



Module Summary

- The hierarchical network structure is composed of the access, distribution, and core layers.
- Based on Cisco SONA, the Cisco Enterprise Architecture provides a modular hierarchical approach for providing network infrastructure and services to all places in the network.
- Network infrastructure services add intelligence to the network infrastructure, supporting application awareness within the network.
- Network management protocols support the exchange of management information between the network management system and managed devices.



Designing Basic Campus and Data Center Networks



Designing for Cisco Internetwork Solutions (DESGN) v2.0

Describing Campus Design Considerations

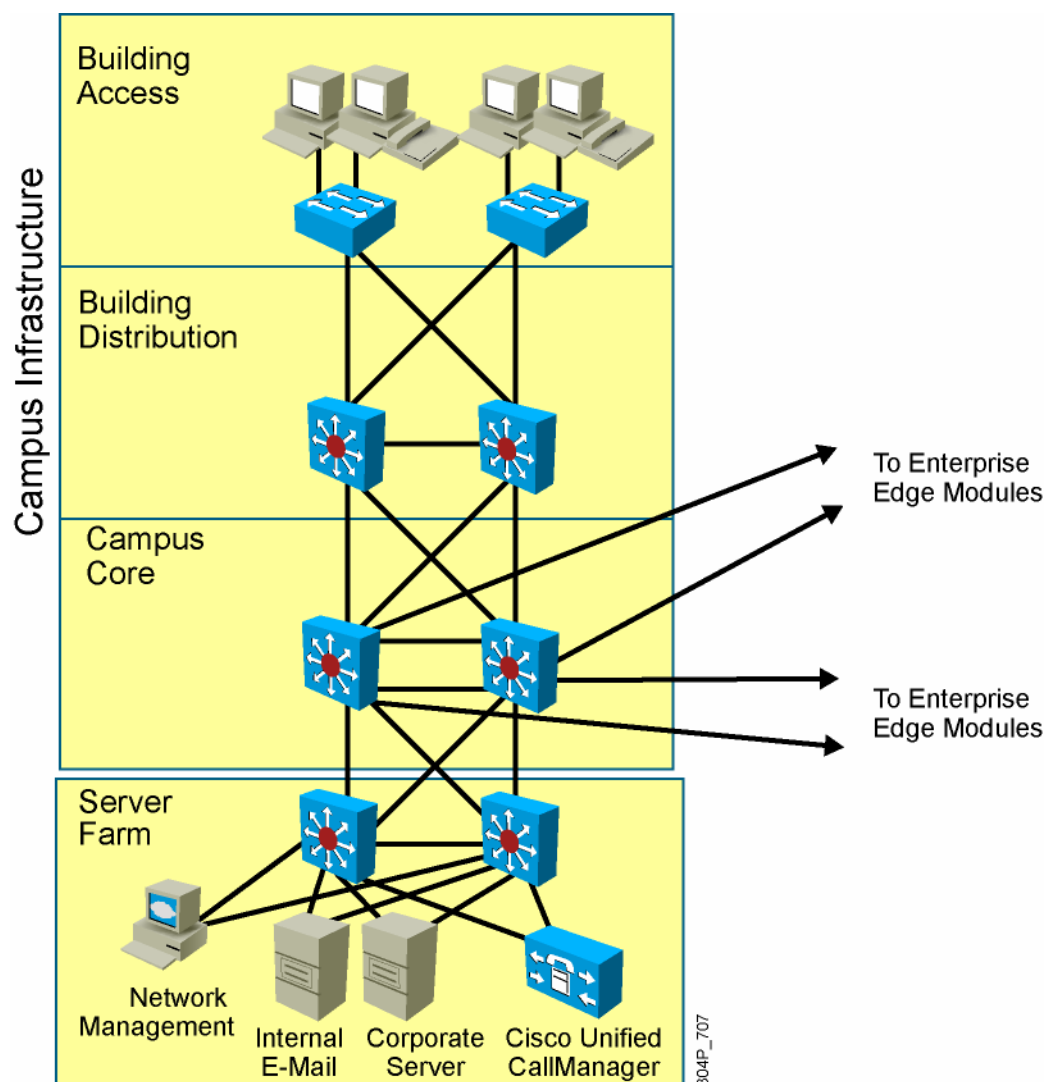


Designing Basic Enterprise Campus Networks

Designing an Enterprise Campus

Campus design factors:

