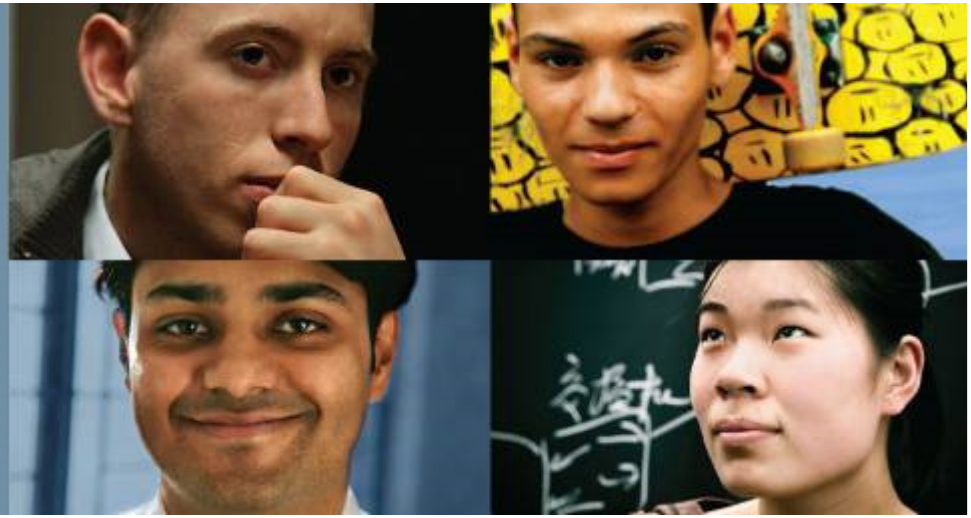
Chapter 1: Hierarchical Network Design



Connecting Networks

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Chapter 1

1.0 Introduction

1.1 Hierarchical Network Design Overview

1.2 Cisco Enterprise Architecture

1.3 Evolving Network Architectures

1.4 Summary

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Chapter 1: Objectives

- Describe how a hierarchical network model is used to design networks.
- Explain the structured engineering principles for network design: **Hierarchy, Modularity**, **Resiliency**, **Flexibility**.
- Describe the three layers of a hierarchical network and how they are used in network design.
- Identify the benefits of a hierarchical design.
- Describe the Cisco Enterprise Architecture model.
- Describe the three new business network architectures: borderless network architecture, collaboration network architecture, and the data center or virtualization network architecture.

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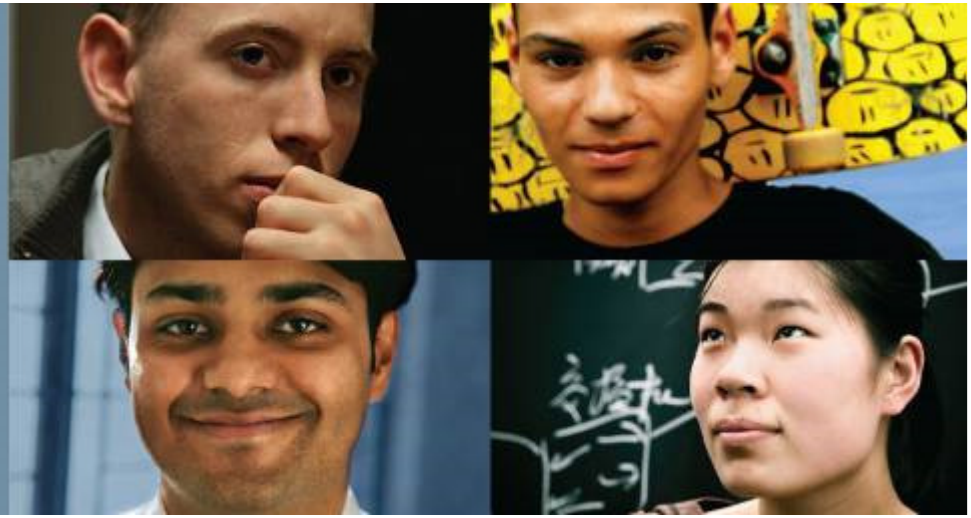
1.1 Hierarchical Network Design Overview



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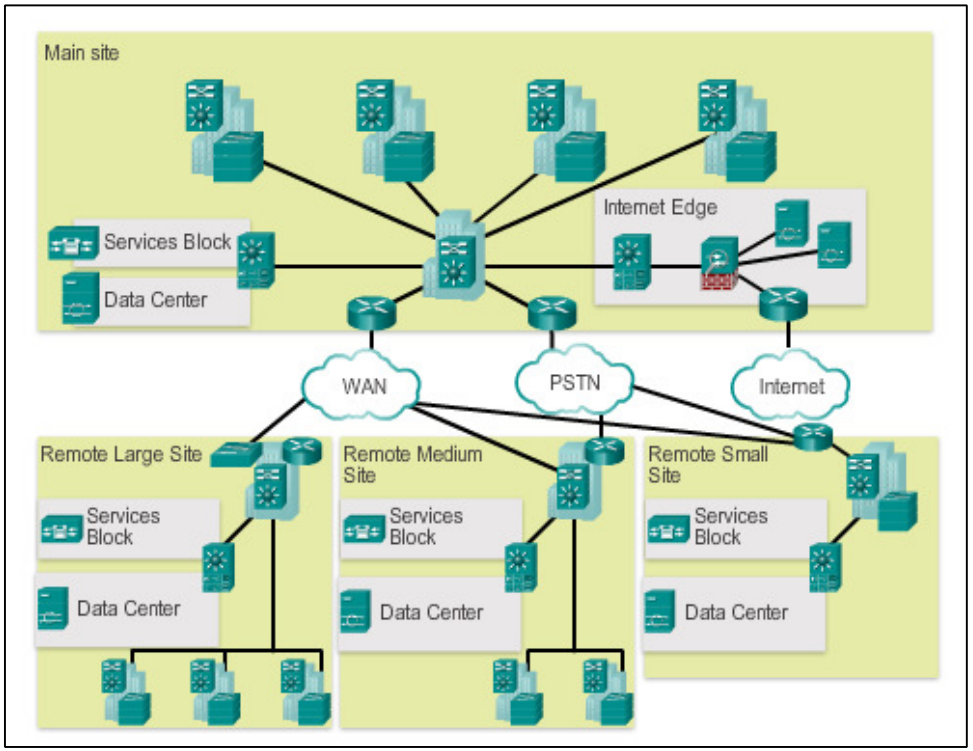
Network Requirements

- **Small network** – Provides services for 1 to 200 devices.
- **Medium-sized network** – Provides services for 200 to 1,000 devices.
- **Large network** – Provides services for 1,000+ devices.



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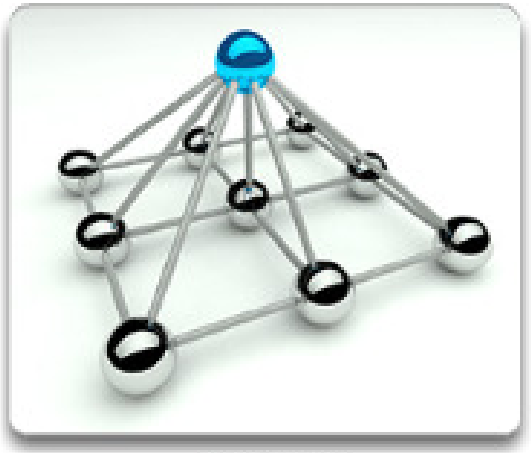
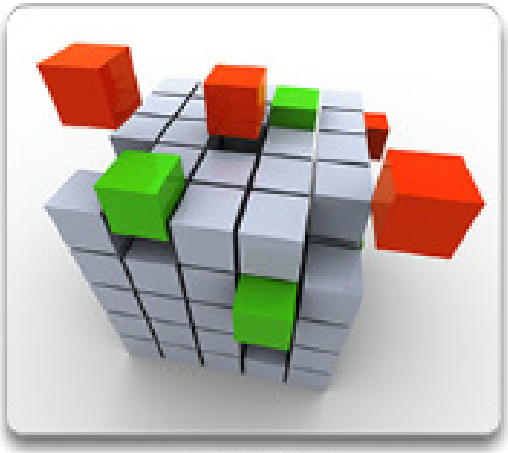
Structured Engineering Principles



