Chapter 1: LAN Design

Scaling Networks

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Mind Wide Open™

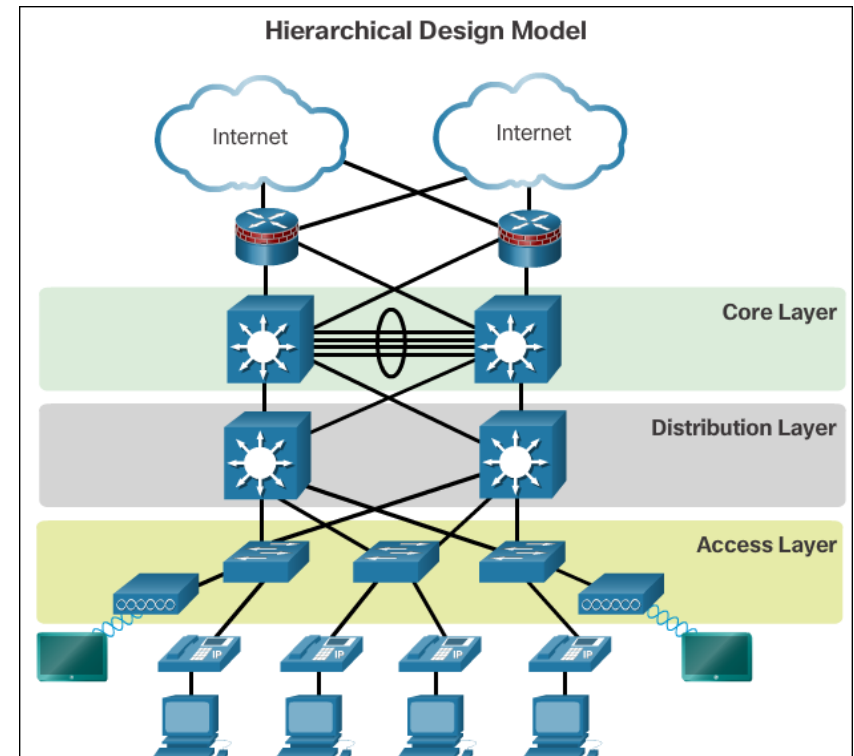1.1 Campus Wired LAN Designs

Cisco Validated Designs

- ## The Need to Scale the Network
  - All enterprise networks must: support critical applications, support converged network traffic, support diverse business needs, and provide centralized administrative control.
  - Campus network designs include small networks that use a single LAN switch, up to very large networks with thousands of connections.

- A hierarchical LAN design includes the access, distribution, and core layers:

  - The access layer provides endpoints and users direct access to the network.
  - The distribution layer aggregates access layers and provides connectivity to services.
  - The core layer provides connectivity between distribution layers for large LAN environments.
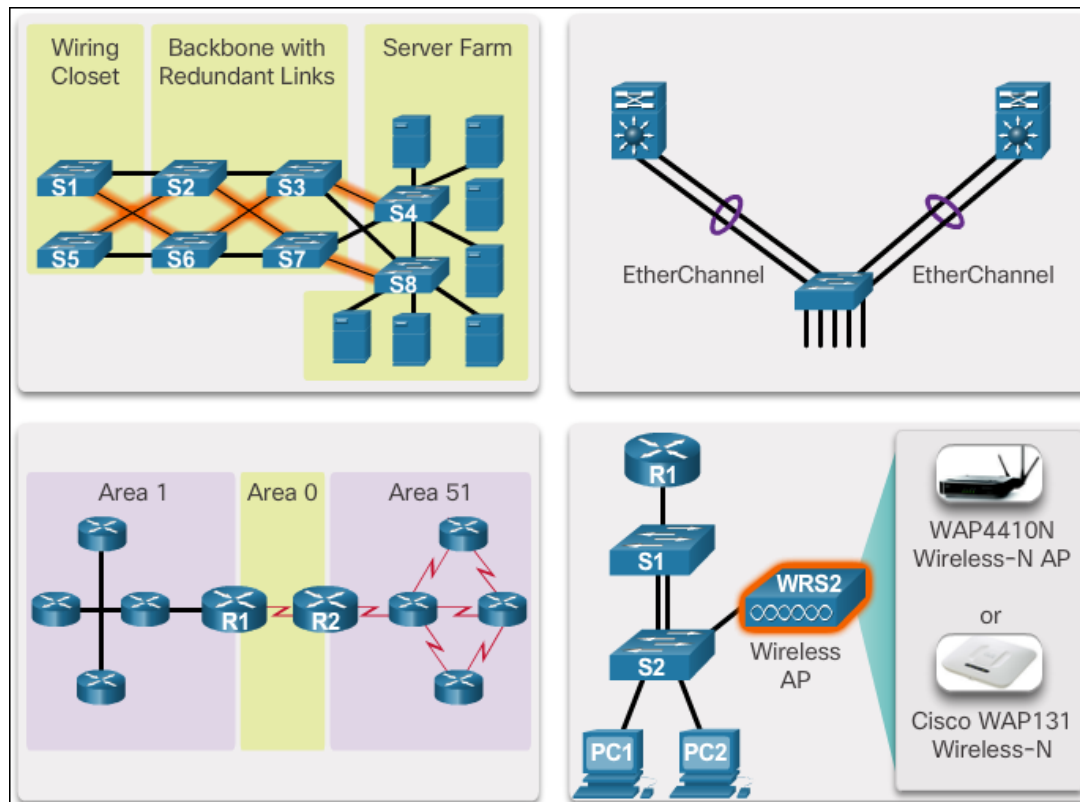
Hierarchical Design Model