- Network applications characteristics
- Device characteristics
- Environmental characteristics



Overview of Network Application Types

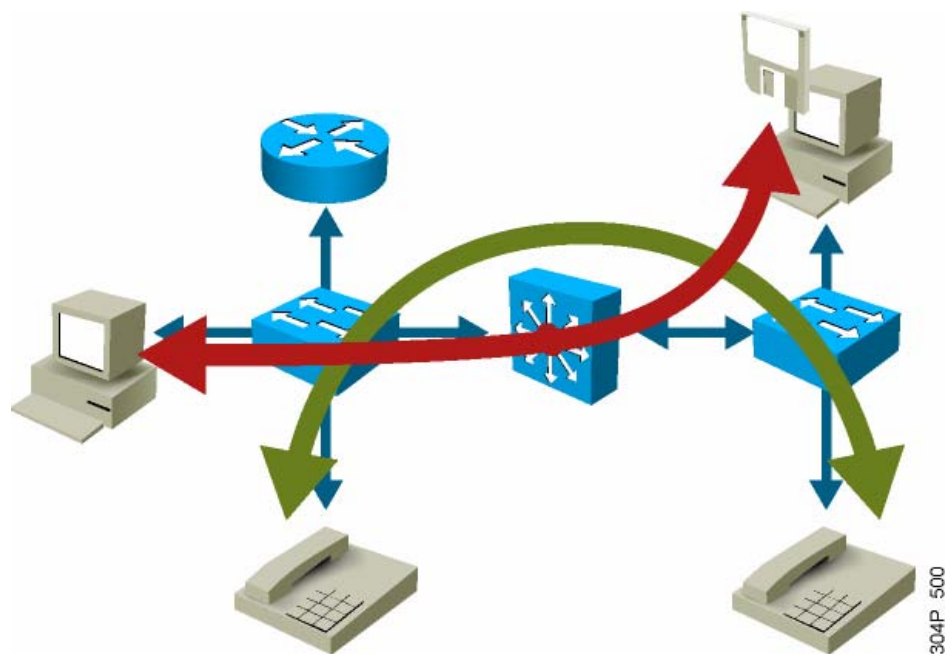
- Peer-to-peer
- Client-local server
- Client-server farm
- Client-enterprise edge Server

Network Requirements of Applications

- Connectivity type
- Total required throughput
- High availability
- Total network costs

