CompTIA Network+ Exam N10-008

Lesson 8

Explaining Network Topologies and Types

Objectives

- Explain network types and characteristics
- Explain tiered switching architecture
- Explain virtual LANs

Lesson 8

Topic 8A

Explain Network Types and Characteristics

Client-server versus Peer-to-peer Networks

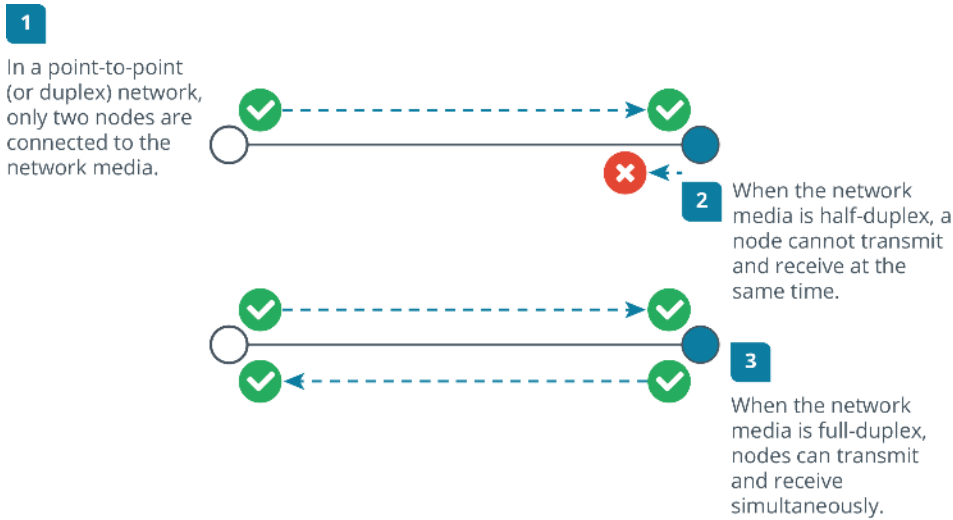
- Server makes network applications and resources available
- Client consumes the services provided by servers
- Client-server
  - Machines are dedicated to a client or to a server role
  - Centralized administration
- Peer-to-peer
  - Machines can be configured in both client and server roles
  - Administration is decentralized

Network Types

- Local area network (LAN)
  - Home/residential network/small office/home office (SOHO)
  - Small and medium sized enterprise (SME)
    - Larger network with hundreds or thousands of servers and clients
    - Campus area network (CAN)
  - Datacenters
- Wide area network (WAN)
  - Metropolitan area network (MAN)
- Personal area network (PAN)

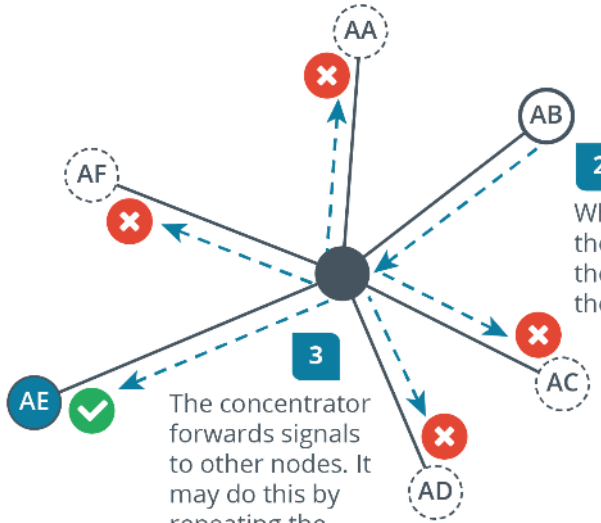
Network Topology

- Physical topology is the placement of nodes and media links between them
- Logical topology is the flow of data
- Point-to-point topology



