

Computer Networks

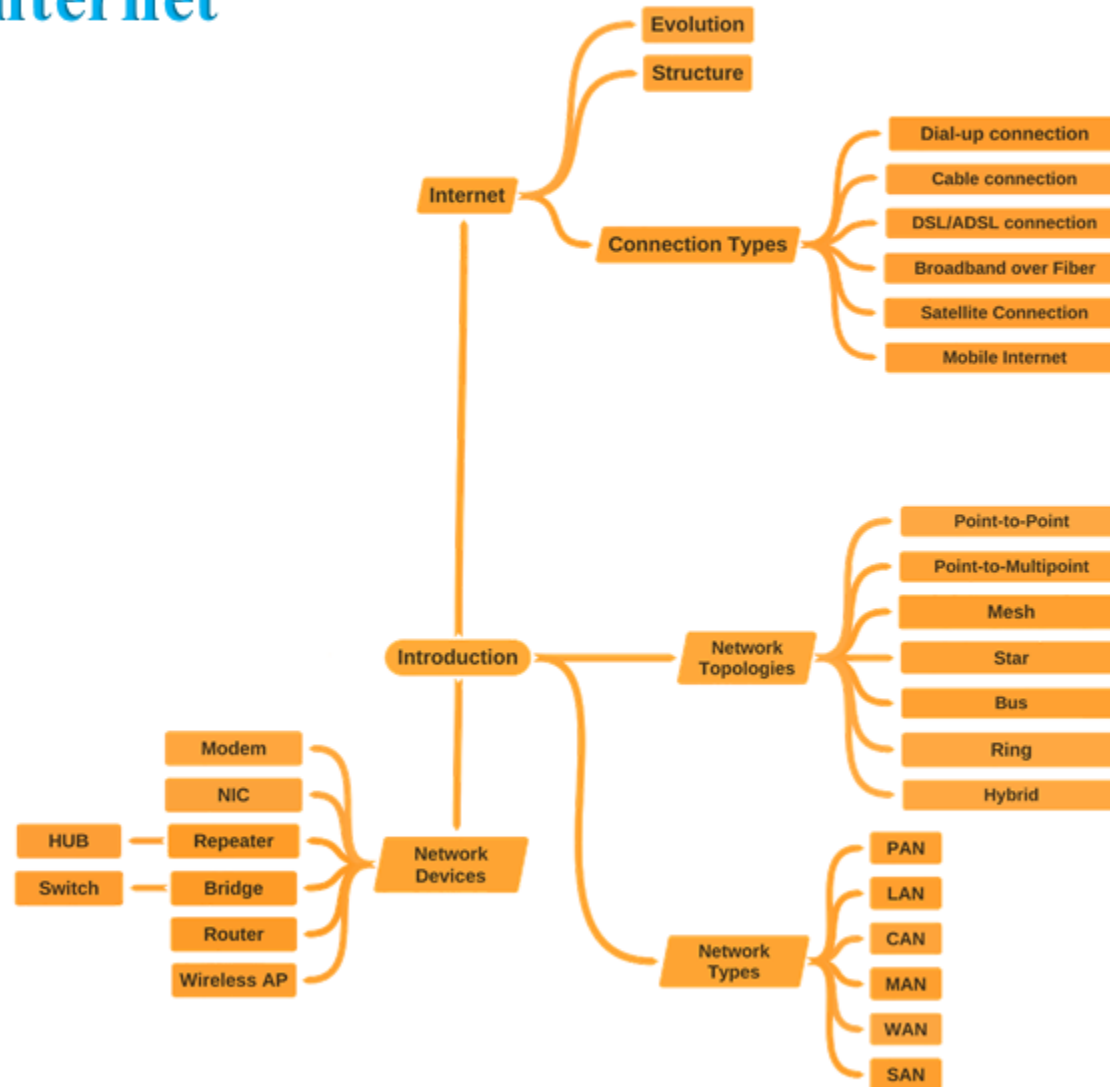
Introductory Lecture

An Overview

By
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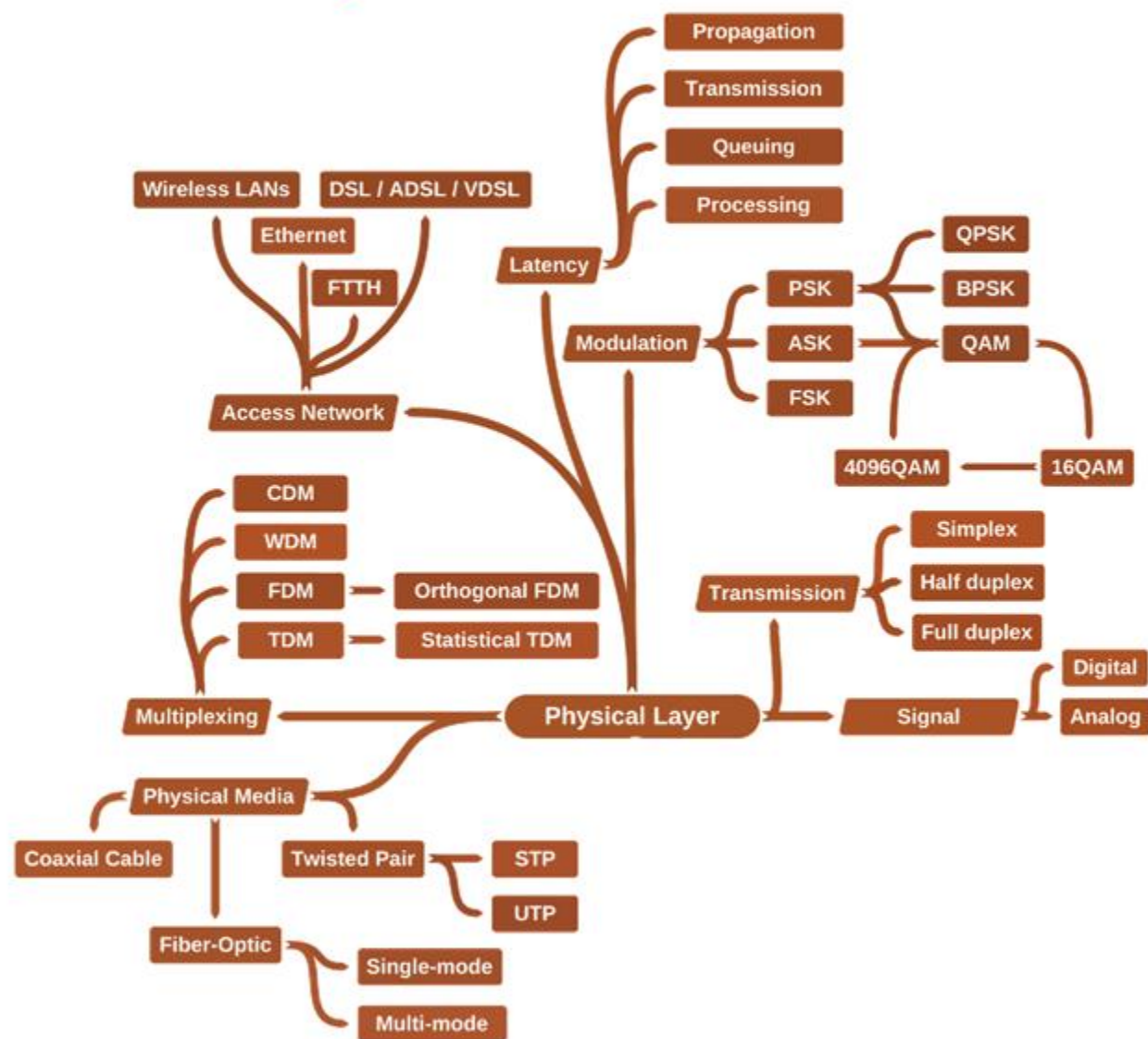
- Provides basic knowledge of how computers communicate together.
- Most of new technologies depend on communication networks, such as:
 - Cybersecurity.
 - Internet of Things (IoT).
 - Cloud computing.
 - Modern cellular technologies such as 5G.
 - Data centers, web applications, storage, etc.