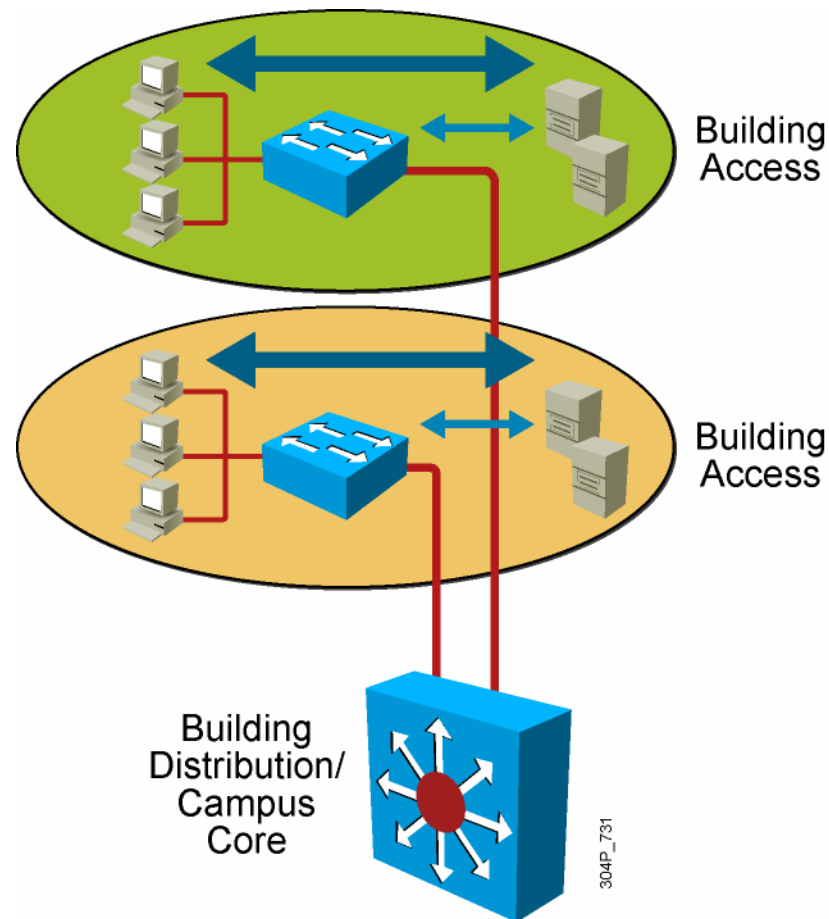
Example: Peer-to-Peer Applications

- Instant messaging
- File sharing
- IP phone calls
- Video conference systems



Example: Client-Local Server Applications

- Servers are located close to clients.
- Servers and clients are in the same LAN.
- Request to servers from nonlocal LANs is rare.



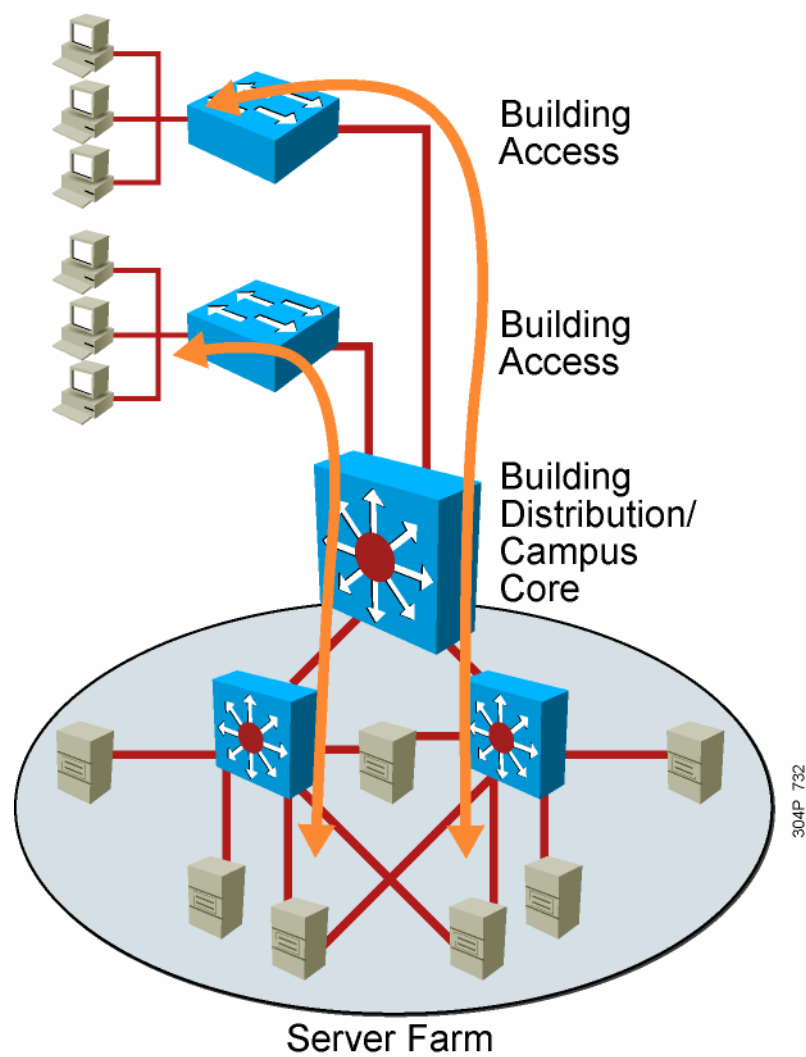
Example: Client-Server Farm Applications

Typical applications:

- Mail servers
- File servers
- Database servers

Access to applications:

