graphics
- GIF → Graphics Interchange Format
- TIFF → Tagged Image File
- PSD → Photoshop Document
- AI → Adobe Illustrator
- BMP → Bitmap File

What is Video Compression?

- Reducing the size of a video file by encoding is called Video Compression.
- 2 Types of Video Compression
 - (A) Lossless Compression
 - (B) Lossy Compression

1. Lossless Compression

- Compresses data without losing any original quality.
- Example = ZIP, PNG, BMP, WAV, FLAC, GIF

PNG = Portable Network Graphics

BMP = Bitmap Image File

WAV = Waveform Audio File

FLAC = Free Lossless Audio Codec

GIF = Graphics Interchange Format

ZIP = Zigzag Inline Package

Note = PDF are also Lossless (Portable Document Format)

2. Lossy Compression

- Reduces file size by permanently removing some of the original data.

Example = JPEG images, MP3 music files, Streaming video, MPEG,

JPEG = Joint Photographic Experts Group

MPEG = Moving Picture Experts Group

MP3 = MPEG Audio Layer 3

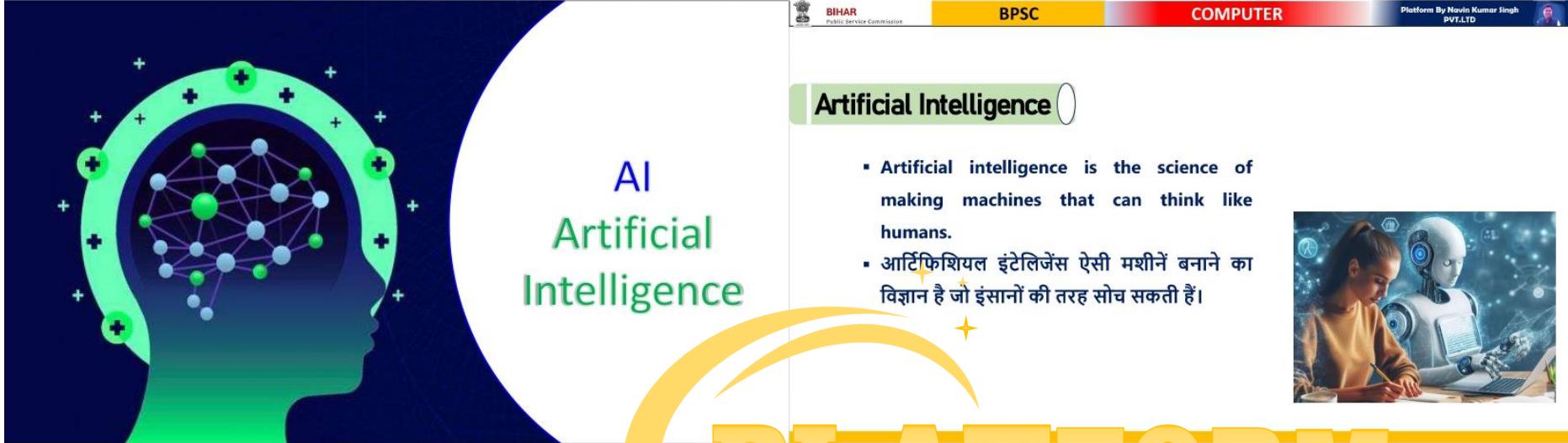
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Stages of Multimedia Project Development

1. Planning
2. Designing
3. Developing
4. Testing
5. Deploying





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● Artificial Intelligence

- Machines today can learn from experience, adapt to new inputs, and even perform human-like tasks with help from artificial intelligence (AI).
- आज मशीनें अनुभव से सीख सकती हैं, नए इनपुट के अनुकूल हो सकती हैं और यहां तक कि कृत्रिम बुद्धिमत्ता (एआई) की मदद से मानव जैसे कार्य भी कर सकती हैं।
- Artificial intelligence examples today, from chess-playing computers to self-driving cars, are heavily based on deep learning and natural language processing.
- शतरंज खेलने वाले कंप्यूटर से लेकर सेल्फ-ड्राइविंग कार तक, आज कृत्रिम बुद्धिमत्ता के उदाहरण काफी हद तक डीप लर्निंग और प्राकृतिक भाषा प्रसंस्करण पर आधारित हैं।

About AI

- Building smart machines
- Intelligence of machines or software
- Founder of AI John McCarthy
- John McCarthy coined the term Artificial Intelligence in which year 1956
- Advance form of AI is called → Deep Learning
- AI systems are made up of → Machines + Hardware + Software
- Machine becomes intelligent once → Trained

4**Types of AI**

- 1 Reactive Machines AI
- 2 Limited Memory AI
- 3 Theory Of Mind AI
- 4 Self-aware AI