Introduction to Computer Networks and the Internet

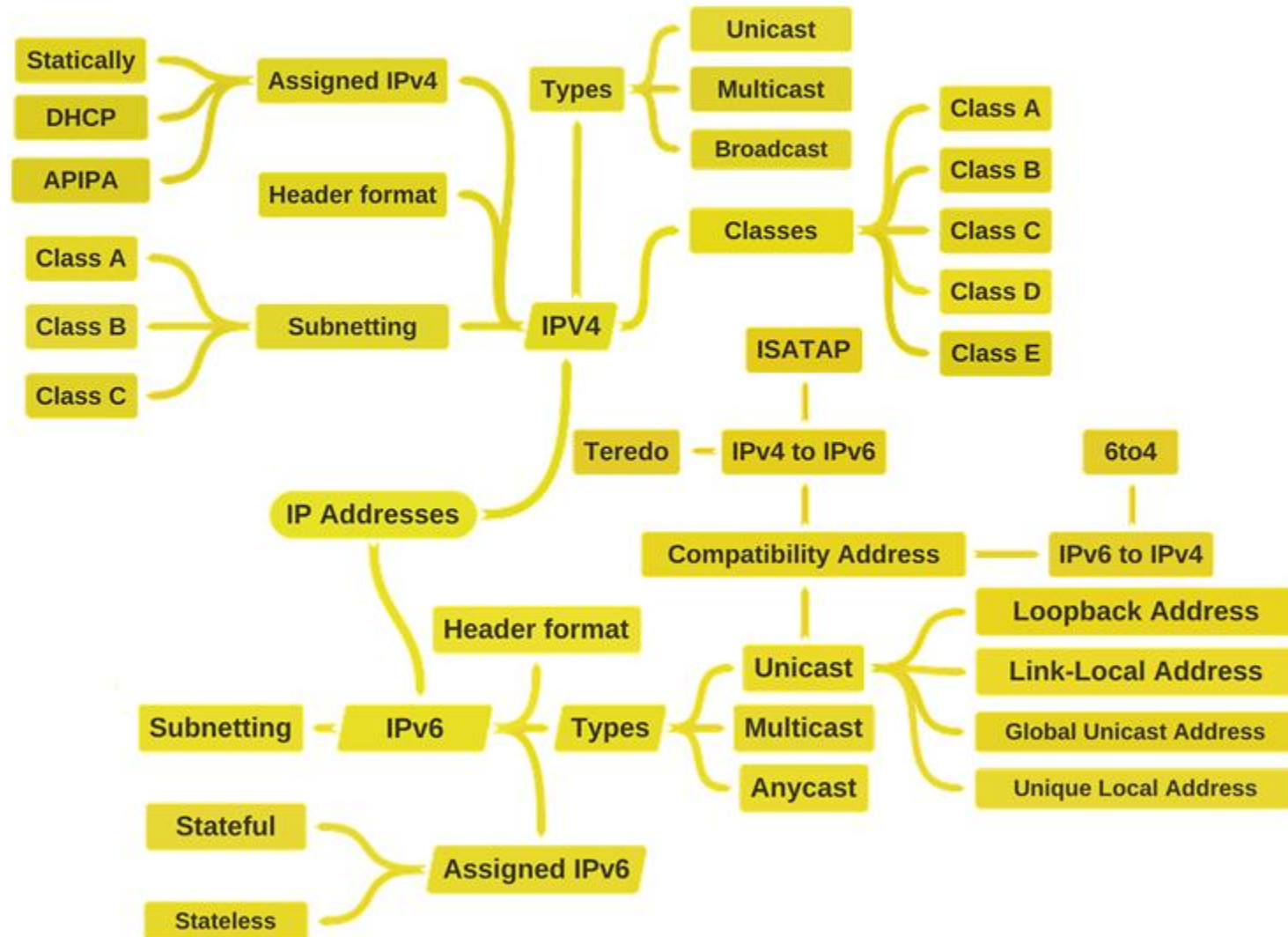


Introduction to Computer Networks and the Internet

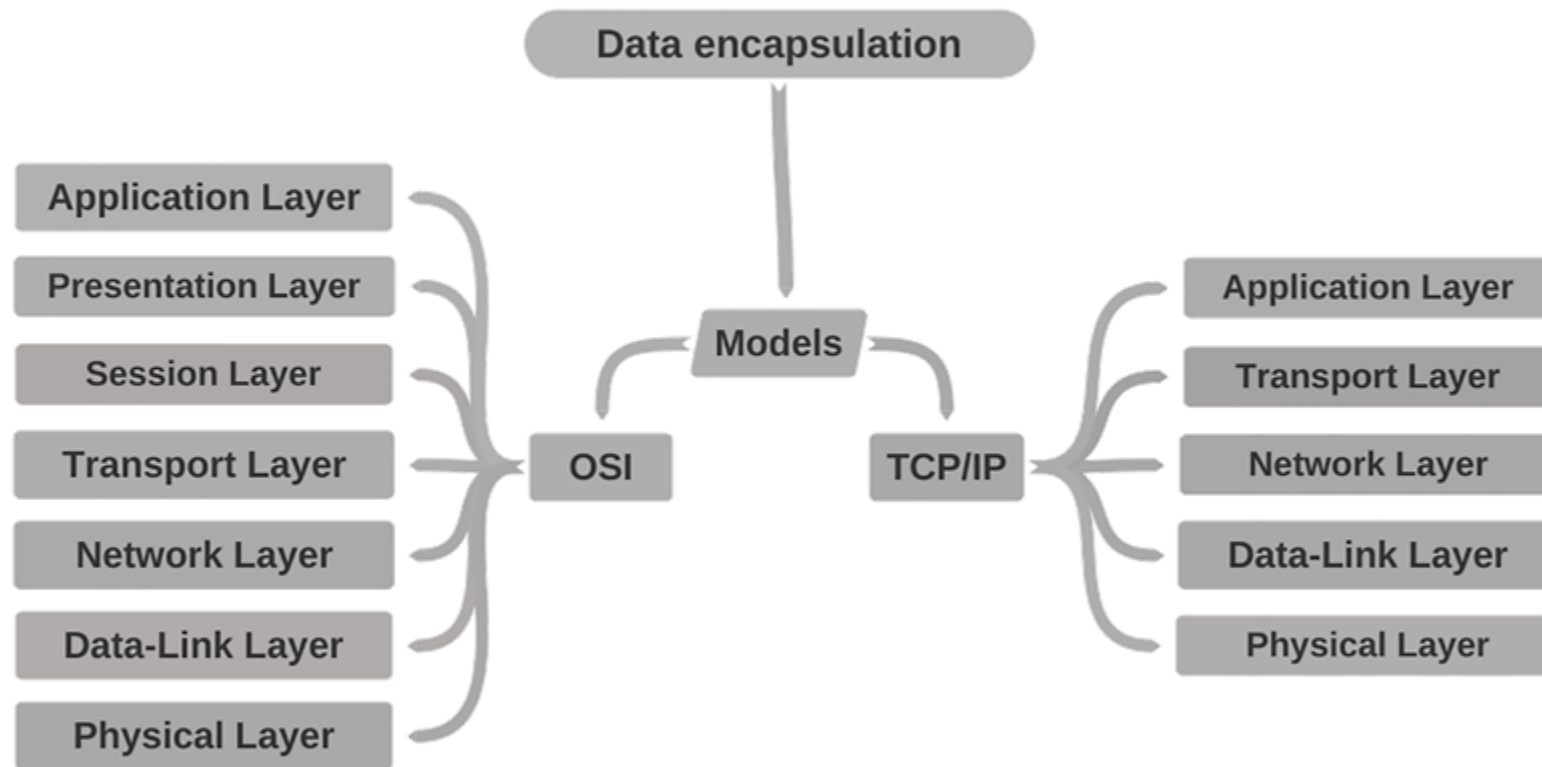
- Understand the meaning of network.
- Recognize the different types of network.
- Understand the network topologies.
- Recognize the different types of network devices and their functions.
- Understand the Internet evolution.
- Define network protocols.
- Understand the different types of Internet connection and their properties.