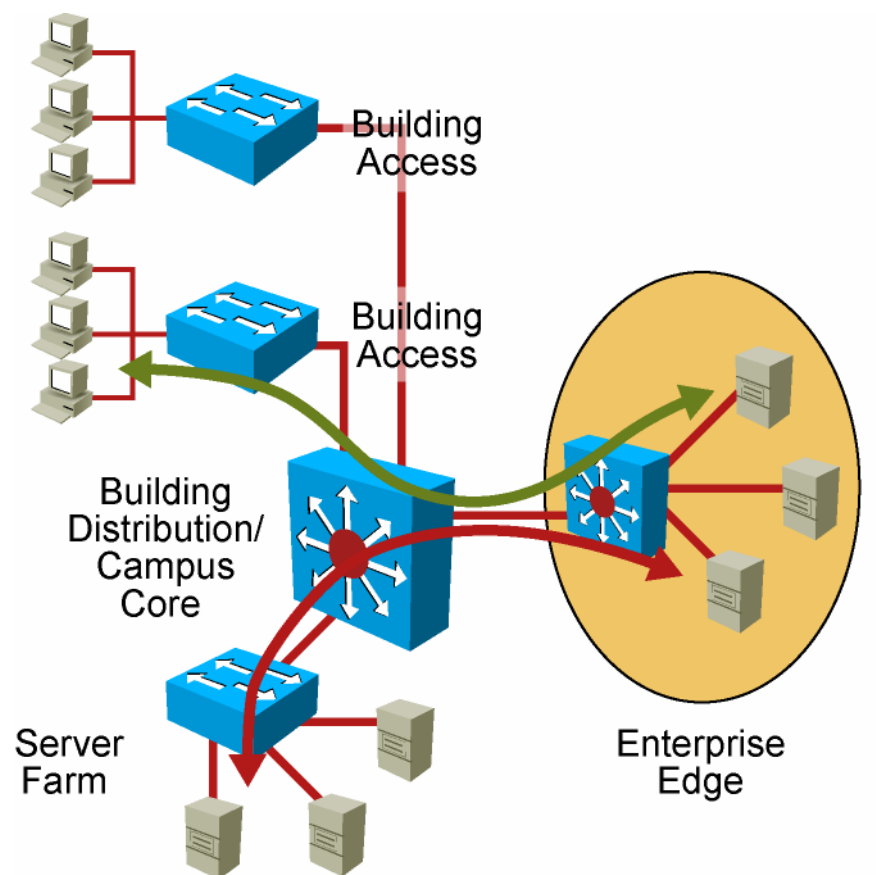
- Fast
- Reliable
- Controlled (security)



Example: Client-Enterprise Edge Applications

Typical applications:

- Internet applications
 - Mail servers
 - Web servers
 - Public Internet servers
- E-commerce applications



Relative Network Requirements by Application Type

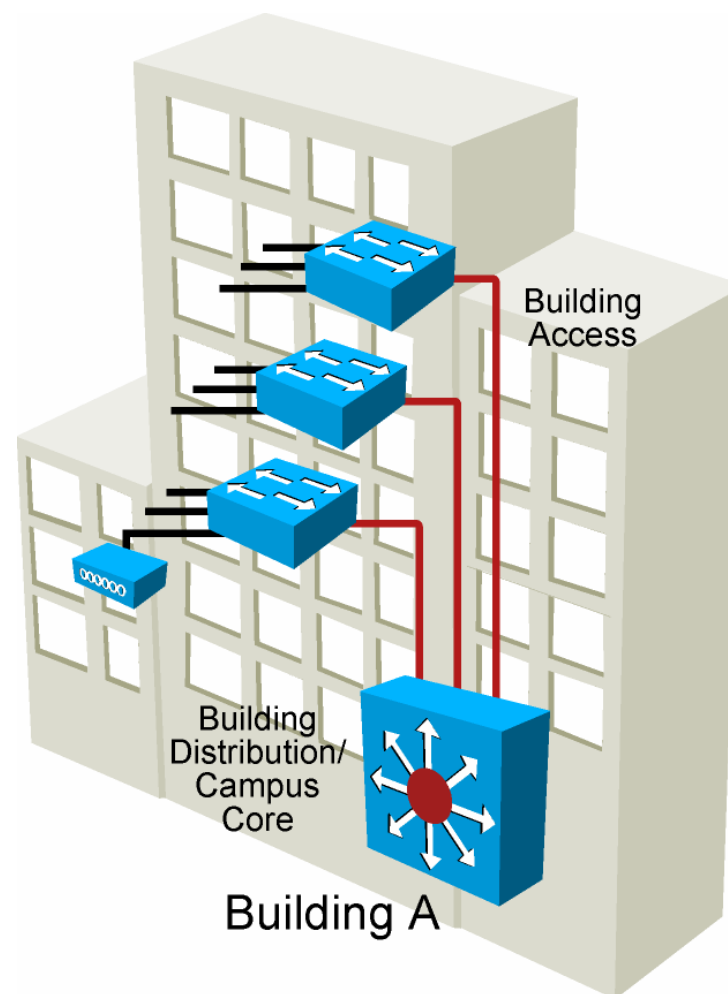
| | Peer-to-Peer | Client-Local Servers | Client-Server Farm | Client-Enterprise Edge Servers |
|---------------------------|----------------|----------------------|--------------------|--------------------------------|
| Connectivity type | Switched | Switched | Switched | Switched |
| Total required throughput | Medium to high | Medium | High | Medium |
| High availability | Low to high | Medium | High | High |
| Total network costs | Low to medium | Medium | High | Medium |