Star Topology

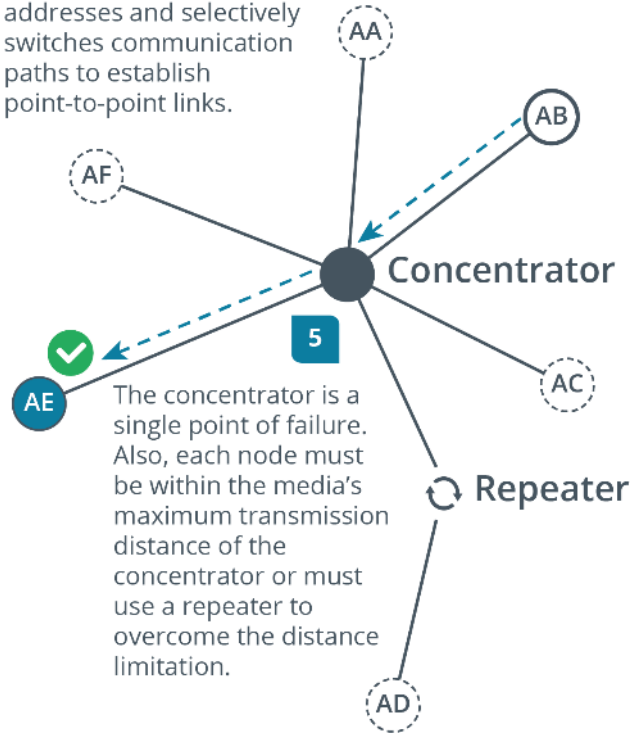
1 In a star topology, each node is connected to a concentrator over dedicated network media.



2 When a node transmits, the signal is sent over the network media to the concentrator.

3 The concentrator forwards signals to other nodes. It may do this by repeating the signal to all nodes, working as logical bus topology (implemented as an Ethernet hub).

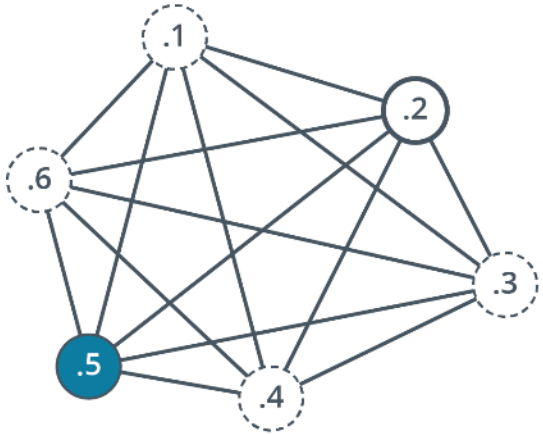
4 More commonly, the concentrator tracks node addresses and selectively switches communication paths to establish point-to-point links.



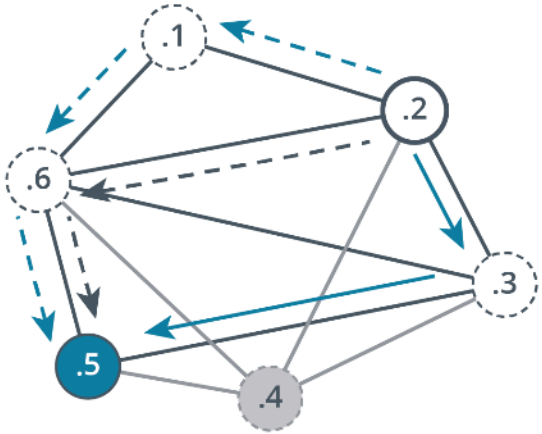
5 The concentrator is a single point of failure. Also, each node must be within the media's maximum transmission distance of the concentrator or must use a repeater to overcome the distance limitation.

Mesh Topology

1 In a fully connected mesh network, each node has a point-to-point link with every other node. This requires exponentially more links as nodes are added: n*(n−1)/2