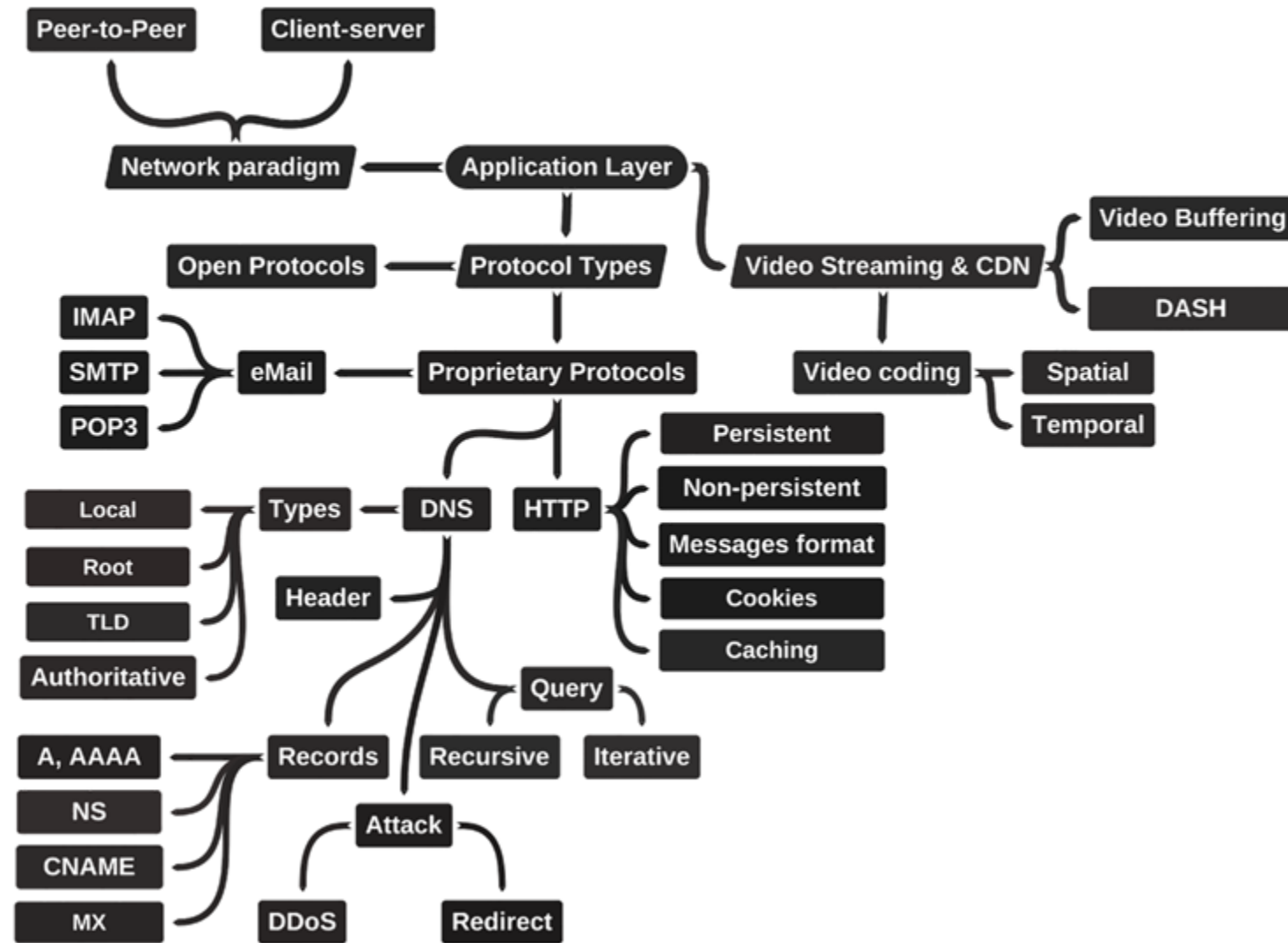
- Differentiate between analog and digital signals.
- Understand the difference between wavelength, frequency, amplitude, and phase.
- Apply Frequency, bandwidth, throughput, and latency calculations.
- Define different techniques of Digital Modulation.
- Understand network performance.
- Define communication modes.
- Understand the different types of Multiplexing.
- Recognize the network cabling and connectors.
- Understand the different methods for accessing networks.