Branches of AI

1. Machine Learning
2. Deep Learning
3. Natural Language Processing
4. Robotics
5. Expert Systems
6. Fuzzy Logic

- In which university the first demonstration of AI program run
→ Carnegie Mellon University
- What is Artificial intelligence → Making a Machine intelligent

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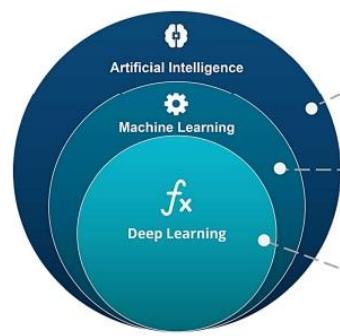
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 **AI evolution Sequence**

- Birth of AI
- Neural Network
- Machine Learning
- Deep Learning

**Languages use in AI**

- Python
- Lisp = list processing
- Java
- JavaScript
- C++
- Prolog Programming in Logic
- Julia
- Haskell
- Scala
- R



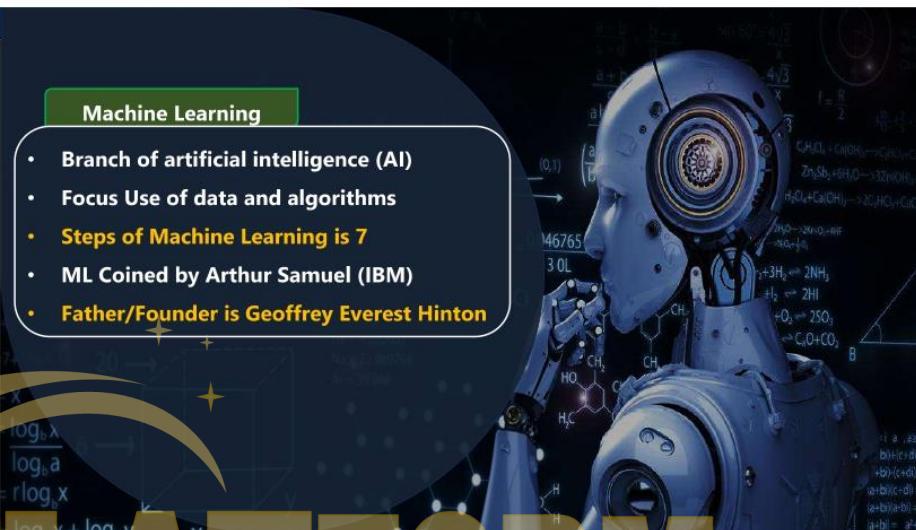
ARTIFICIAL INTELLIGENCE
A technique which enables machines to mimic human behaviour

MACHINE LEARNING
Subset of AI technique which use statistical methods to enable machines to improve with experience

DEEP LEARNING
Subset of ML which make the computation of multi-layer neural network feasible

Machine Learning

- Branch of artificial intelligence (AI)
- Focus Use of data and algorithms
- **Steps of Machine Learning is 7**
- ML Coined by Arthur Samuel (IBM)
- Father/Founder is Geoffrey Everest Hinton



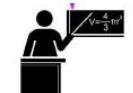
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Types of Machine Learning