Environmental Characteristics for Network Design

- The network devices and distances between them determine the network geography.
- The campus network design is scoped with respect to geography:
 - Intrabuilding
 - Interbuilding
 - Distant remote buildings

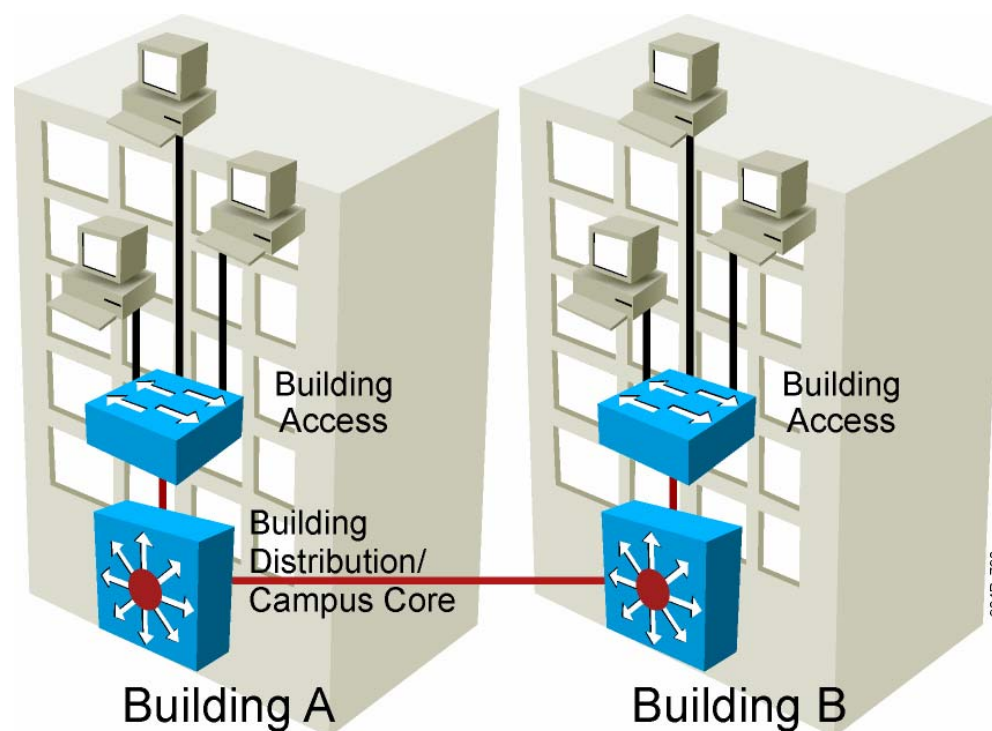
Intrabuilding Structure

- Provides connectivity inside the building
- Built with the building access and building distribution layers
- Transmission options:
 - Copper
 - Optical fiber
 - Wireless



