

Basics of Computer Networking

A comprehensive guide to understanding computer networks, from fundamental concepts to advanced protocols and security measures.



What is a Computer Network?

A computer network is a collection of interconnected devices that share resources and information. These devices include computers, servers, printers, and other hardware that enable efficient data exchange.

Networks facilitate various applications such as email, file sharing, and internet browsing through established communication protocols.



Key Network Terminologies

Network

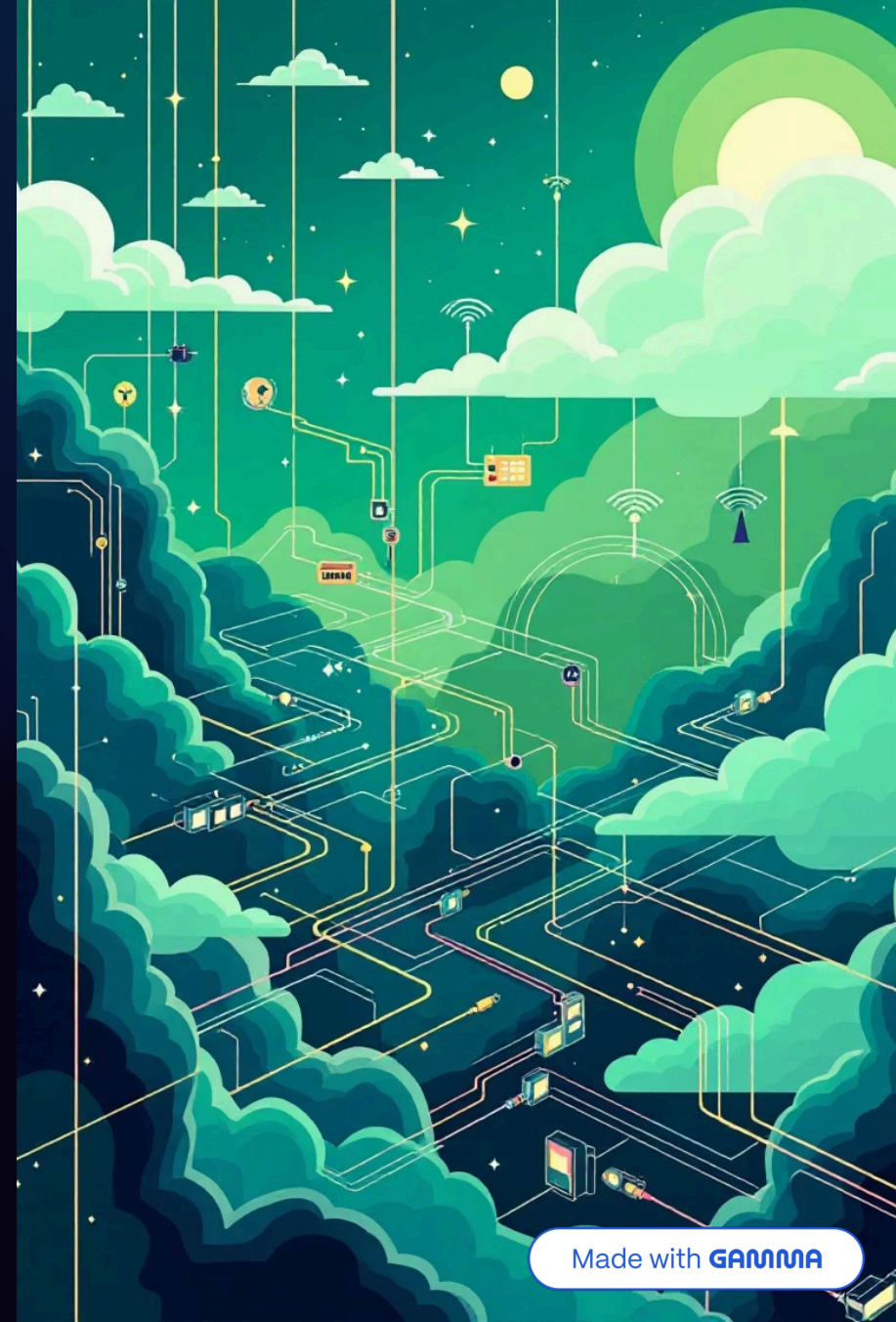
Group of connected computers and devices that communicate and share data with each other.

Node

Any device that can send, receive, or forward data - laptops, mobiles, printers, servers.

Transmission Media

Physical or wireless medium through which data travels between devices.



Network Architecture Types

Client-Server Architecture

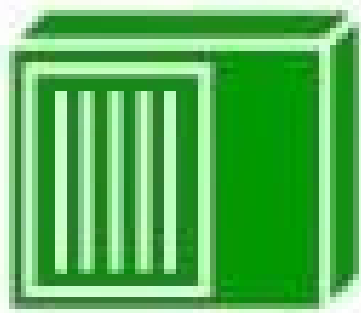
Nodes can be servers or clients, where server nodes manage client node behavior. Centralized control and resource management.