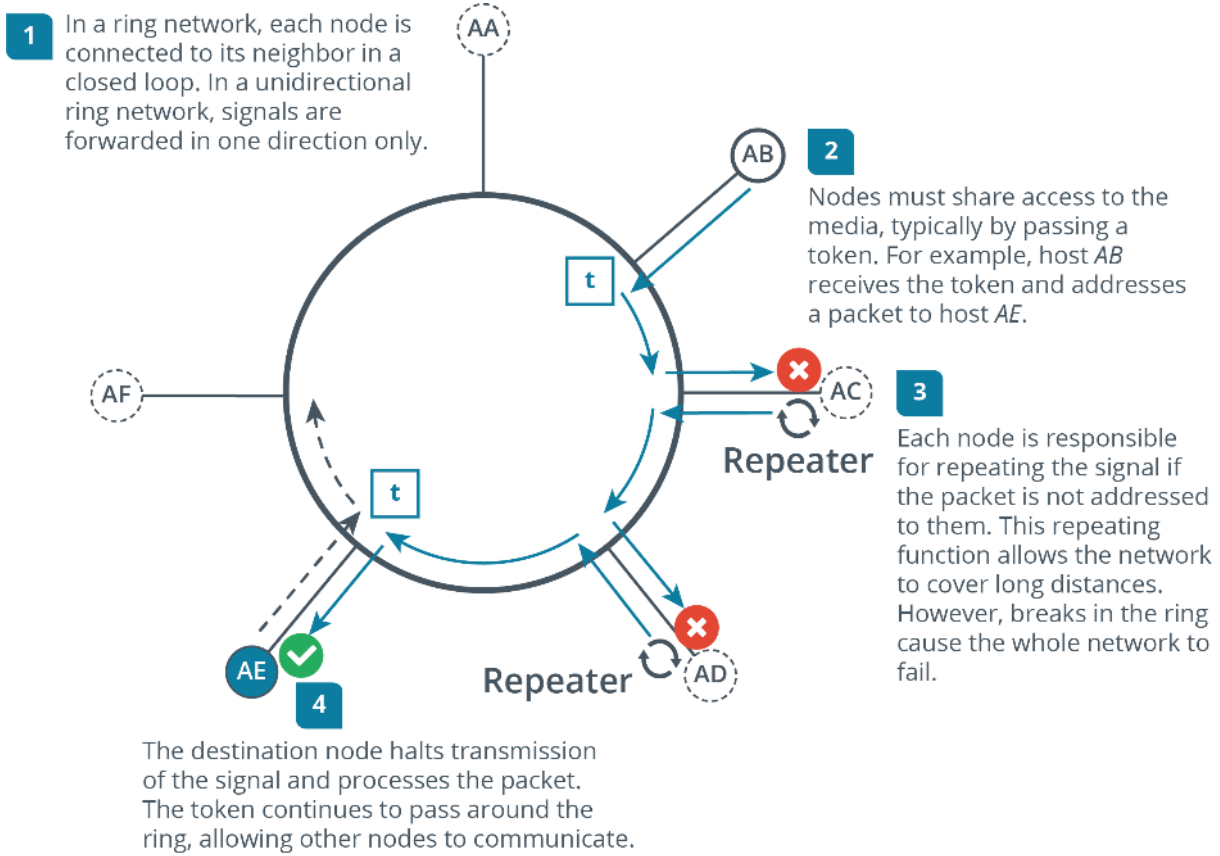


2 Provisioning so many interfaces and links is difficult, so partial mesh networks are often preferred, In a partial mesh, nodes can forward packets to a destination by learning the network topology.