Hierarchy



Modularity

Resiliency

Flexibility

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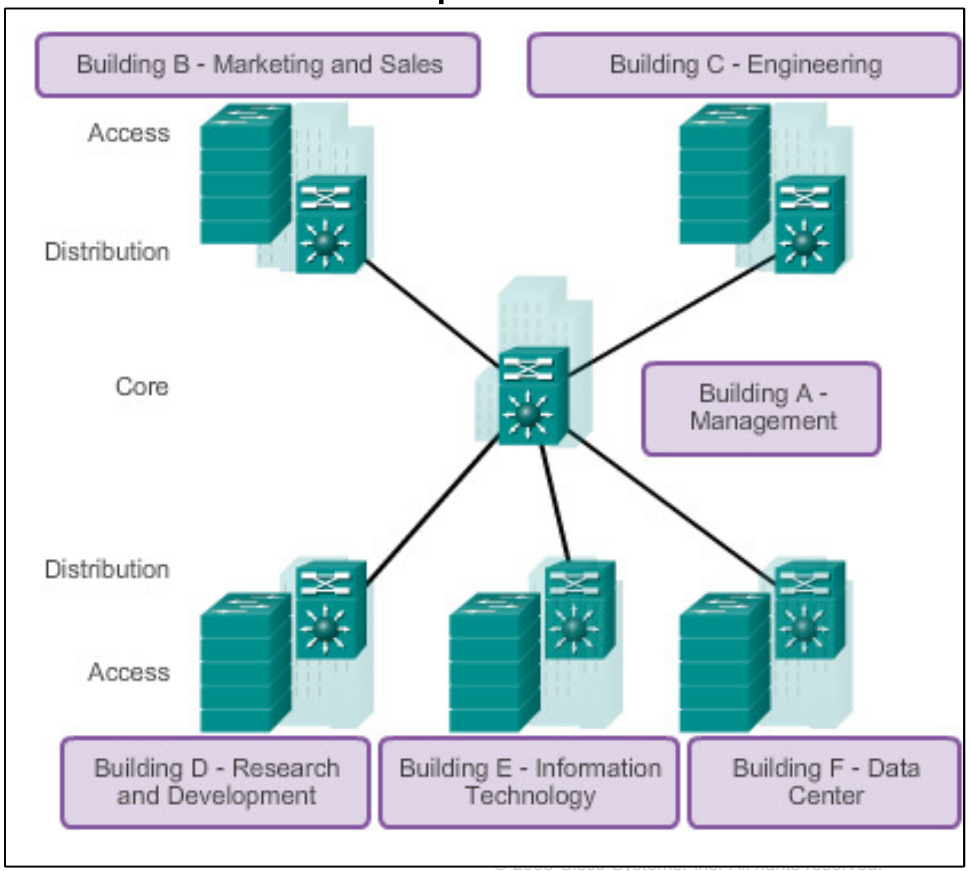
Network Hierarchy

- **Access layer** – Provides workgroup or user access to the network.
- **Distribution layer** – Provides policy-based connectivity.
- **Core layer** – Provides fast transport between distribution switches.



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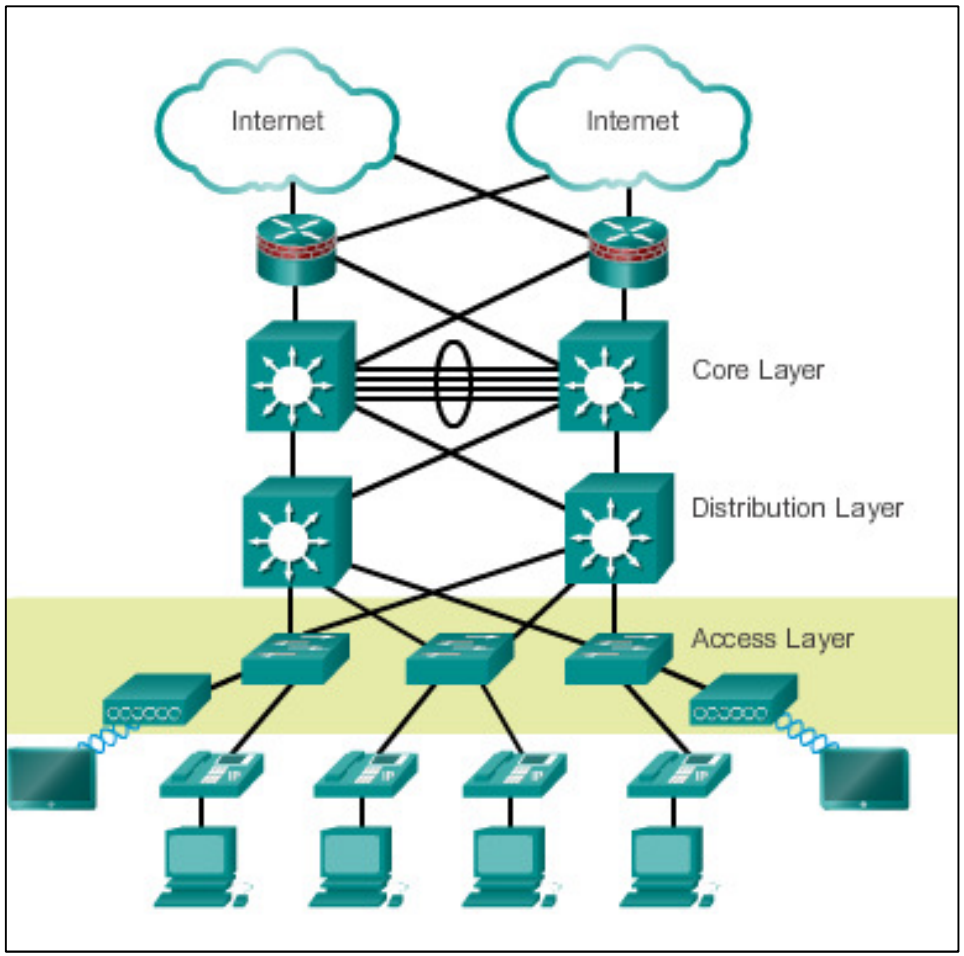
Access Layer

- Layer 2 switching
- High availability
- Port security
- QoS classification and marking and trust boundaries
- Address Resolution Protocol (ARP) inspection
- Virtual access control lists (VACLs)
- Spanning tree
- Power over Ethernet (PoE) and auxiliary VLANs for VoIP



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Distribution Layer

- Aggregation of LAN or WAN links
- Policy-based security in the form of access control lists (ACLs) and filtering
- Routing services between LANs and VLANs and between routing domains (e.g., EIGRP to OSPF)
- Redundancy and load balancing
- A boundary for route aggregation and summarization configured on interfaces toward the core layer

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Core Layer

- Provides high-speed switching (i.e., fast transport)
- Provides reliability and fault tolerance
- Scales by using faster, and not more, equipment
- Avoids CPU-intensive packet manipulation caused by security, inspection, quality of service (QoS) classification, or other processes