Interbuilding Structure

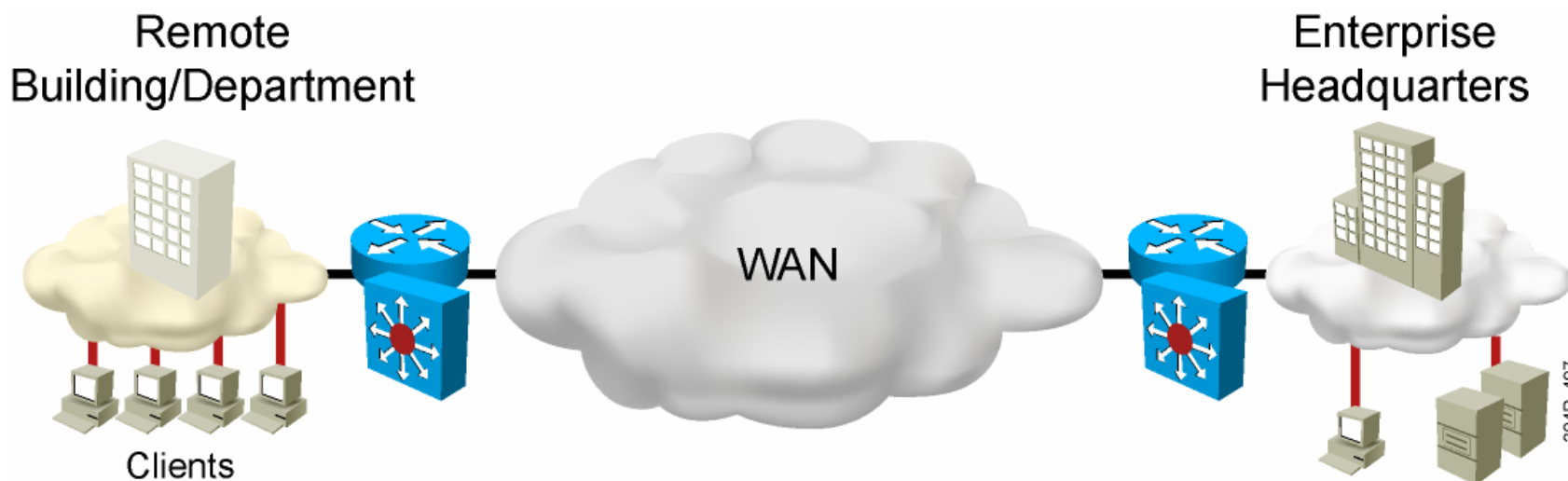
- Connectivity between buildings
- Distances between buildings within a few kilometers
- Building distribution with campus core layer
- Typical transmission media: optical fiber



Distant Remote Building Structure

Metropolitan-based network connectivity options:

- Using company-owned fiber
- Through enterprise WAN
- Through service provider offerings