Supervised → Predict next value



Unsupervised → Identify Clusters

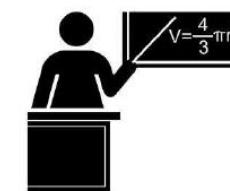


Reinforcement → Learn from mistakes

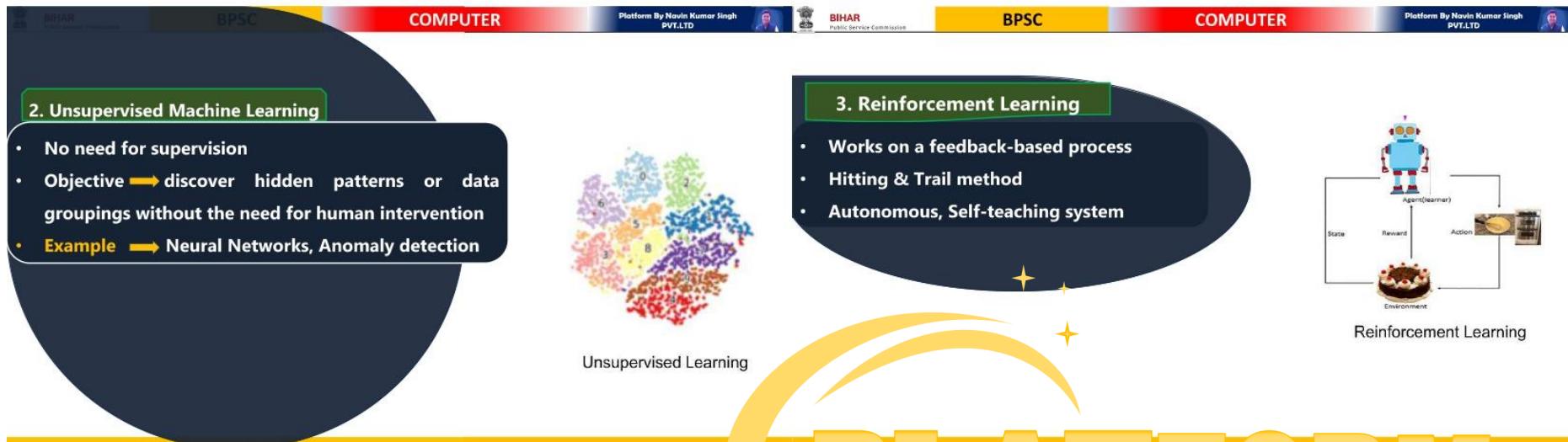


1. Supervised Machine

- Based on Supervision
- We train the machines
- Then we ask the machine to predict the output
- Objective → Map the input variable(x) with the output variable(y)
- Examples Risk Assessment, Fraud Detection, Spam filtering



Supervised Learning

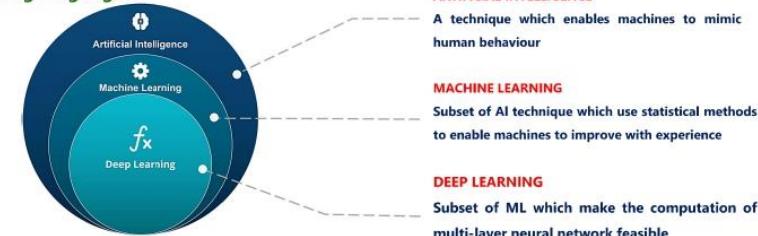


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- About Deep Learning**
- Deep Learning → Geoffrey Everest Hinton
 - Artificial intelligence allows computers, machines, or robots to mimic the capabilities of a human, such as making decisions, recognizing objects, solving problems, and understanding language.



Machine learning (ML)

- Machine learning is a subset of AI centered on building applications that can learn from data to improve their accuracy over time, without human intervention.
- मशीन लर्निंग एआई का एक उपसमूह है जो ऐसे अनुप्रयोगों के निर्माण पर केंद्रित है जो मानवीय हस्तक्षेप के बिना, समय के साथ अपनी सटीकता में सुधार करने के लिए डेटा से सीख सकते हैं।
- Machine learning algorithms can be trained to find patterns to make better decisions and predictions.
- मशीन लर्निंग एल्गोरिदम को बेहतर निर्णय और पूर्वानुमान करने के लिए पैटर्न खोजने हेतु प्रशिक्षित किया जा सकता है।

Deep learning

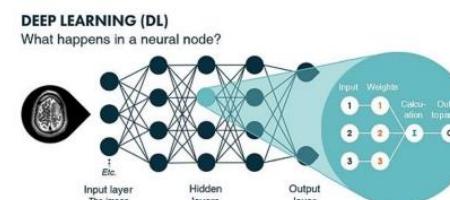
- Deep learning is a subset of machine learning that enables computers to solve more complex problems. Deep learning models are also able to create new features on their own.
- डीप लर्निंग, मशीन लर्निंग का एक उपसमूह है जो कंप्यूटरों को अधिक जटिल समस्याओं को हल करने में सक्षम बनाता है। डीप लर्निंग मॉडल स्वयं भी नई विशेषताएँ बनाने में सक्षम होते हैं।

Examples Deep Learning

- Self-driving cars
- Chatbots
- Facial recognition
- Medical science
- Speech recognition

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- Deep learning is a branch of machine learning that is made up of a neural network with three or more layers.
 - Input layer → Data enters through the input layer.
 - Hidden layers → Hidden layers process and transport data to other layers.
 - Output layer → The final result or prediction is made in the output layer

**Bots/chatbots/Virtual Assistance**

First Chatbot	→ Eliza
Open AI	→ Chat GPT
Google	→ Bard/Gemini
Microsoft	→ Copilot/Cortana
Apple Virtual Assistant	→ Siri
Google Virtual Assistant	→ Google Now, Google Assistant
Blackberry Virtual Assistant	→ Blackberry Assistant
Amazon Virtual Assistant	→ Alexa
Facebook Virtual Assistant	→ Facebook M
Samsung Virtual Assistant	→ Bixby
Home AI System	→ Mark Zuckerberg → Jarvis



THANK YOU