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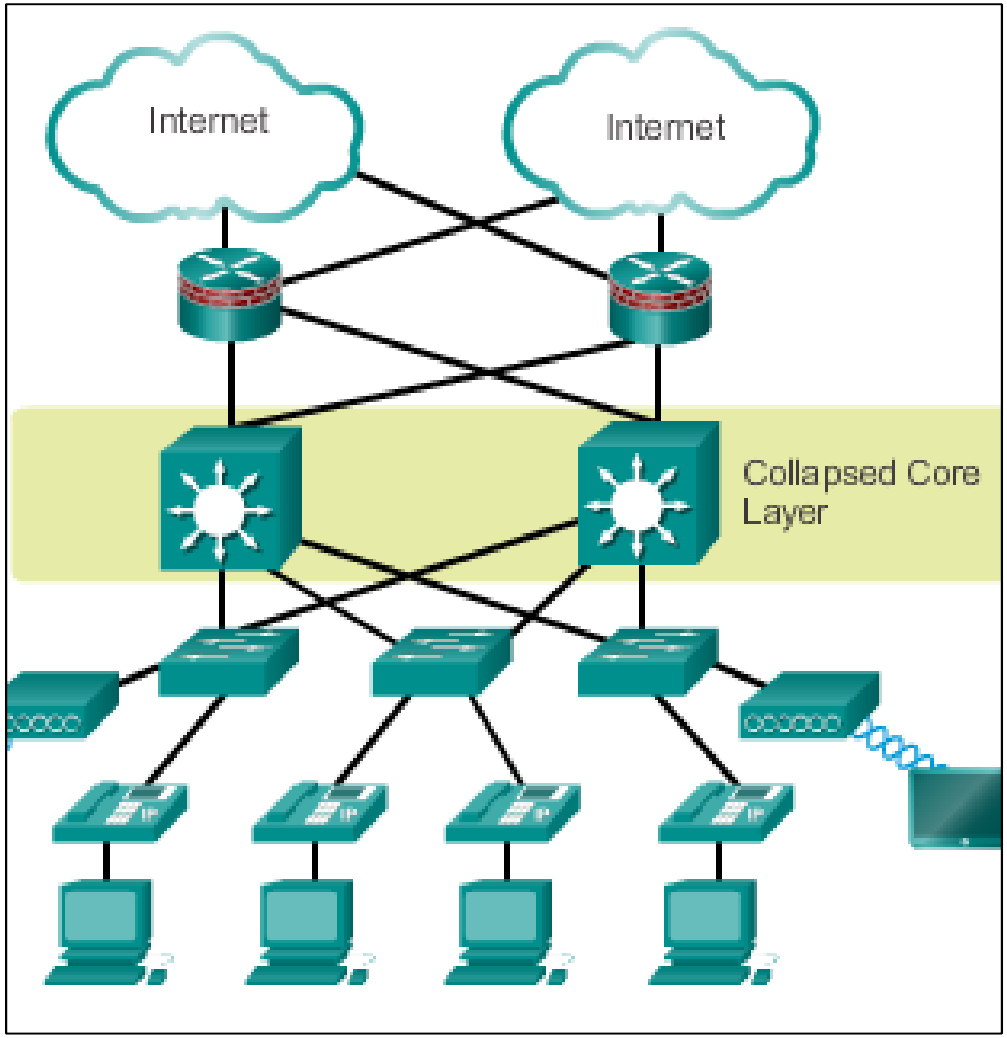
Two-Tier Collapsed Core Design

- A two-tier hierarchical "collapsed core" is when the distribution layer and core layer functions are implemented by a single device.
- Used by smaller businesses to reduce network cost while maintaining most of the benefits of the three-tier hierarchical model.



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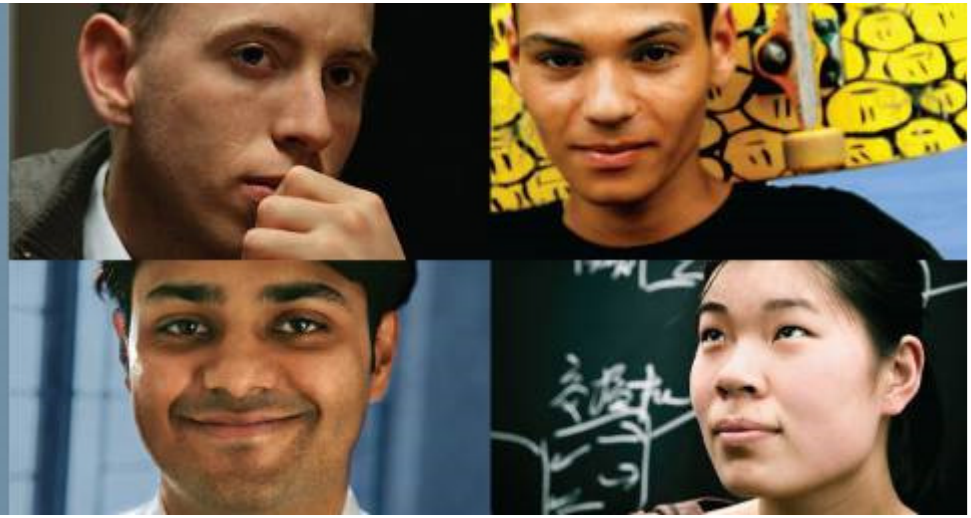
1.2 Cisco Enterprise Architecture



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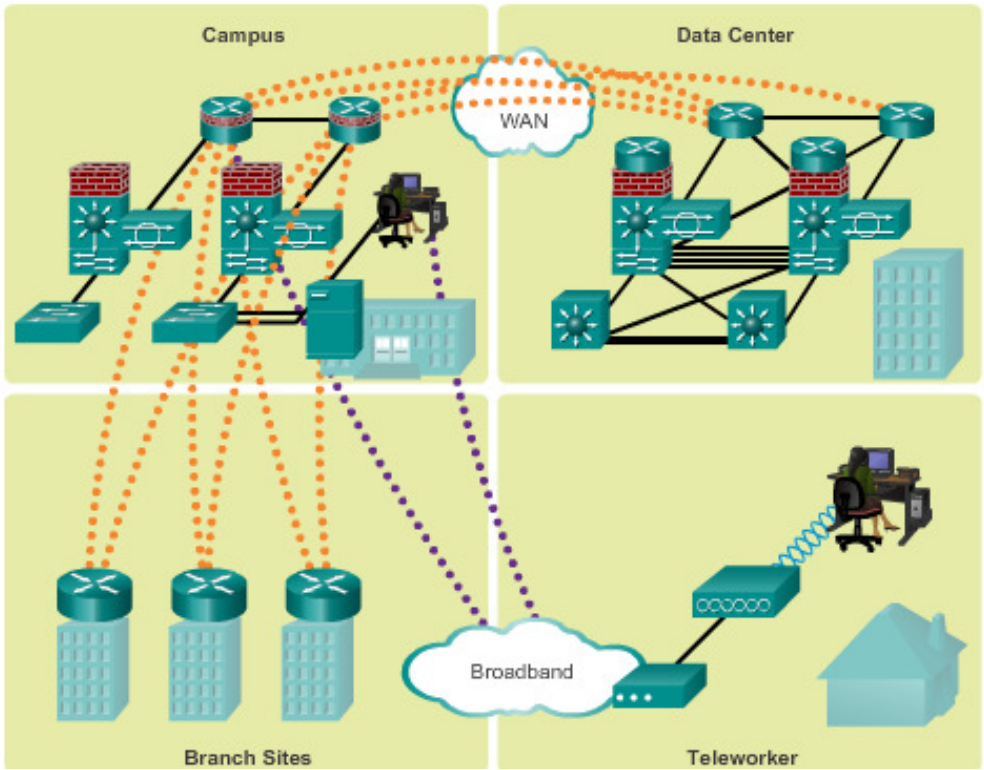
Modular Design

- As the complexity of networks increased, a modular network design has been implemented.
- Modular design separates the network into various functional network modules.



