2.0 Network Implementations

2.1 Compare and contrast various devices, their features, and their appropriate placement on the network.

- **Networking devices**
  - Layer 2 switch
  - Layer 3 capable switch
  - Router
  - Hub
  - Access point
  - Bridge
  - Wireless LAN controller
  - Load balancer
  - Proxy server
  - Cable modem
  - DSL modem
  - Repeater
  - Voice gateway
  - Media converter
  - Intrusion prevention system (IPS)/intrusion detection system (IDS) device
  - Firewall
  - VPN headend
- **Networked devices**
  - Voice over Internet Protocol (VoIP) phone
  - Printer
  - Physical access control devices
  - Cameras
  - Heating, ventilation, and air conditioning (HVAC) sensors
  - Internet of Things (IoT)
    - Refrigerator
    - Smart speakers
    - Smart thermostats
    - Smart doorbells
  - Industrial control systems/ supervisory control and data acquisition (SCADA)

2.2 Compare and contrast routing technologies and bandwidth management concepts.

- **Routing**
  - Dynamic routing
    - Protocols [Routing Internet Protocol (RIP), Open Shortest Path First (OSPF), Enhanced Interior Gateway Routing Protocol (EIGRP), Border Gateway Protocol (BGP)]
    - Link state vs. distance vector vs. hybrid
  - Static routing
  - Default route
  - Administrative distance
  - Exterior vs. interior
  - Time to live
- **Bandwidth management**
  - Traffic shaping
  - Quality of service (QoS)

2.3 Given a scenario, configure and deploy common Ethernet switching features.

- Data virtual local area network (VLAN)
- Voice VLAN
- Port configurations
  - Port tagging/802.1Q
  - Port aggregation
    - Link Aggregation Control Protocol (LACP)
  - Duplex
  - Speed
  - Flow control
  - Port mirroring
  - Port security
  - Jumbo frames
  - Auto-medium-dependent interface crossover (MDI-X)
- Media access control (MAC) address tables
- Power over Ethernet (PoE)/ Power over Ethernet plus (PoE+)
- Spanning Tree Protocol
- Carrier-sense multiple access with collision detection (CSMA/CD)

- **Address Resolution Protocol (ARP)**
- **Neighbor Discovery Protocol**

2.4 Given a scenario, install and configure the appropriate wireless standards and technologies.

- **802.11 standards**
  - a
  - b
  - g
  - n (WiFi 4)
  - ac (WiFi 5)
  - ax (WiFi 6)
- **Frequencies and range**
  - 2.4GHz
  - 5GHz
- **Channels**
  - Regulatory impacts
- **Channel bonding**
- **Service set identifier (SSID)**
  - Basic service set
  - Extended service set
  - Independent basic service set (Ad-hoc)
  - Roaming
- **Antenna types**
  - Omni
  - Directional
- **Encryption standards**
  - WiFi Protected Access (WPA)/ WPA2 Personal [Advanced Encryption Standard (AES)/ Temporal Key Integrity Protocol (TKIP)]
  - WPA/WPA2 Enterprise (AES/TKIP)
- **Cellular technologies**
  - Code-division multiple access (CDMA)
  - Global System for Mobile Communications (GSM)
  - Long-Term Evolution (LTE)
  - 3G, 4G, 5G
- **Multiple input, multiple output (MIMO) and multi-user MIMO (MU-MIMO)**