Internet   Internet

Core Layer

Distribution Layer

Access Layer

Campus Wired LAN Designs
Expanding the Network

- To support a large, medium or small network, the network designer must develop a strategy to enable the network to be available and to scale effectively and easily.

- One method of implementing redundancy is by installing duplicate equipment and providing failover services for critical devices. Another method of implementing redundancy is redundant paths.
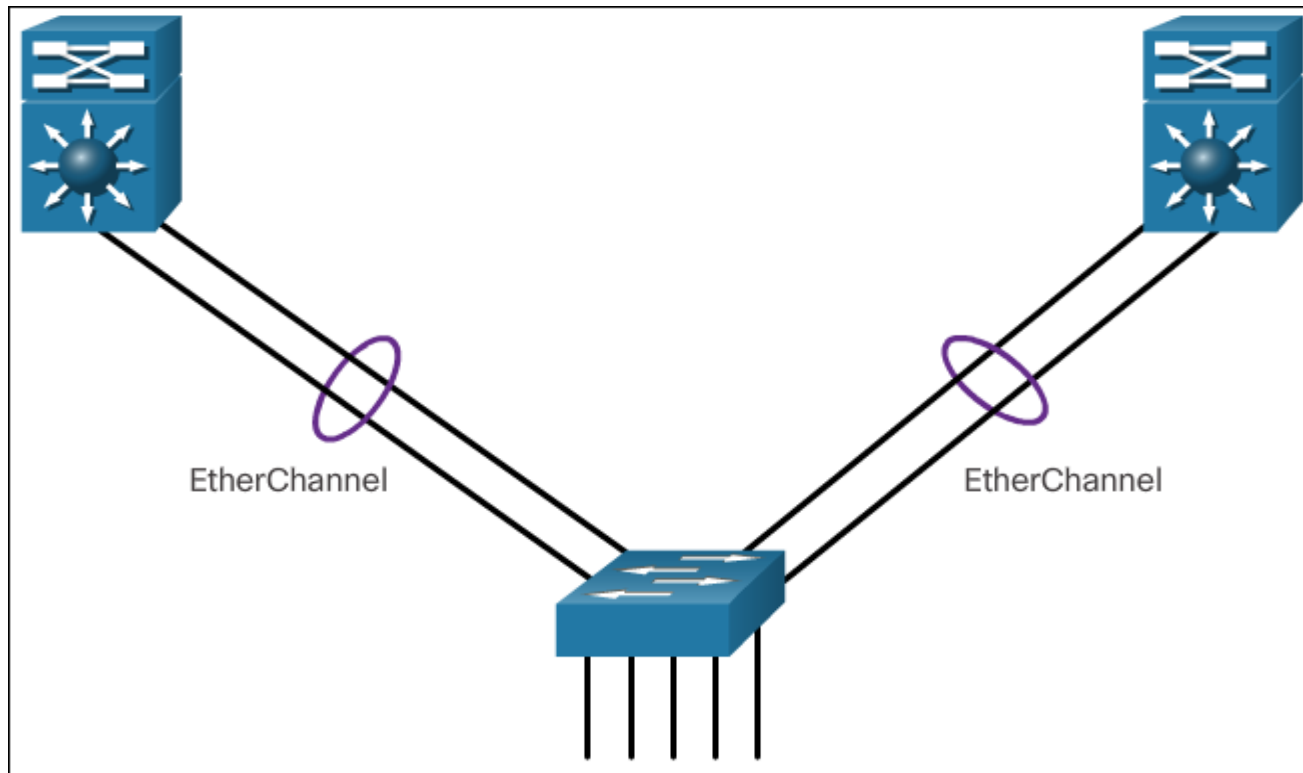
Expanding the Network (Cont.)