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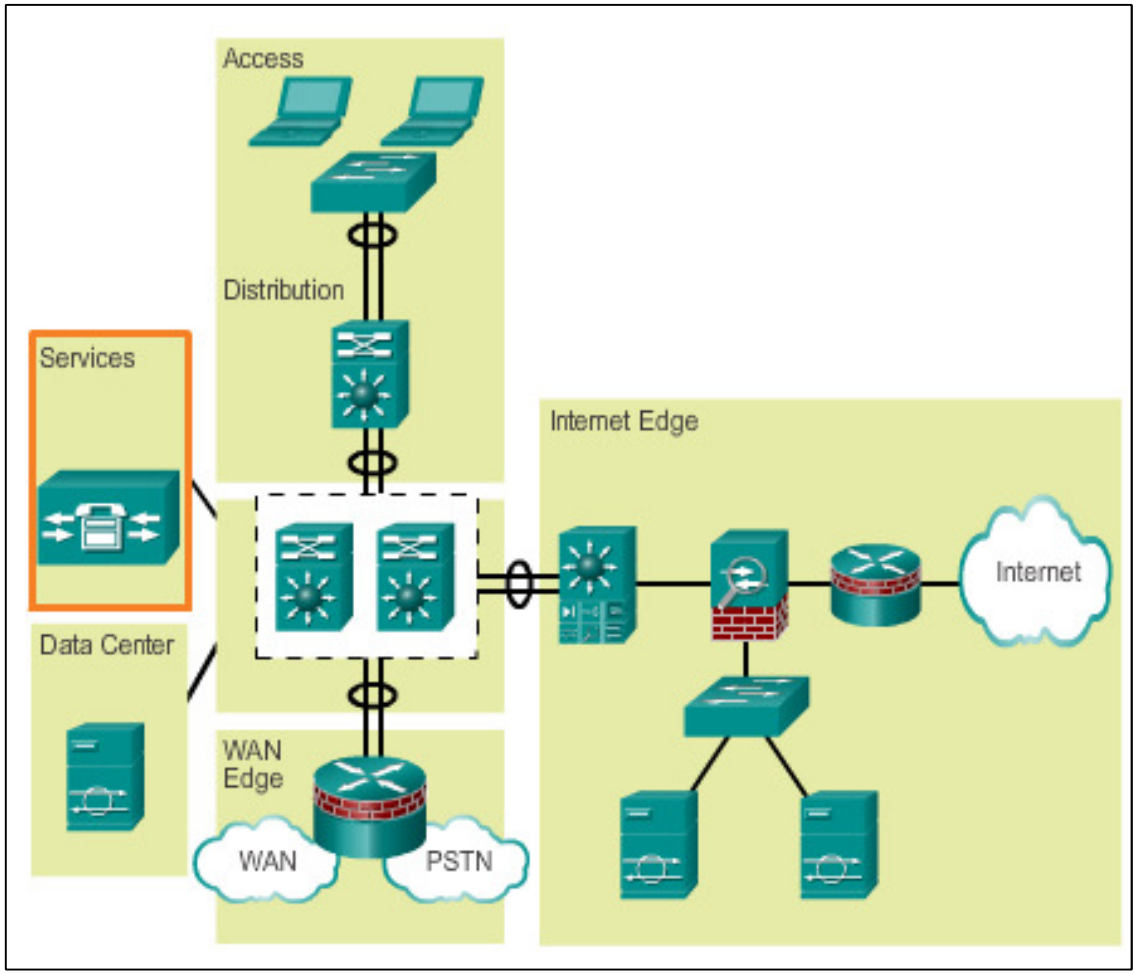
Modules in the Enterprise Architecture

- Access-distribution module – Also called the *distribution block*.
- Services module – A generic block used to identify services, such as centralized Lightweight Access Point Protocol (LWAPP).
- Data center module – Originally called the *server farm*.
- Enterprise Edge module – Consists of the Internet Edge and the WAN Edge.



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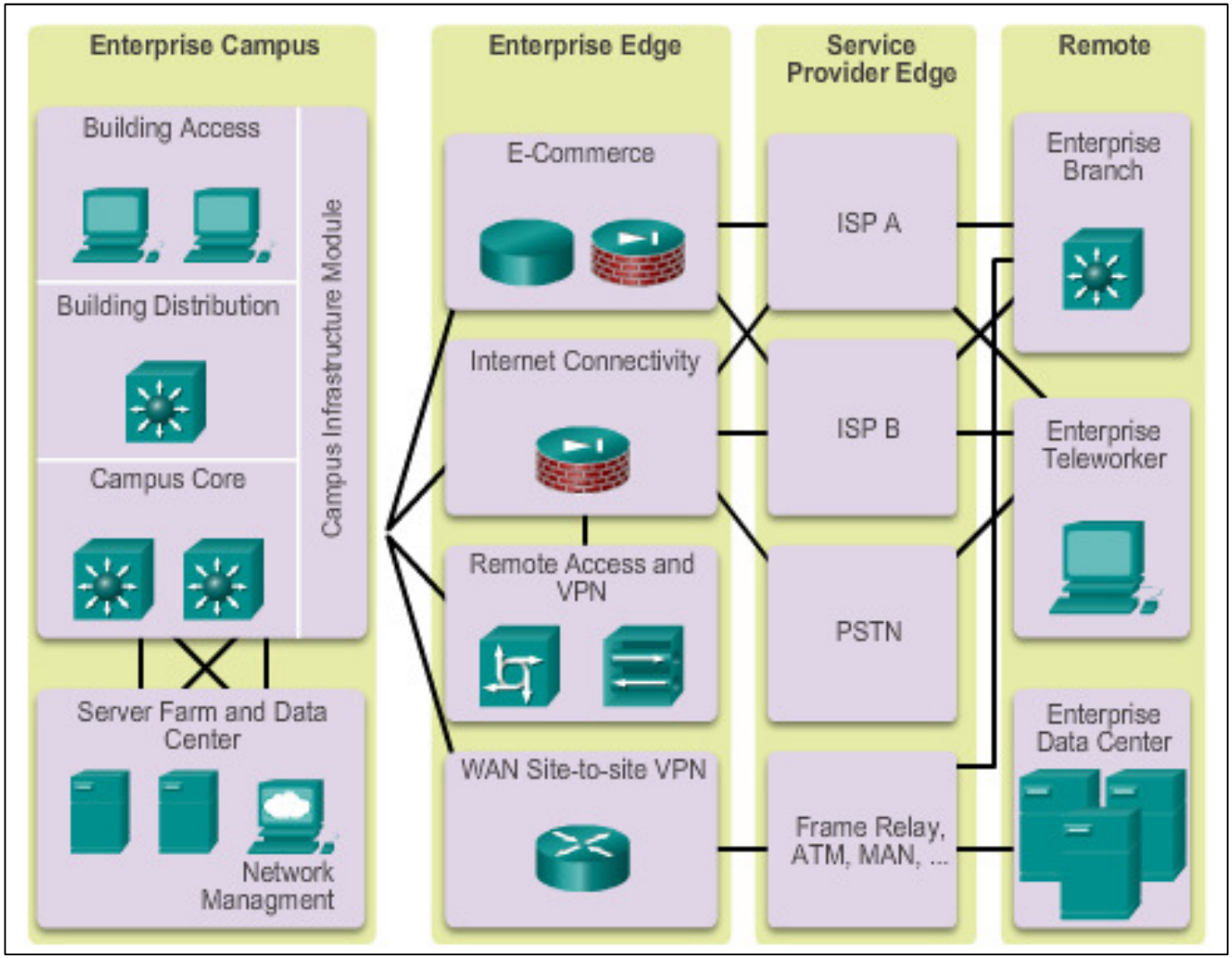
Cisco Enterprise Architecture Model



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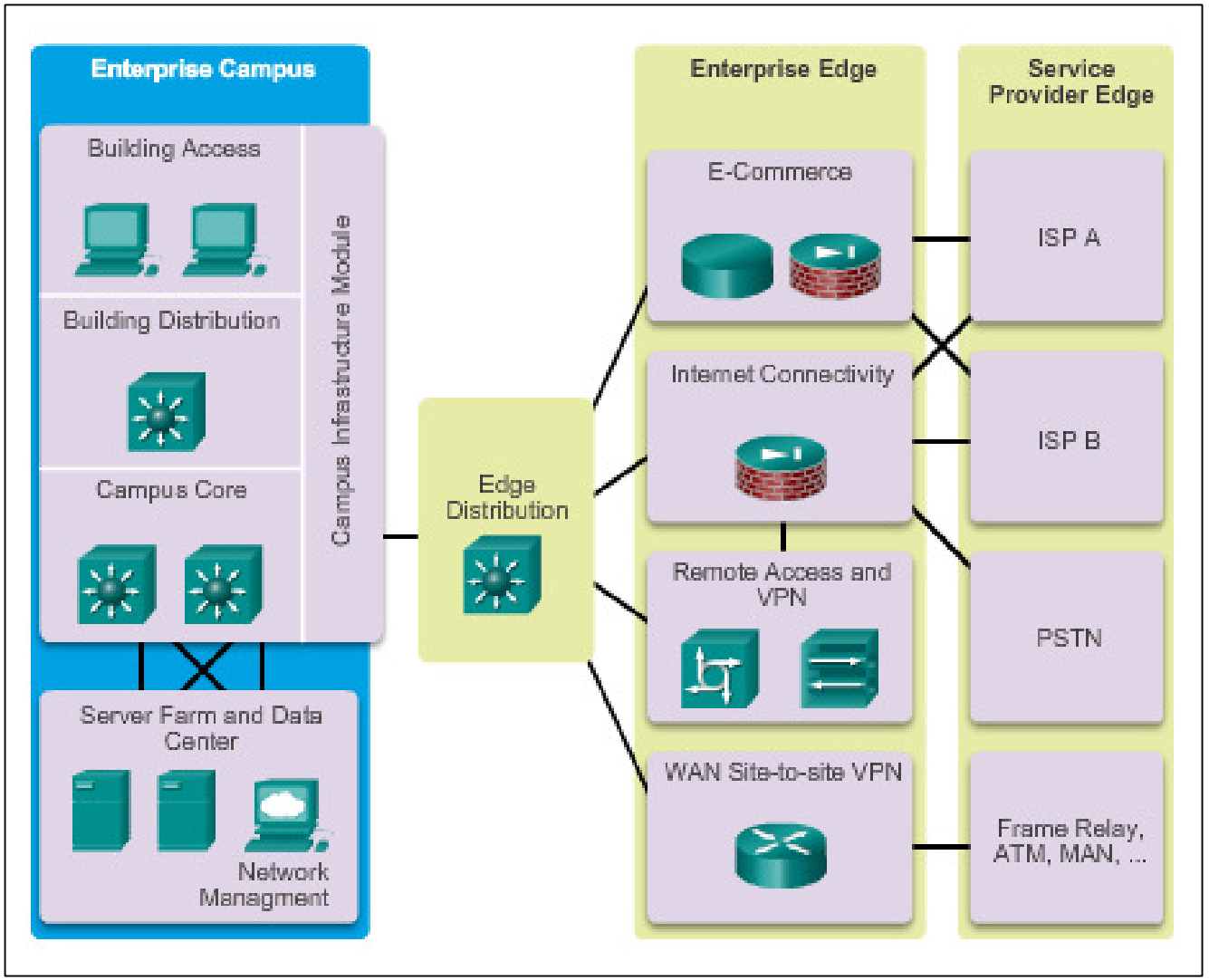
Cisco Enterprise Architecture Model