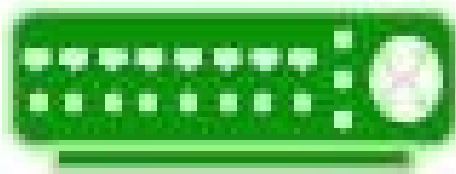
Peer-to-Peer Architecture

No central server concept - each device works freely as either client or server. Distributed network approach.





Hub



Switch

Network Devices



Routers

Direct data packets between networks, determining the best path for data transmission across multiple networks.



Switches

Connect devices within a single network, managing data flow between connected devices efficiently.



Hubs & Bridges

Basic networking devices that connect multiple devices and extend network segments for broader connectivity.

Network Topologies

Star Topology

All devices connect to central hub or switch

Mesh Topology

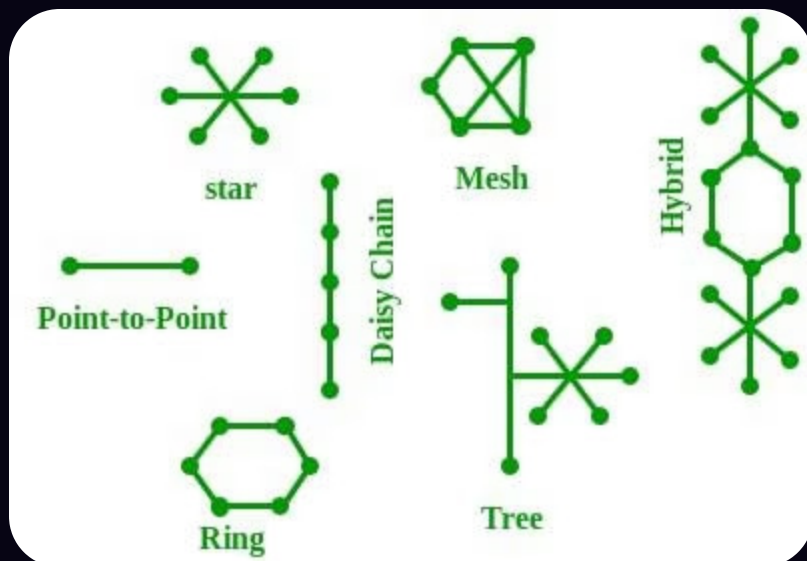
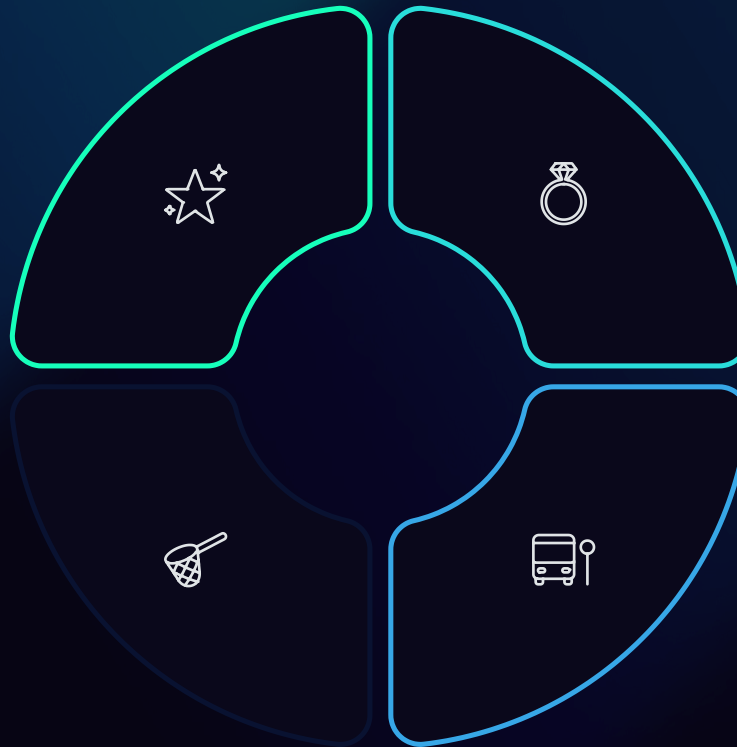
Every device connected to every other device

Ring Topology

Devices connected in circular loop

Bus Topology

All devices connected to single central cable



OSI Model - 7 Layers



Physical Layer

Raw bit transmission over physical medium



Data Link Layer

Node-to-node data transfer and error correction



Network Layer

Routing and logical addressing (IP)



Transport Layer

End-to-end communication (TCP/UDP)



Session Layer

Session management and control



Presentation Layer

Data encryption and compression



Application Layer

User interface and network services



Essential Network Protocols

TCP/IP

Foundational internet protocol suite enabling reliable communication and data routing.