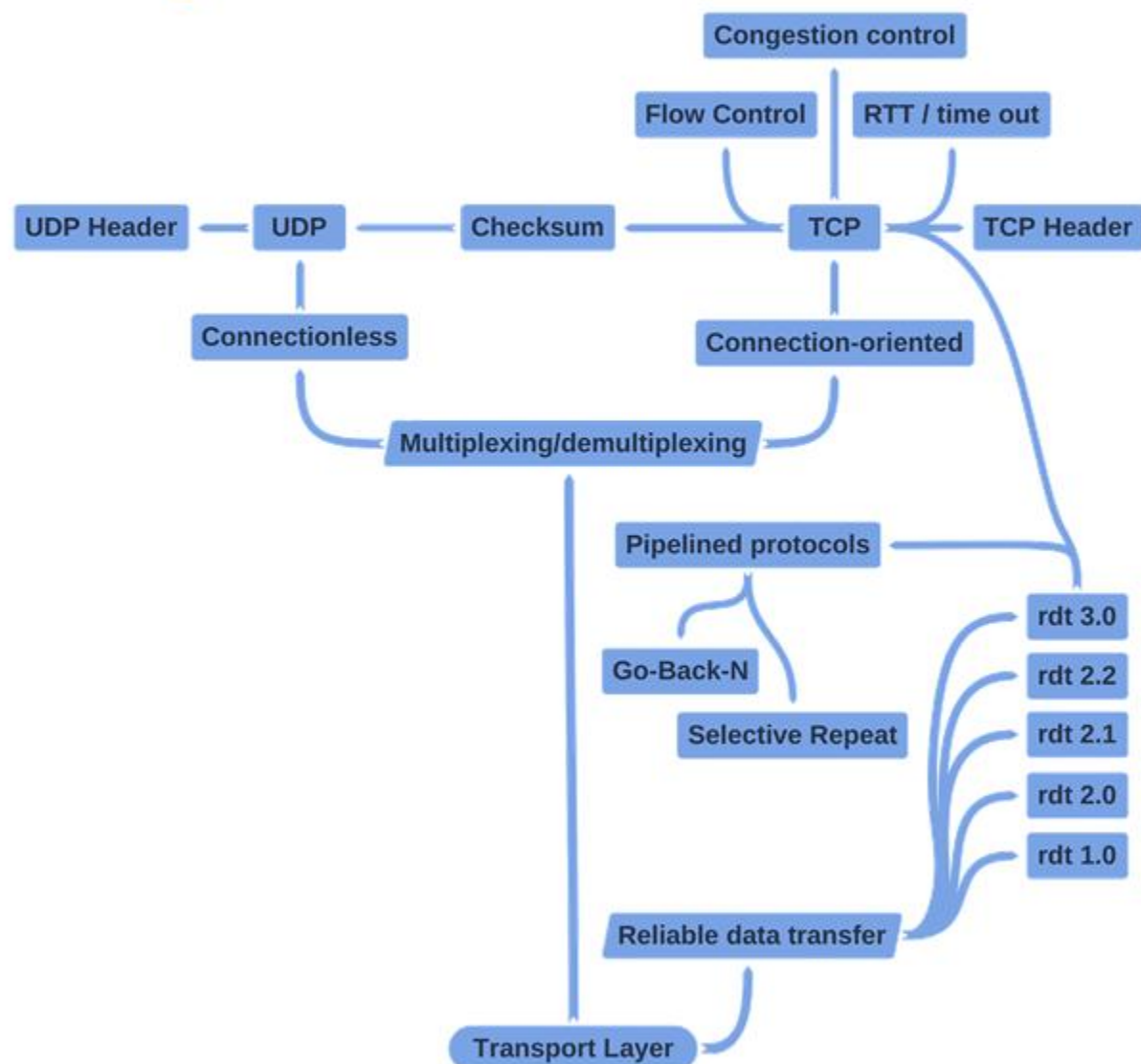
- Understand the structure of IP address v4.0 (IPv4) and IP address v6.0 (IPv6)
- Understand the subnet mask for IPv4.
- Calculate the number of hosts for a given network.
- Recognize the IPv4 classes.
- Understand how an IP address v4.0 or v6.0 is assigned to the host.
- Differentiate between unicast, multicast, broadcast, and anycast.
- Understand the different types of unicast addresses of IPv6.
- Understand the meaning of Classless Inter-Domain Routing (CIDR).
- Understand how to perform subnetting for IPv4 addresses.
- Understand how to perform subnetting for IPv6 addresses.