Cisco Enterprise Campus



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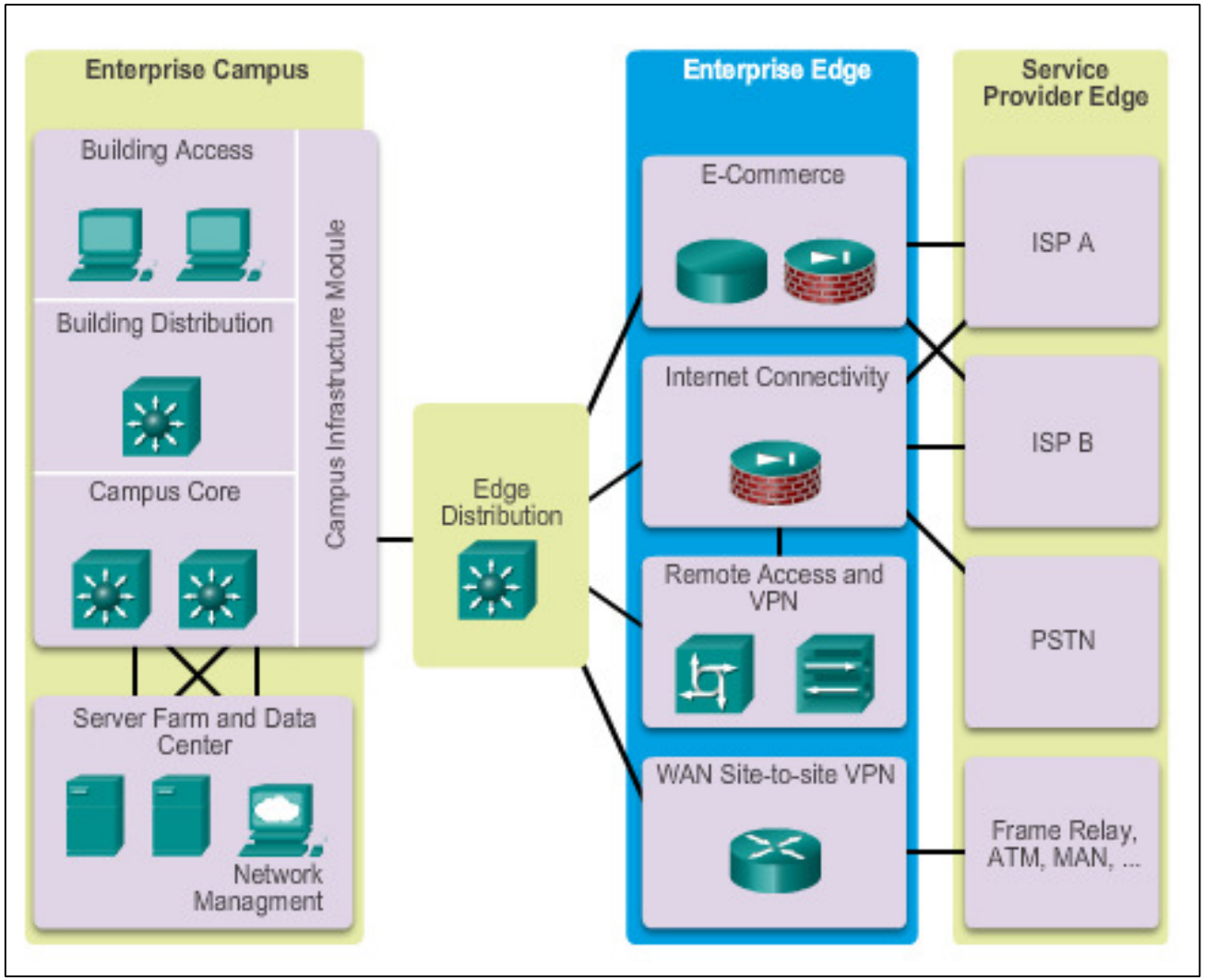
Cisco Enterprise Architecture Model

Cisco Enterprise Edge



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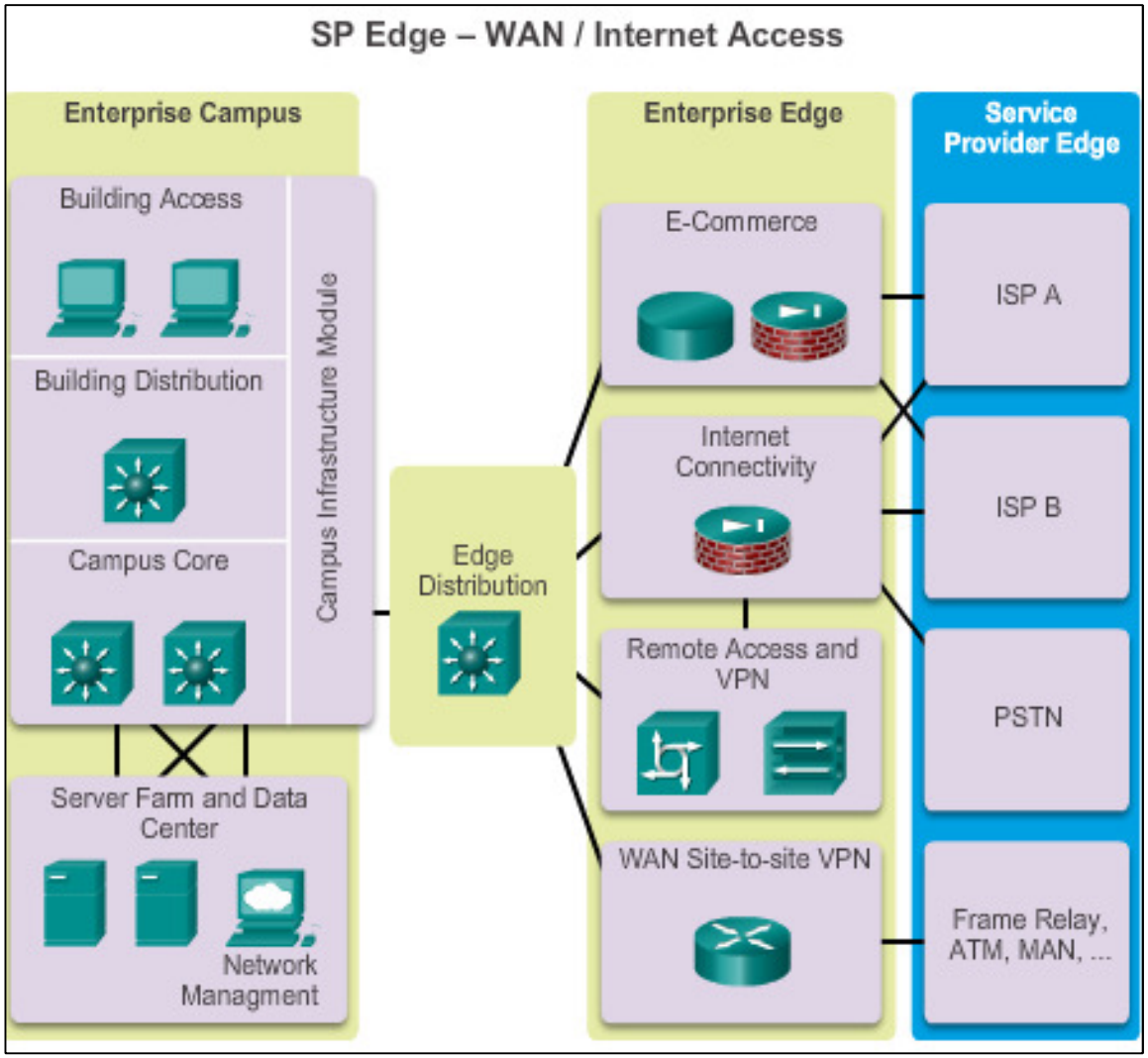
Cisco Enterprise Architecture Model