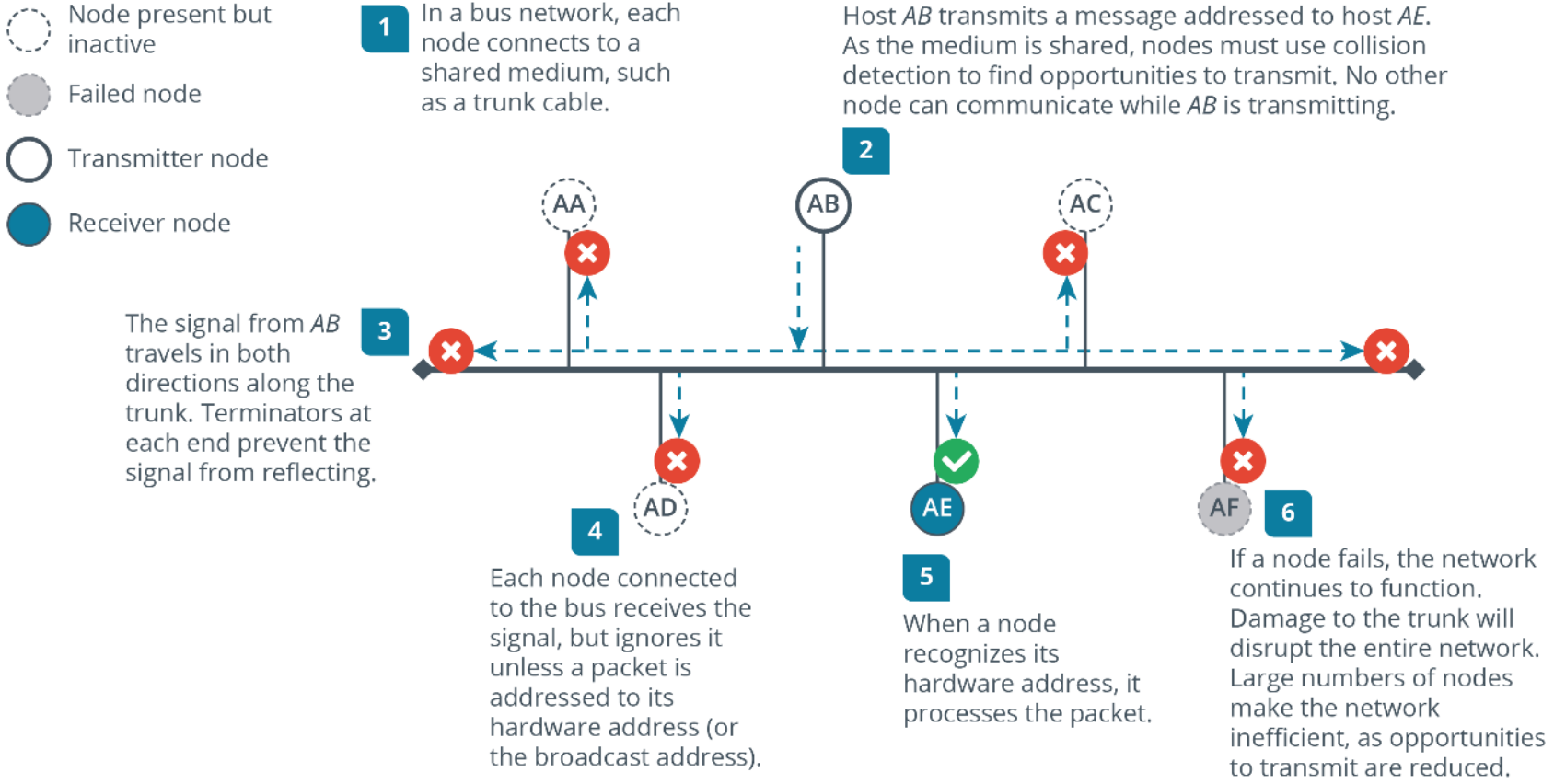


3 Packets can take multiple routes through the network, providing resilience if some nodes or links fail.

Ring Topology

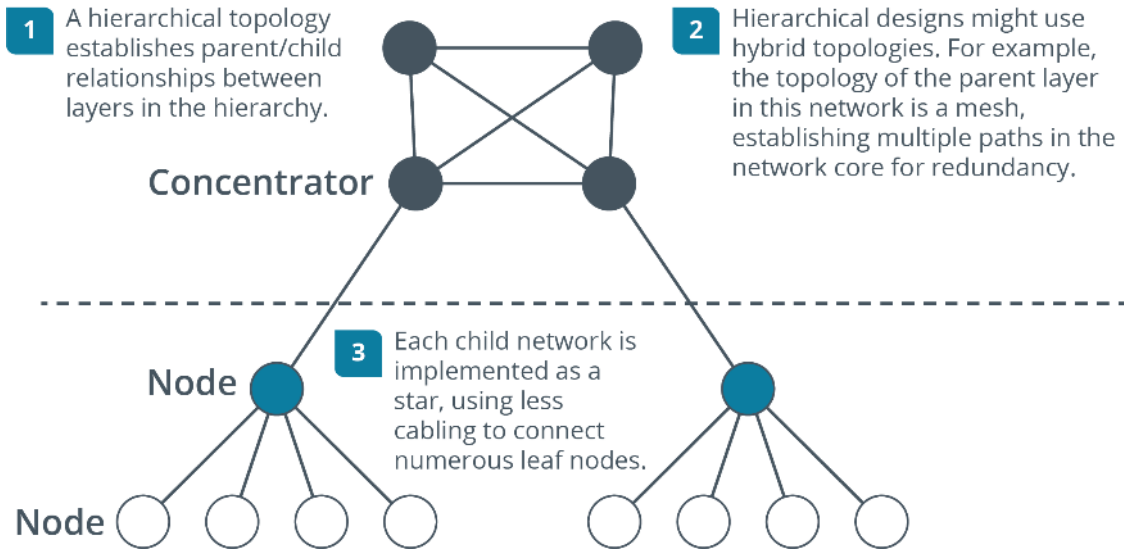


Bus Topology



Hybrid Topology

- Different logical and physical topologies
  - Switched Ethernet is a logical bus but physical star
  - Star-wired ring
- Hierarchical hybrid topology
  - Hierarchical star
  - Hierarchical star-mesh
  - Star of stars
  - Star with ring



Review Activity: Network Types and Characteristics