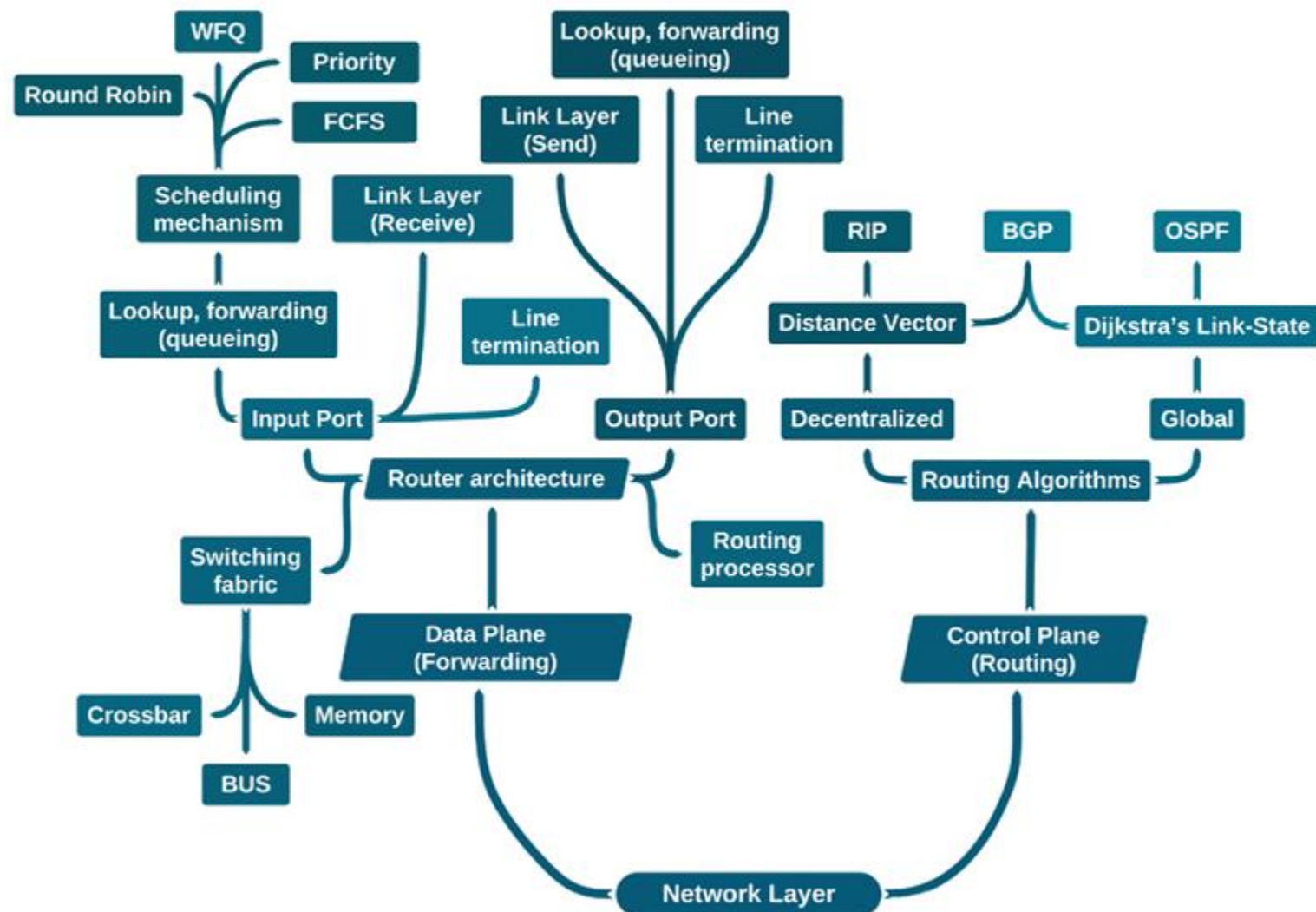
- Understand the types of network models.
- Understand the function of each layer in OSI model.
- Differentiate between OSI model and TCP/IP (Internet) model.
- Define data encapsulation.
- Understand how encapsulation takes place.
- Understand how frames switching from source to destination.
- Understand circuit switching.
- Understand packet switching.
- Recognize the difference between circuit and packet switching.
- Understand Internet structure.



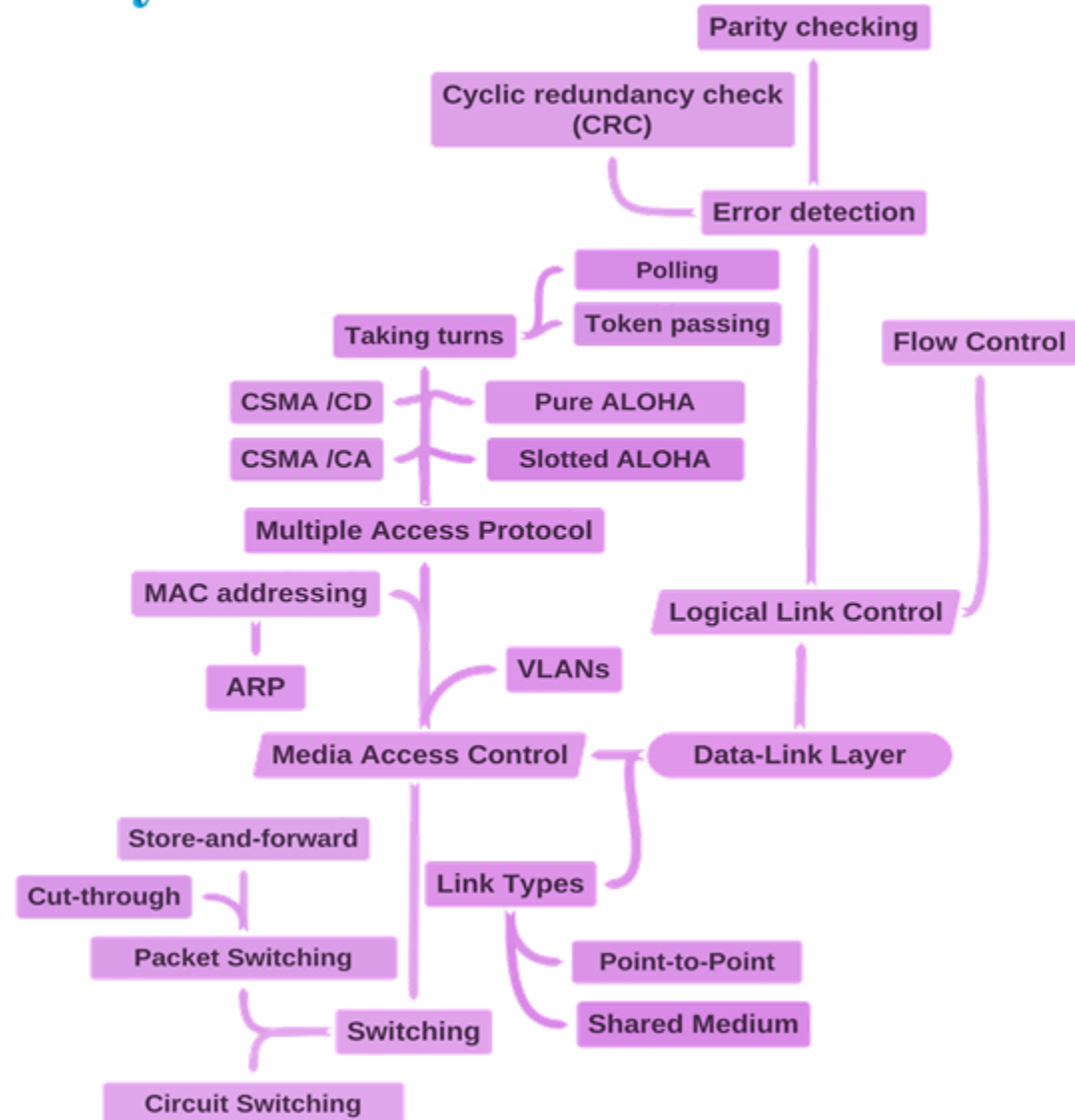
- Define network applications.
- Understand the difference between client-server and P2P paradigm
- Understand file distribution: Client-Server vs P2P.
- Understand the types of Hyper Text Transfer Protocol (HTTP) and HTTP message format.
- Apply non-persistent and persistent HTTP time calculations.
- Understand cookies and web cache.
- Define email and understand POP3 and SMTP interaction.
- Understand how DNS works and recognize DNS records, query types, cache, and DNS message components.
- Understand video Streaming and Content Distribution Networks (CDN).