Service Provider Edge



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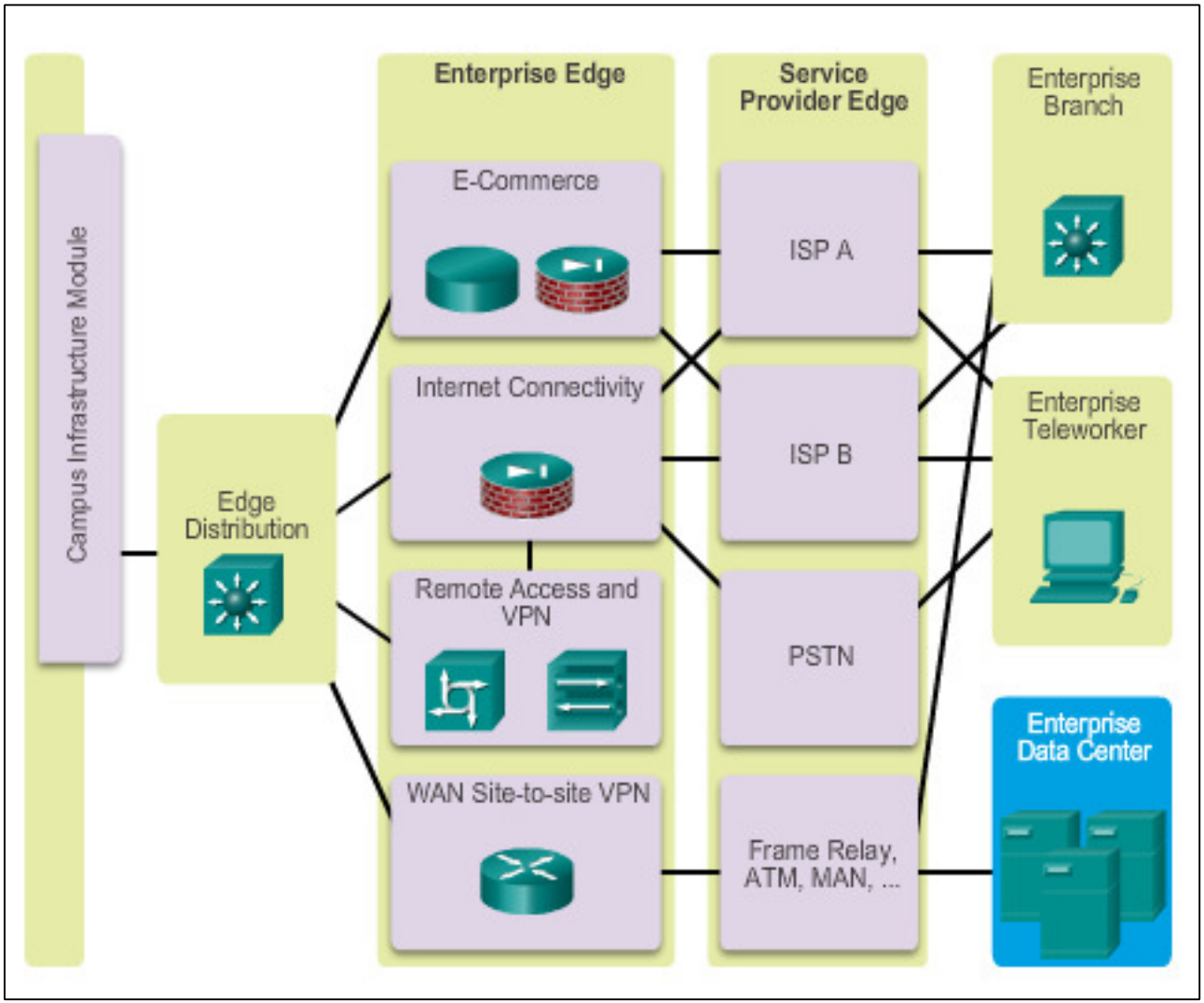
Cisco Enterprise Data Center



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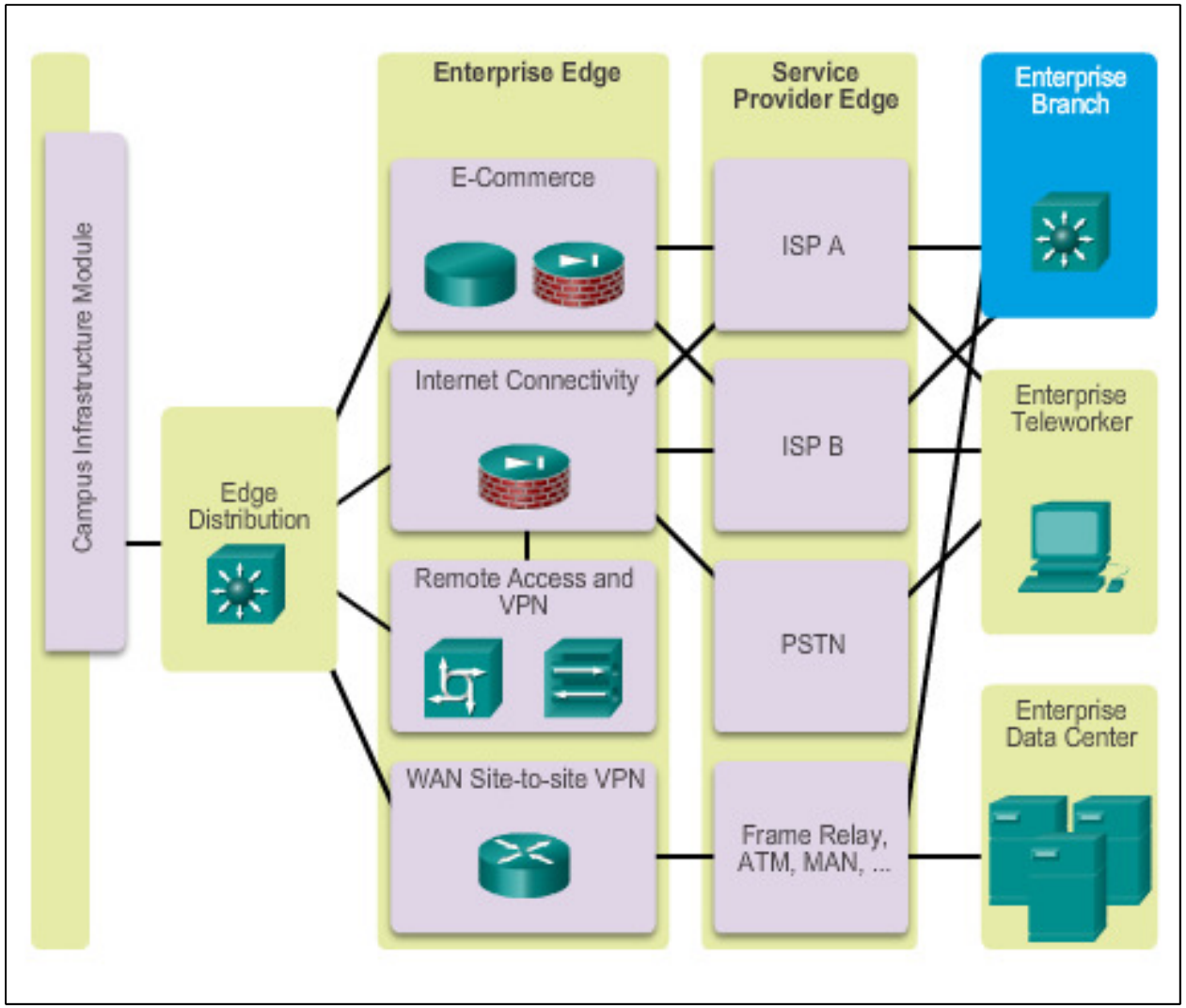
Cisco Enterprise Branch