Campus Transmission Media

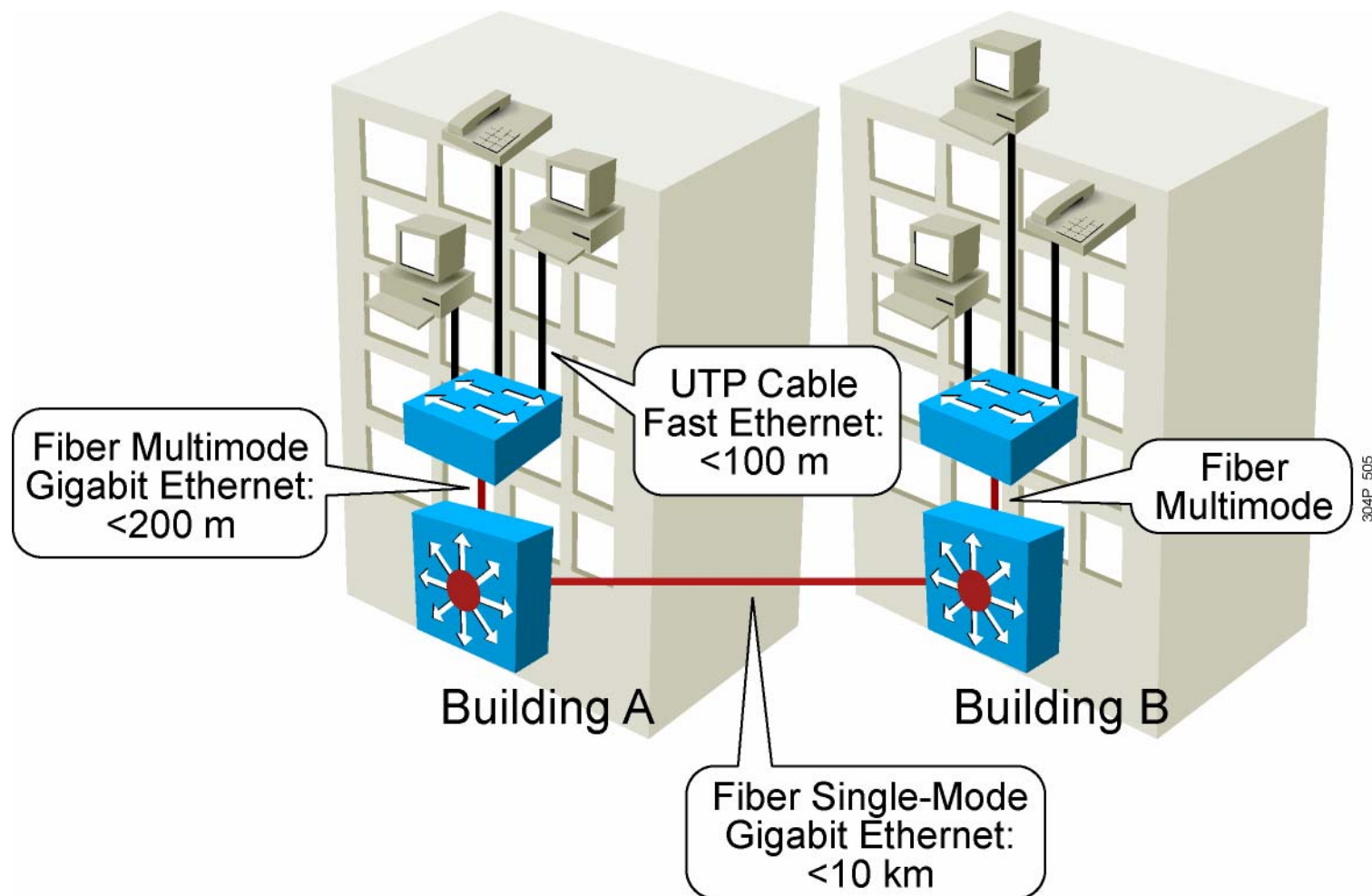
- Physical media in network design influences:
 - Network bandwidth
 - Allowable distance between devices
 - Copper design considerations:
 - Electromagnetic interference, grounding, security
 - Signal attenuation, distance limitations
- Optical fiber design considerations:
 - Light signal (LED or laser)
 - Expensive, providing a long-term investment
- Wireless design considerations:
 - Distance, interference, bandwidth, security

Comparison of Campus Transmission Media

| | Copper Twisted Pair | Multimode Fiber | Single-Mode Fiber | Wireless |
|-----------|---------------------|---|--|-----------------------|
| Bandwidth | Up to 10 Gbps | Up to 10 Gbps | Up to 10 Gbps or higher | Up to 54 Mbps* |
| Distance | Up to 100 m | Up to 2 km (Fast Ethernet) Up to 550 m (Gigabit Ethernet) Up to 300 m (10 Gigabit Ethernet) | Up to 80 km (Fast Ethernet) Up to 100 m (Gigabit Ethernet) Up to 80 km (10 Gigabit Ethernet) | Up to 500 m at 1 Mbps |
| Price | Inexpensive | Moderate | Moderate to expensive | Moderate |

*Wireless is half-duplex, so effective bandwidth will be no more than one half this rate.