- A failure domain is the area of a network that is impacted when a critical device or network service experiences problems. Smaller failure domains reduce the impact of a failure on company productivity.

- Link aggregation allows an administrator to increase the amount of bandwidth between devices by creating one logical link made up of several physical links. EtherChannel is a form of link aggregation used in switched networks.


EtherChannel   EtherChannel

Expanding the Network (Cont.)

- To communicate wirelessly, end devices require a wireless NIC that incorporates a radio transmitter/receiver and the required software driver to make it operational. Additionally, a wireless router or a wireless access point (AP) is required for users to connect.

- Link-state routing protocols, such as Open Shortest Path First (OSPF), works well for larger hierarchical networks where fast convergence is important. OSPF routers establish and maintain neighbor adjacency or adjacencies, with other connected OSPF routers.
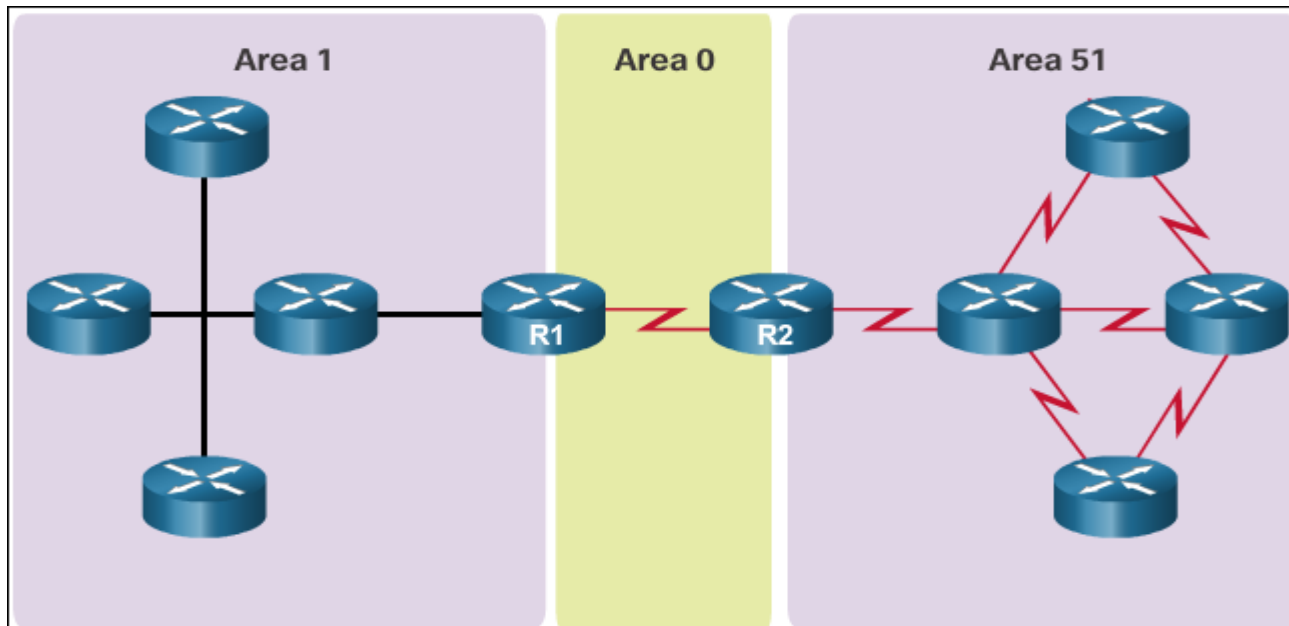
1.2 Selecting Network Devices

Switch Hardware

- There are five categories of switches for enterprise networks: Campus LAN, Data Center, Cloud-Managed, Service Provider, and Virtual Networking.

- The port density of a switch refers to the number of ports available on a single switch. Fixed configuration switches typically support up to 48 ports on a single device. Modular switches can support very high-port densities through the addition of multiple switch port line cards.

24-port switch

48-port switch

Modular switch with up to 1000+ ports

Switch Hardware (Cont.)