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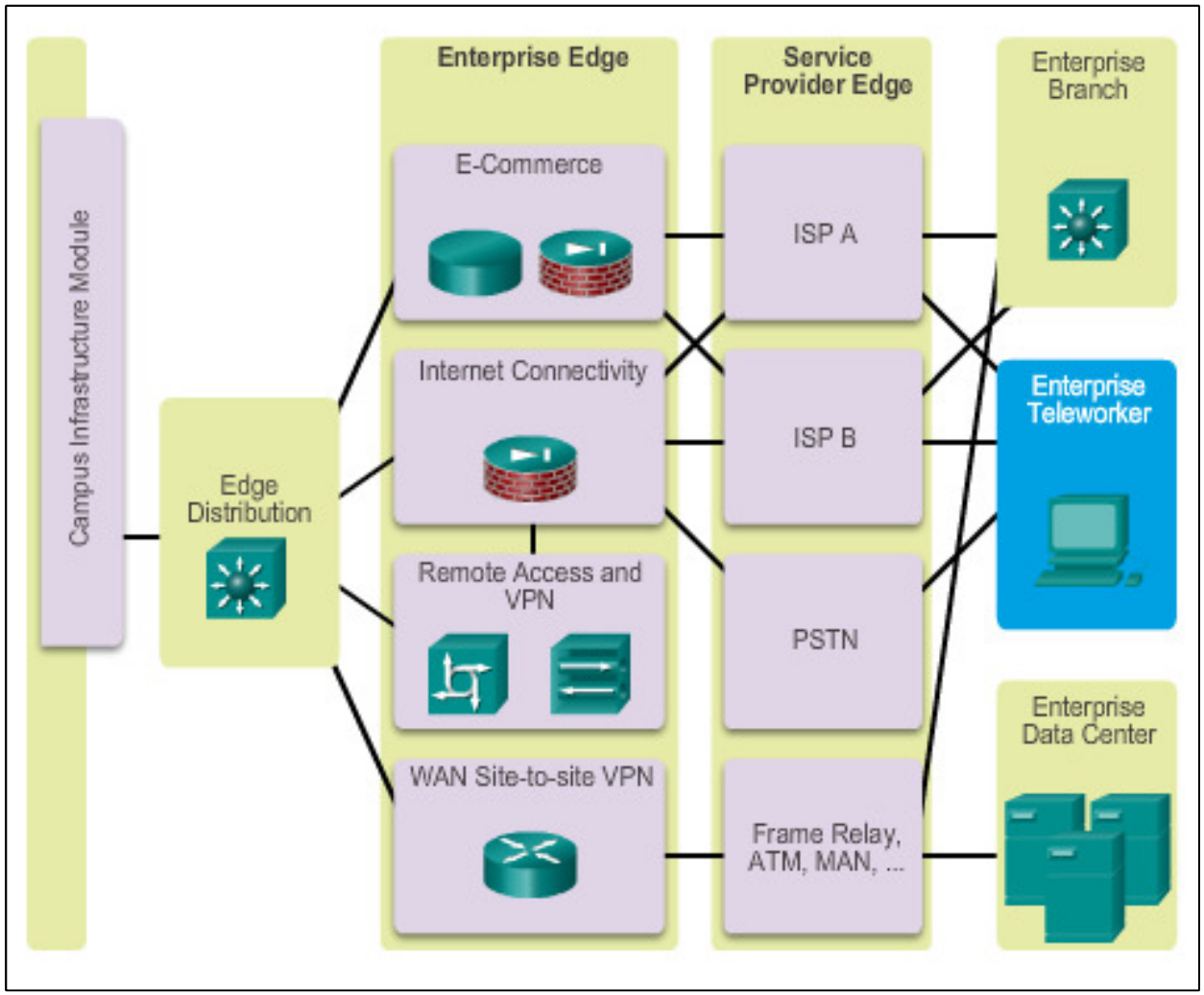
Cisco Enterprise Teleworker



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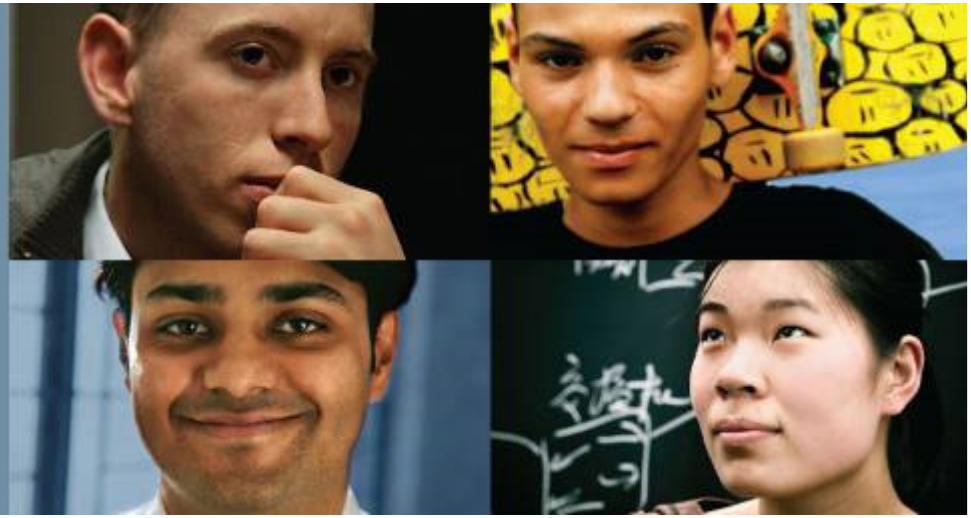
1.3 Evolving Network Architectures



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IT Challenges

Some of the top trends include:

- Bring Your Own Device (BYOD)
- Online collaboration
- Video communication
- Cloud computing

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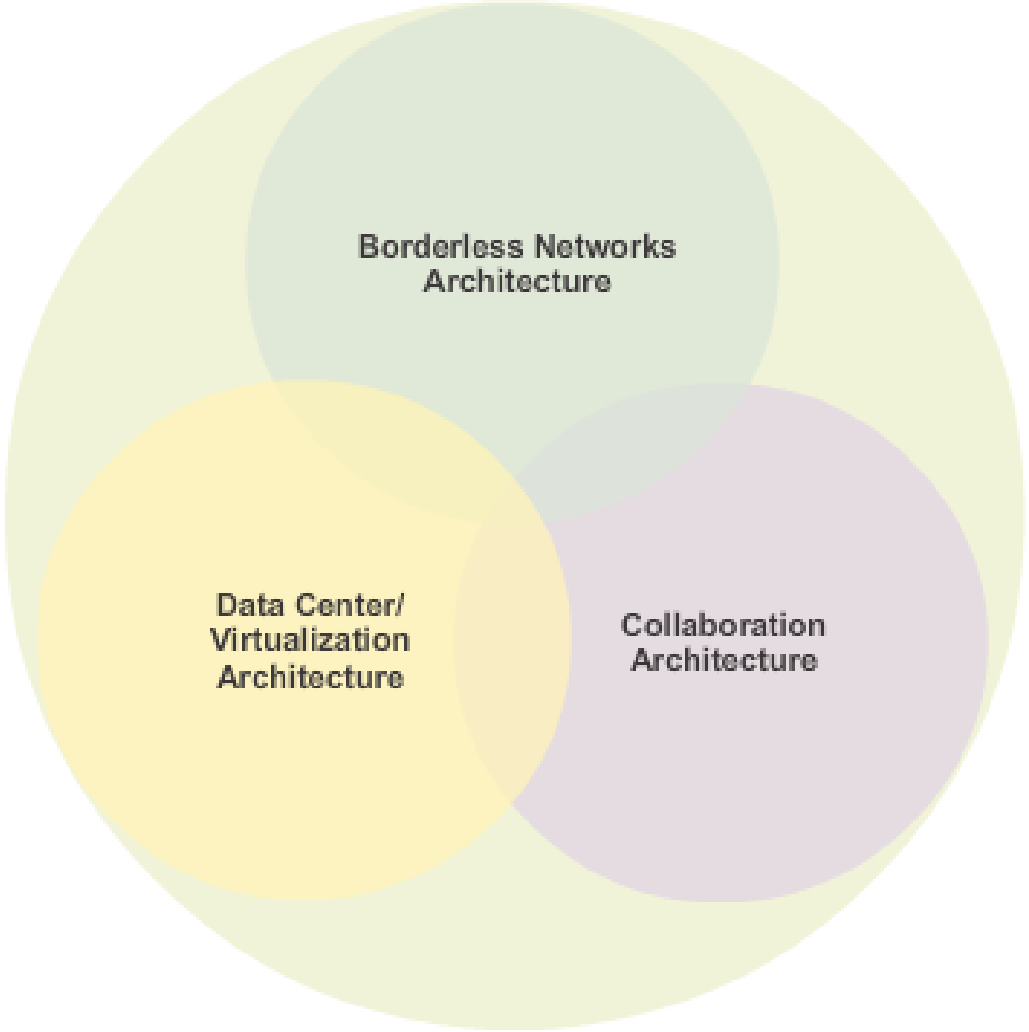
Emerging Enterprise Architectures