- Client-server versus Peer-to-peer Networks
- Network Types
- Network Topology
- Star Topology
- Mesh Topology
- Ring Topology
- Bus Topology
- Hybrid Topology

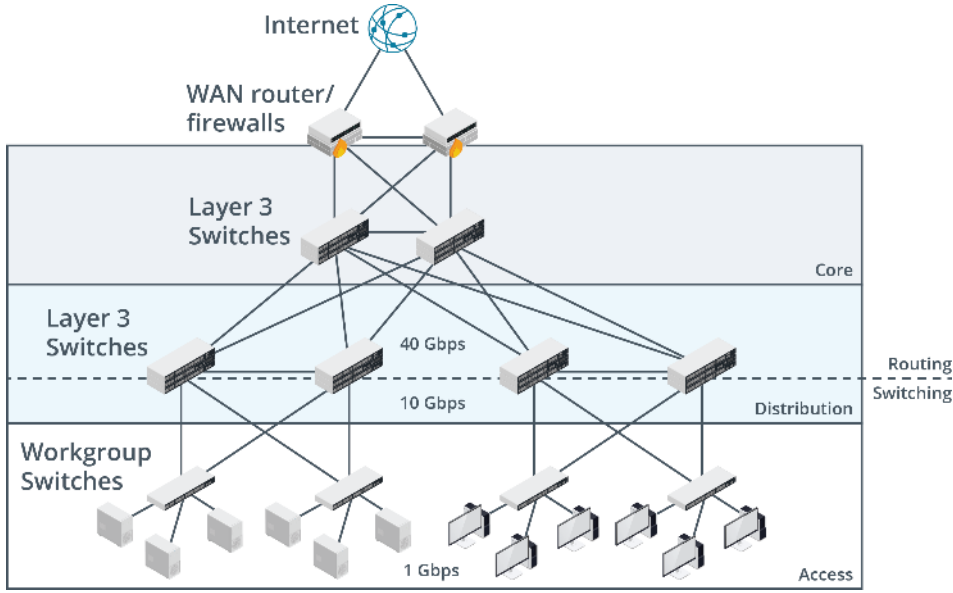
Lesson 8

Topic 8B

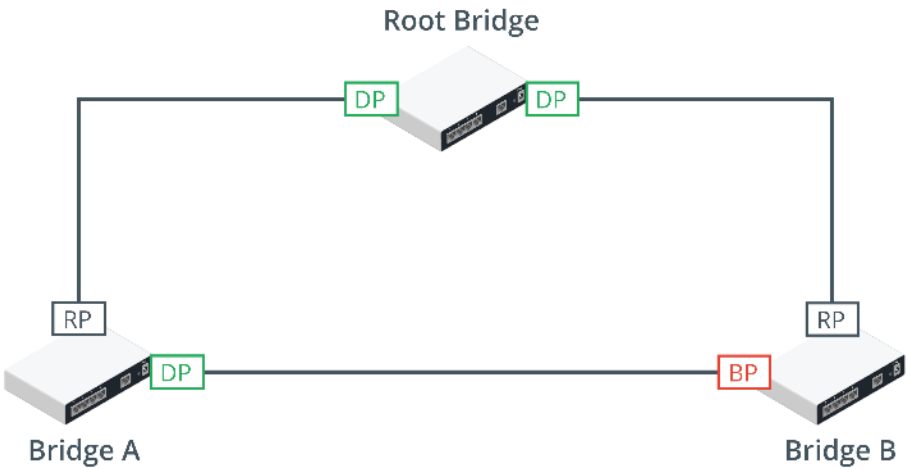
Explain Tiered Switching Architecture

Three-tiered Network Hierarchy

- Access/edge layer
  - Workgroup switches connect end systems
- Distribution/aggregation layer
  - Fault tolerant links between access blocks and core
  - Layer 3 switches
- Core layer
  - Network backbone



