Exam Keywords

Data communication

- Overview and principles
- Bits, numbers, ASCII
- Communication Mediums
- Bitrate and delays
- Packet loss
- Serial vs parallel communication
- Protocol importance
- Internet components (hosts, switches, routers, ISPs)
- Internet services
- TCP/IP vs OSI model
- Layering, encapsulation
- Network topologies (pros/cons)

The Application Layer

- Network applications
- Architecture (e.g. Client-server)
- IP addresses, ports
- Socket programming
- Transport layer services used
- HTTP
    - Webpage structure
    - Persistent vs non-persistent connections
    - Cookies and state
    - Web caching
- DNS (structure, caching, resource records)
    - Centralized DNS issues
    - Hierarchical DNS

The Transport Layer

- Transport services (reliability, throughput, timing, security)
- Multiplexing/demultiplexing
- UDP packet vs TCP segment
- Connectionless vs connection-oriented
- UDP
- TCP (handshaking, ACK, RTT, retransmitting)
- Flow control vs congestion control
    - TCP congestion control phases (slow start, avoidance, fast recovery)

The Network Layer

- Data plane
    - Data plane vs control plane
    - Forwarding vs routing
    - Router components
    - Switching fabrics (memory, bus, crossbar)
    - Input/output queuing
    - Head-of-line blocking
    - Packet scheduling (FIFO, priority, round robin)
    - IP addressing (IPv4 structure, subnet, CIDR)
    - Forwarding methods (destination-based, longest prefix, SDN/OpenFlow)
    - IP address assignment (manual, DHCP)
    - DHCP process
    - NAT
    - IPv4 vs IPv6 (datagram structure, tunneling)
- Control Plane
    - Routing algorithms (goal, graph model)
    - Link-state vs distance-vector algorithms
        - Dijkstra's algorithm
        - Bellman-Ford equation
        - Count-to-infinity problem
    - Autonomous Systems (AS)
        - Intra-AS vs Inter-AS routing
        - BGP (AS-PATH, NEXT-HOP, hot potato routing)
    - SDN vs traditional routing
    - Traceroute

The Link Layer

- Link layer services (flow, error detection/correction, duplex)
- IP Framing
- Error detection (parity, CRC)
- Multiple access problem
- TDMA, FDMA, CSMA/CD, collision detection
    - Binary exponential backoff
- Modern Ethernet multiple access (switches)
- MAC address vs IP address
- ARP

Wireless and Mobile Networks

- Wireless network elements
- Challenges (signal strength, interference)
- Hidden terminal problem
- Wi-Fi association (AP, channels, SSID, authentication)
- Collision avoidance
- CDMA
- Mobility (indirect vs direct routing)

Security

- Cryptography principles
- Symmetric key
- Public key
- Session key establishment

Industrial Networking

- Field bus features (real-time, safety, security, control)
- Isochronous Real Time (TDMA, low jitter)