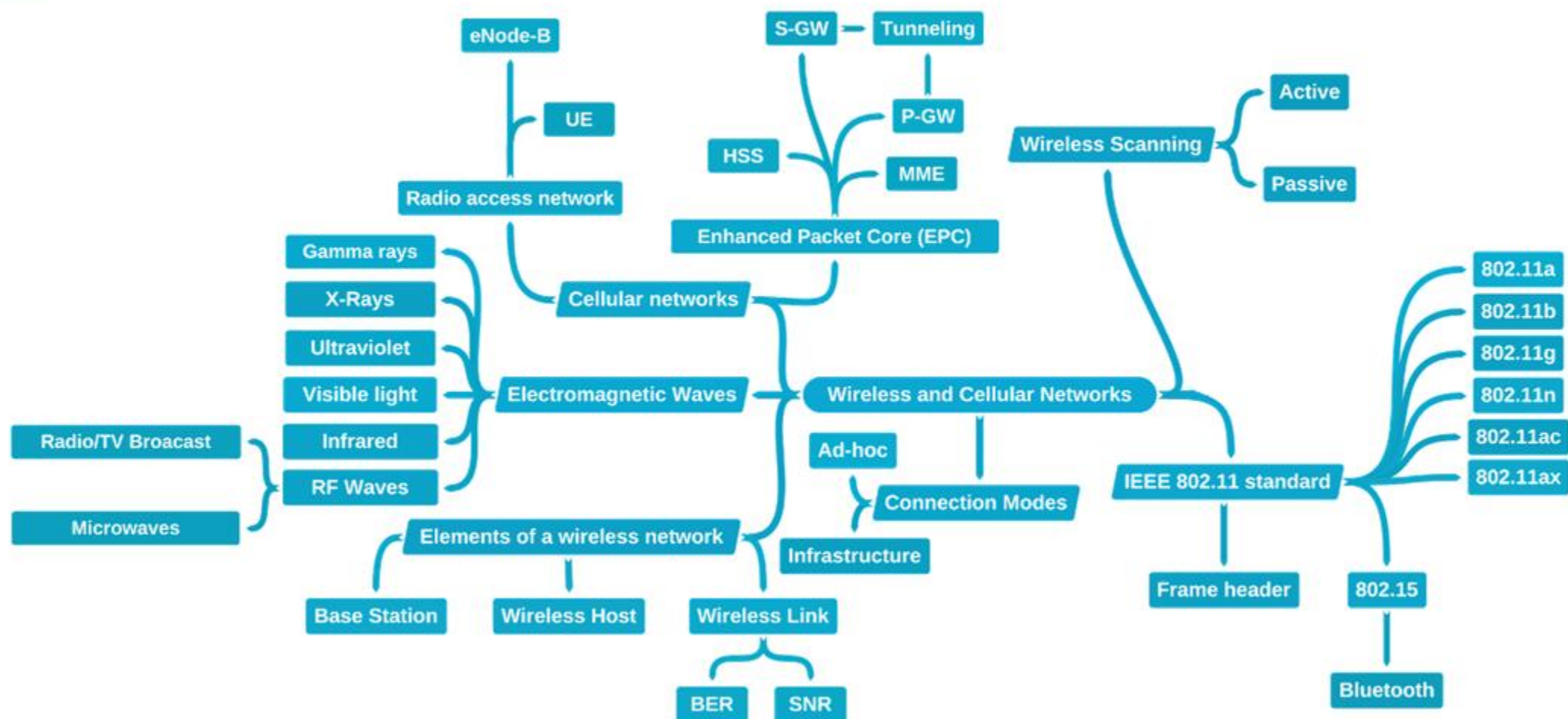
- Define socket and understand socket programming.
- Understand multiplexing / demultiplexing in transport layer.
- Understand UDP and UDP segment structure.
- Understand Checksum and how it works.
- Understand the principles of reliable data transfer.
- Differentiate between different versions of rdt protocol.
- Differentiate between Go-Back-N and selective repeat protocols
- Understand Connection-Oriented Transport: TCP and segment structure.
- Understand congestion and congestion control.