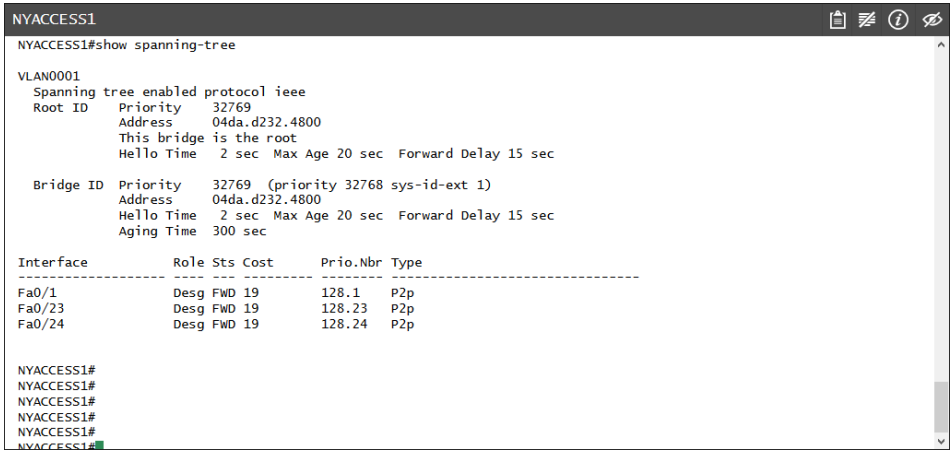
Spanning Tree Protocol



- Multiple paths between switches (or bridges) provide fault tolerance
- But multiple paths allow infinite loops as Ethernet has no TTL
- Spanning Tree Protocol (STP)
  - Prevent switching loops
  - Designate a single active path from any one device to the root bridge

Spanning Tree Protocol Configuration

- Ensure selection of appropriate root bridge
- Devices exchange bridge protocol data units (BPDUs) to determine topology
- Network is converged when all bridge ports are blocking or forwarding
- Rapid STP (RSTP)/IEEE 802.1w reduces outages



Switching Loop and Broadcast Storm Issues

- Switching loops can be catastrophic as there is no Time To Live (TTL) to expire a frame
- Broadcast storms occur when switches keep receiving the same broadcasts and re-broadcast them continually and also start flooding unicast traffic
- “Classic” cause is to bridge two ports with a misplaced patch cord
- Verify STP is functioning correctly
- Verify physical configurations and interconnections

Review Activity: Tiered Switching Architecture

- Three-tiered Network Hierarchy
- Spanning Tree Protocol
- Spanning Tree Protocol Configuration
- Switching Loop and Broadcast Storm Issues