- Forwarding rates define the processing capabilities of a switch by rating how much data the switch can process per second.

- Wire speed is the data rate that each Ethernet port on the switch is capable of attaining. Data rates can be 100 Mb/s, 1 Gb/s, 10 Gb/s, or 100 Gb/s.

- Less expensive, lower performing switches can be used at the access layer, and more expensive, higher performing switches can be used at the distribution and core layers, where the forwarding rate has a greater impact on network performance.

24-port Gigabit Ethernet Switch

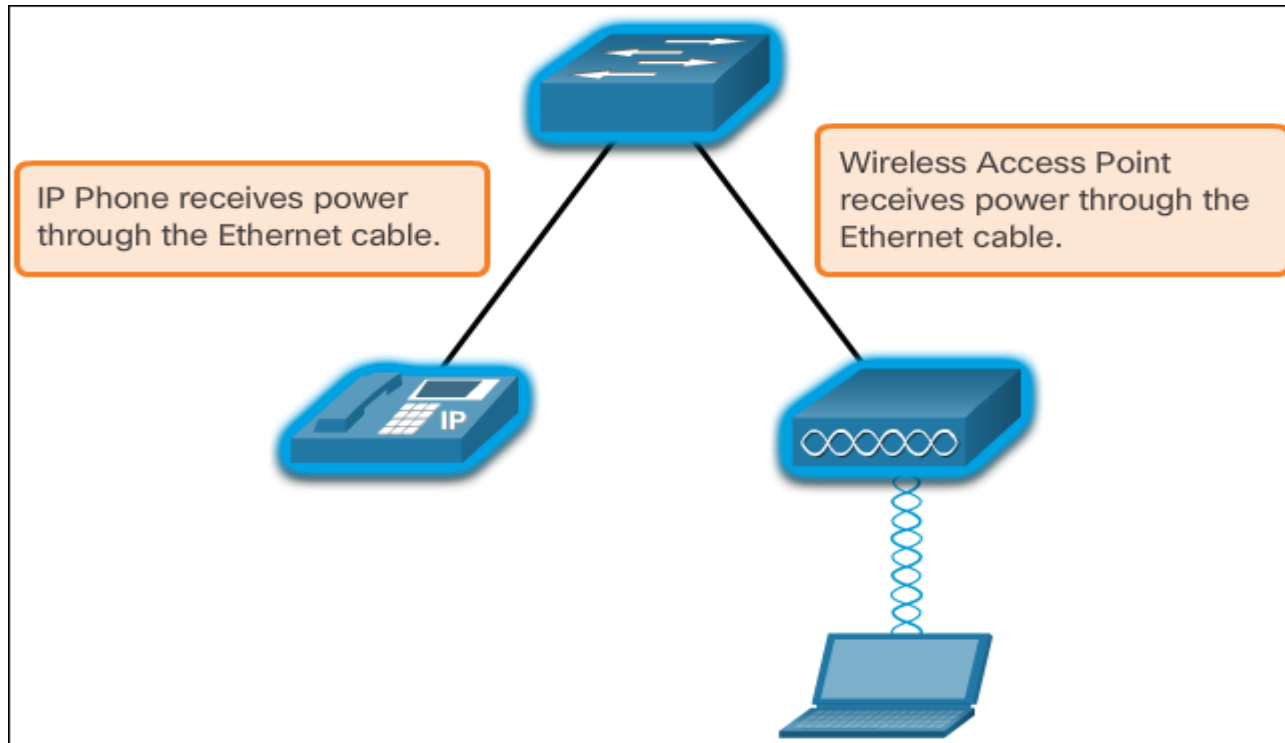Capable of switching 24 Gb/s of traffic

48-port Gigabit Ethernet Switch

Capable of switching 48 Gb/s of traffic

Switch Hardware (Cont.)

- Power over Ethernet (PoE) allows the switch to deliver power to a device over the existing Ethernet cabling.

- Multilayer switches are typically deployed in the core and distribution layers of an organization's switched network. Multilayer switches are characterized by their ability to build a routing table, support a few routing protocols, and forward IP packets at a rate close to that of Layer 2 forwarding.

IP Phone receives power through the Ethernet cable.

Wireless Access Point receives power through the Ethernet cable.

Managing Devices

- IOS refers to the package of routing, switching, security, and other internetworking technologies integrated into a single multitasking operating system.

- Out-of-band management is used for initial configuration or when a network connection is unavailable.

- In-band management is used to monitor and make configuration changes to a network device over a network connection.