HTTP/HTTPS

Web page transmission protocols - HTTP unsecured, HTTPS with SSL/TLS encryption.

DNS

Translates domain names into IP addresses for seamless internet navigation.

DHCP

Automatically assigns IP addresses to network devices, reducing manual configuration.

Network Identifiers

32

IPv4 Address Length

Bits in IPv4 address format

128

IPv6 Address Length

Bits in newer IPv6 format

48

MAC Address Length

Bits in physical address

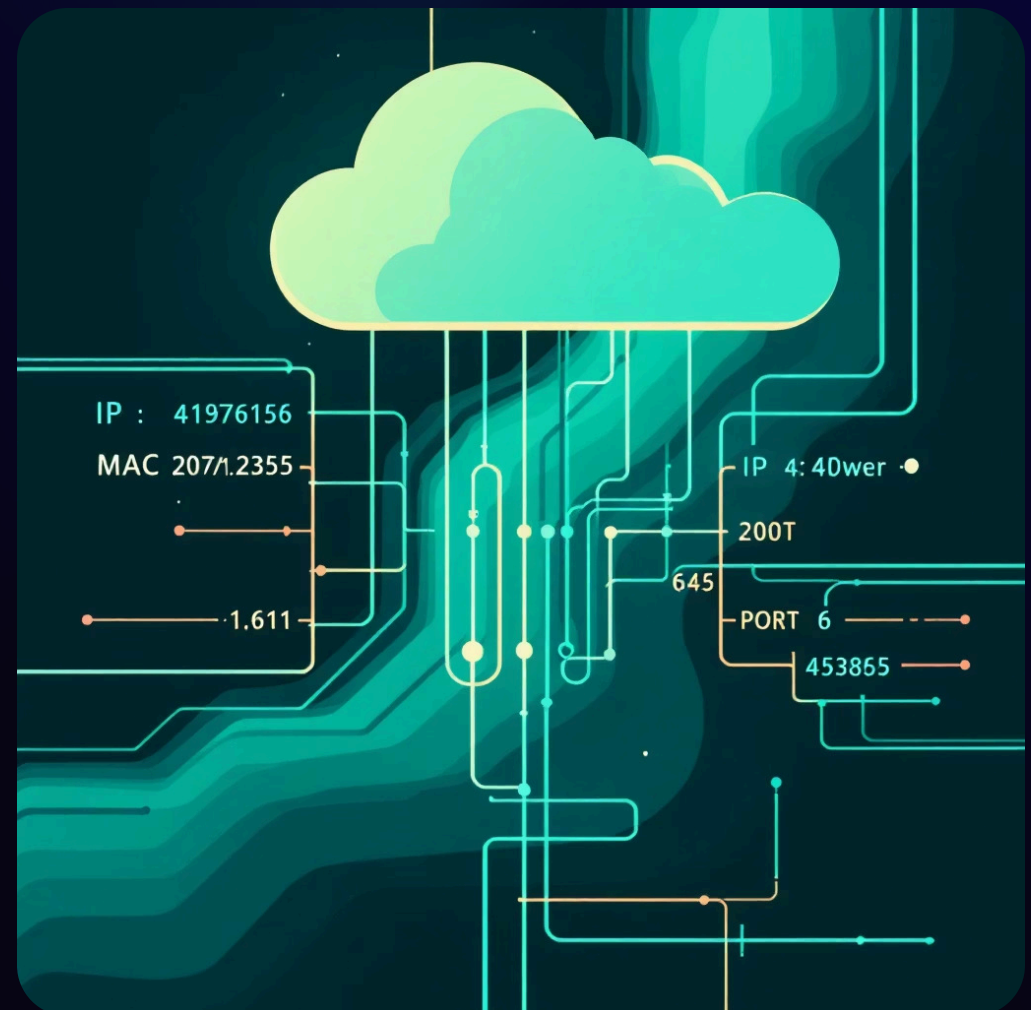
65,536

Total Ports

Available port numbers (0-65535)

Key Identifiers

- **Hostname:** Unique device name on network
- **IP Address:** Logical network address
- **MAC Address:** Physical hardware identifier
- **Port:** Logical channel for applications
- **Socket:** IP address + port combination





Network Security Essentials



Firewalls

Monitor and control network traffic based on security rules



Encryption

Encode data to prevent unauthorized access in VPNs and HTTPS



Access Control

Restrict network resource access based on user identity and role



Regular Updates

Keep software and hardware updated to protect against vulnerabilities

Network security is crucial for protecting data and resources from unauthorized access and cyber threats.