Lesson 8

Topic 8C

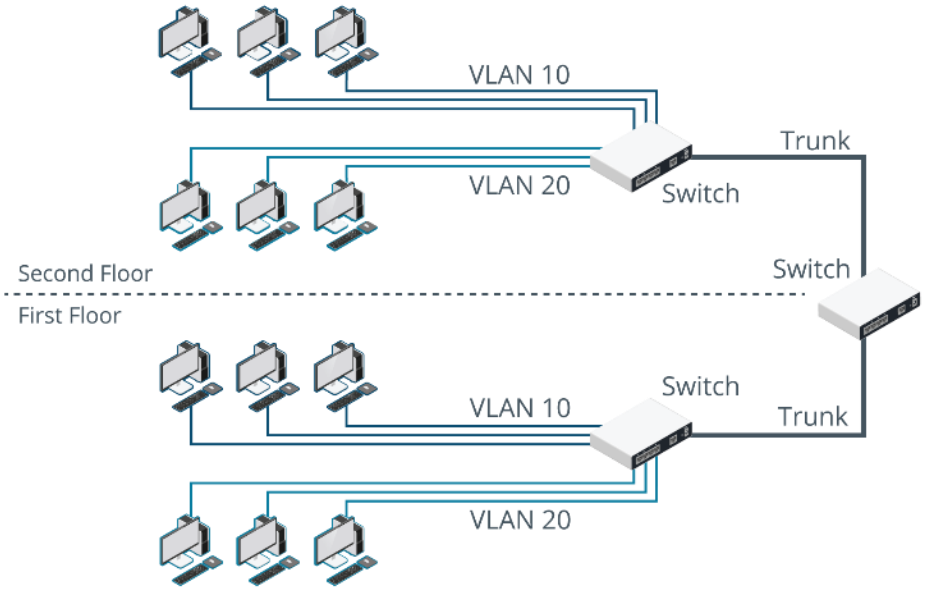
Explain Virtual LANs

Virtual LAN IDs and Membership

- Virtual LANs (VLANs)
  - Break up broadcast domains
  - Filter traffic between VLAN segments using access control lists (ACLs)
  - Prioritize traffic in voice VLANs
- Static assignment
  - Set VLAN ID as part of switch port interface configuration
- Dynamic assignment
  - Assign by MAC address
  - Assign by authentication

```
interface swp5
  bridge-access 100

interface swp6
  bridge-access 100

interface swp7
  bridge-access 100

interface swp8
  bridge-access 100

interface swp9
  bridge-access 200

interface swp10
  bridge-access 200

interface swp11
  bridge-access 200

interface swp12
  bridge-access 200

interface bridge
  bridge-ports swp5 swp6 swp7 swp8 swp9 swp10 swp11 swp12
  bridge-vids 10 100 200
  bridge-vlan-aware yes
```

Trunking and IEEE 802.1Q



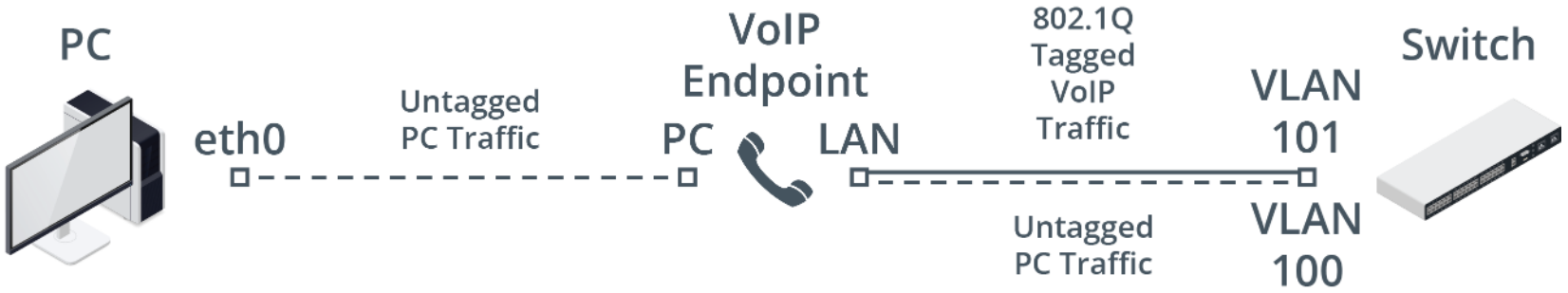
- Switches interconnected via trunk links
- VLAN ID information might need to be transported across trunks
- 802.1Q frame format used on trunks to store VLAN ID

Tagged and Untagged Ports

- Untagged
  - Host or access ports
  - Switch assigns tags, not end systems
- Tagged port
  - Typically trunk link
  - Also used by virtualization hosts

Voice VLANs

- Voice over IP (VoIP) bandwidth and latency requirements
- Voice VLAN allows VoIP handset to share physical port with PC
- Handset operates a 2-port switch
  - PC data sent as untagged frames
  - VoIP data sent as 802.1Q in a voice or auxiliary VLAN
- Switch assigns PC data to one VLAN and VoIP data to another



Review Activity: Virtual LANs

- Virtual LAN IDs and Membership
- Trunking and IEEE 802.1Q
- Tagged and Untagged Ports
- Voice VLANs

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Summary