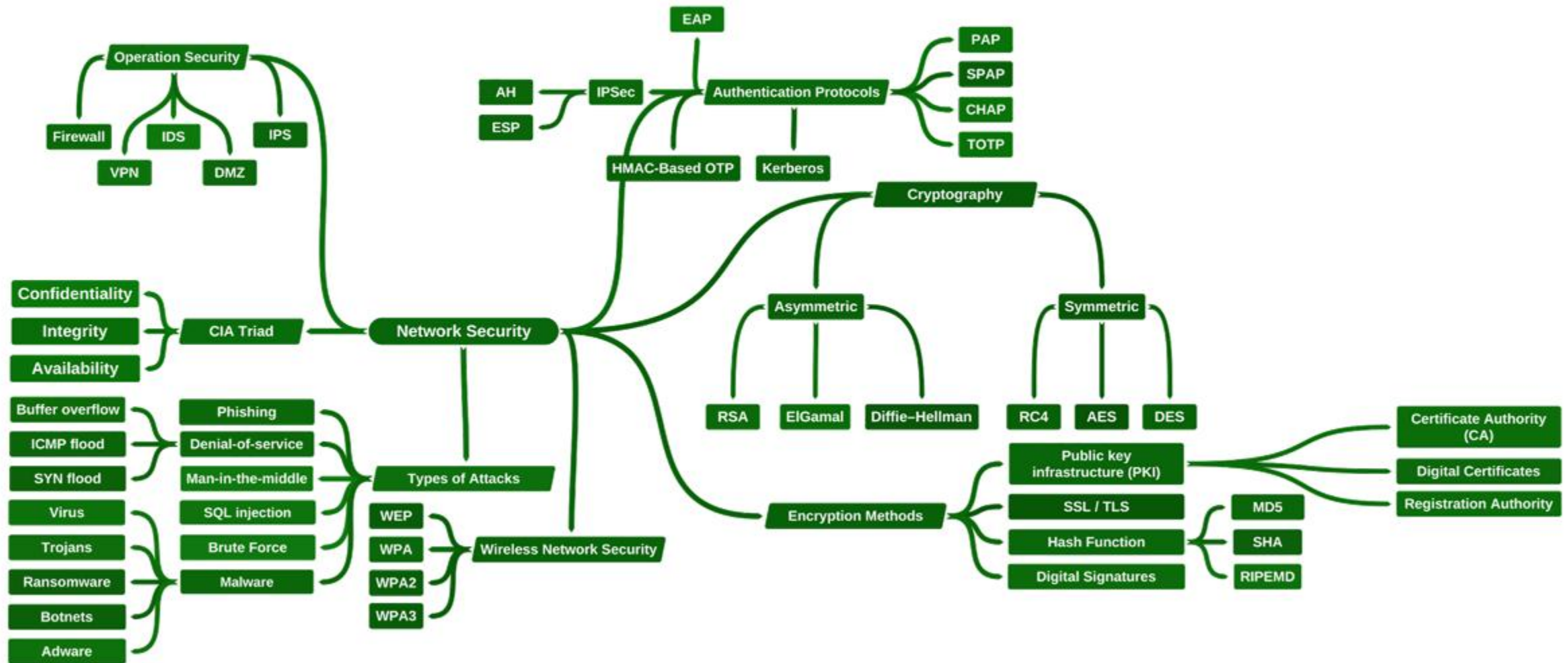
- Understand network layer functions.
- Differentiate between the control plane and the data plane.
- Understand router architecture.
- Understand forwarding table.
- Recognize the types of switching fabrics.
- Understand the buffer management and Scheduling mechanism.
- Recognize IPv4 and IPv6 packet headers and Understand NAT and tunneling.
- Define routing algorithms.
- Differentiate between link-state and distance vector algorithms and how they operate.
- Understand Internet routing protocols (RIP, OSPF, and BGP).



- Understand link layer functions and services .
- Understand link layer services.
- Recognize where the link layer implemented.
- Understand error detection.
- Differentiate between the types of error detection (Parity checking and CRC).
- Define MAC and Differentiate between the types of MAC protocols (Slotted ALOHA, Pure ALOHA, CSMA/CD, CSMA/CA, and taking turns).
- Understand address resolution protocol and how it works.
- Understand Ethernet and recognize ethernet frame structure.
- Understand Switches and VLANs.



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- Understand the principle of Network security .
- Recognize the Types of Attacks
- Differentiate between symmetric and asymmetric Cryptography.
- Recognize different symmetric and asymmetric ciphers (DES, 3DES, AES, RSA, RC4).
- Recognize different common encryption methods (Digital certificates, PKI, SSL, TLS, Hash function, digital signature).
- Recognize different Authentication Protocols (PAP, SPAP, CHAP, TOTP, HMAC-OTP, Kerberos, EAP)
- Understand Wireless network security.
- Understand operation security (Firewall, IDS, IPS).
- Understand VPN and DMZ.