Example: Transmission Media



Infrastructure Device Characteristics

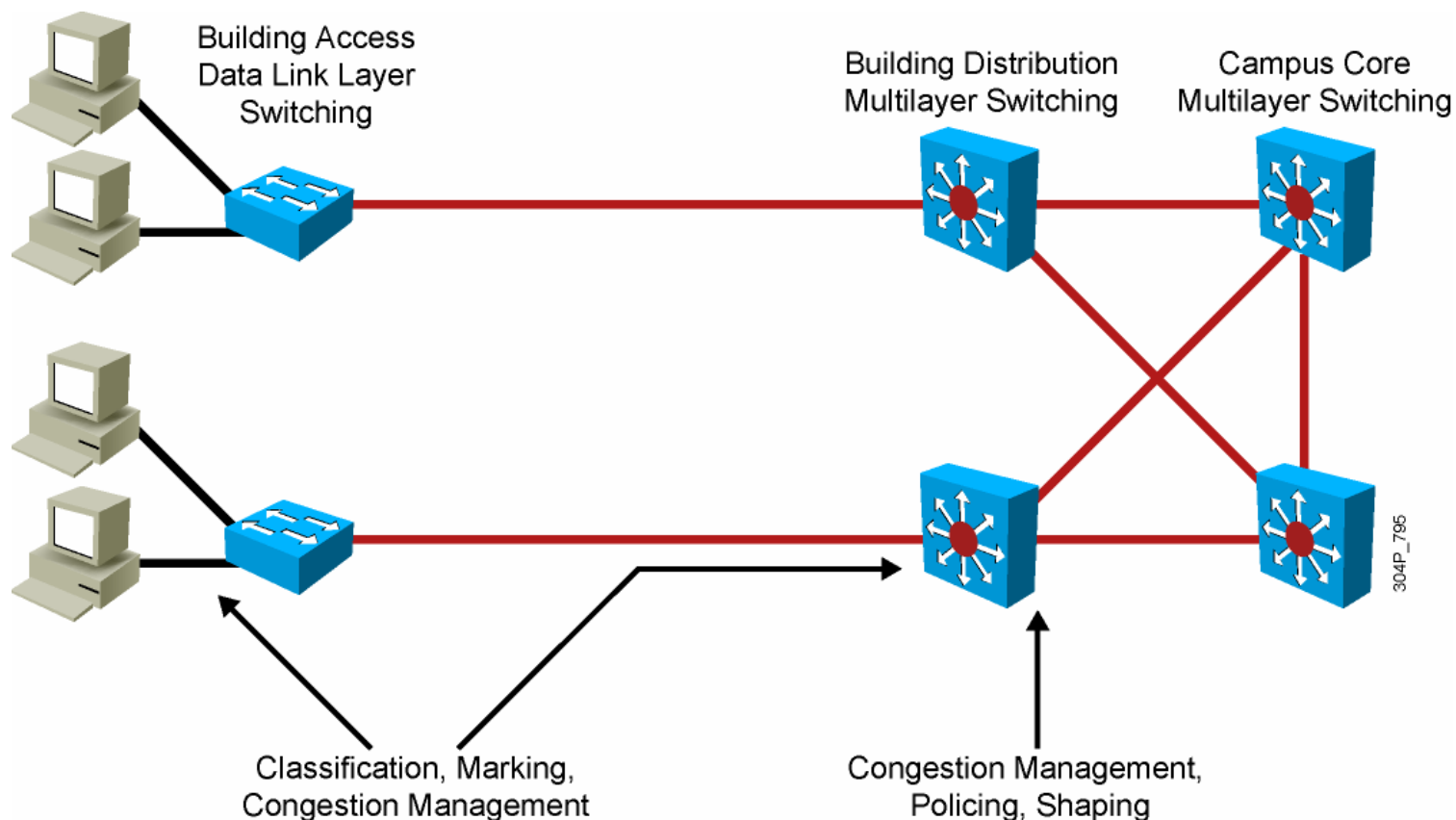
Switches connect end devices as well as infrastructure devices:

- Access layer is typically data link layer switches.
- Distribution and core layer typically use multilayer switches.

Switch type and switching layer decision is influenced by:

- Infrastructure services requirements(QoS, including policing, and so on)
- Size of the network segments
- Expected network failure convergence times
- Cost

Example Network Service: QoS in LAN Switches



Enterprise QoS guarantees that critical applications receive the required bandwidth or services.

Summary

- Campus network design is influenced by several factors; first by applications characteristics, such as throughput and availability requirements.
- Second are environmental characteristics, such as the location of devices and buildings and transmission media.
- Third are infrastructure device characteristics, such switching type and support for network services.