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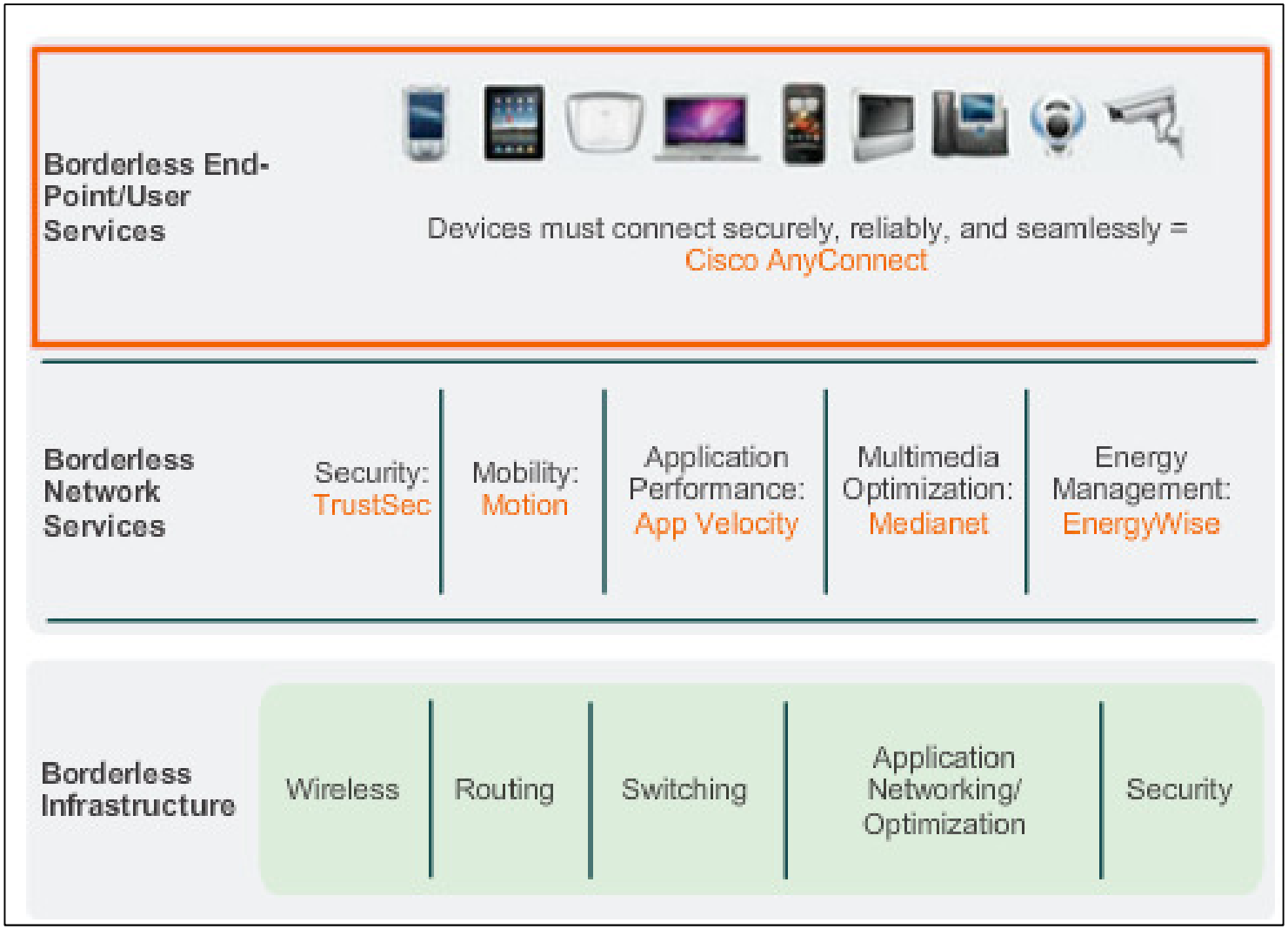
Cisco Borderless Networks



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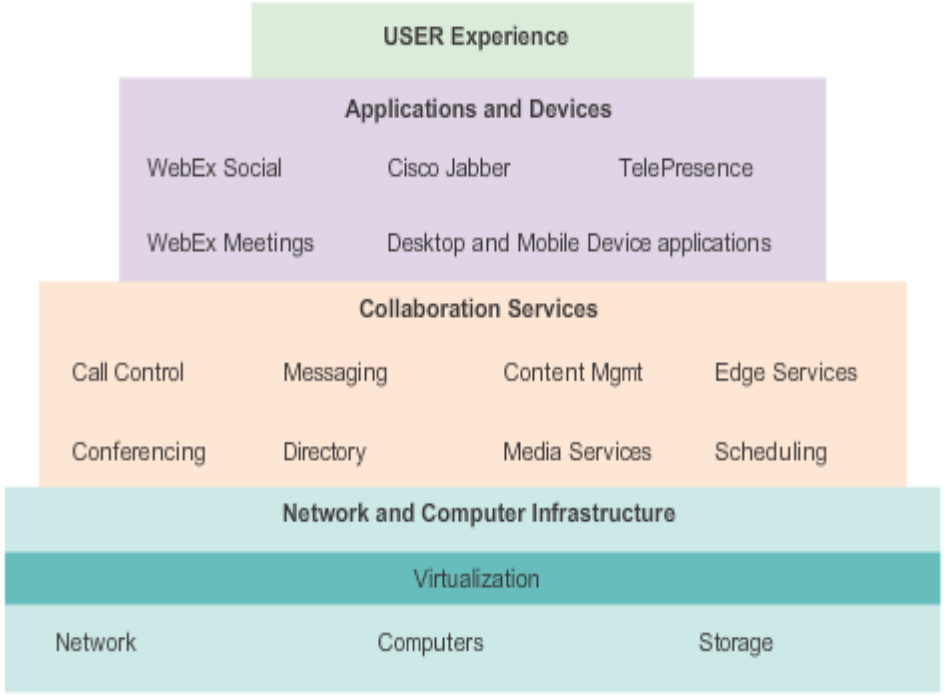
Collaboration Architecture

Cisco's collaboration architecture is composed of three layers:

- **Application and Devices** – Unified communications and conference applications, such as Cisco WebEx Meetings, WebEx Social, Cisco Jabber, and TelePresence.
- **Collaboration Services** – Supports collaboration applications.
- **Network and Computer Infrastructure** – Allows collaboration anytime, from anywhere, on any device.



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Data Center and Virtualization

The data center architecture consists of three components:

- **Cisco Unified Management Solutions** – Simplifies and automates the process of deploying IT infrastructure and services with speed and enterprise reliability.
- **Unified Fabric Solutions** – Delivers network services to servers, storage, and applications, providing transparent convergence, and scalability.
- **Unified Computing Solutions** – Cisco's next-generation data center system unites computing, network, storage access, and virtualization into a cohesive system designed to reduce total cost of ownership (TCO).

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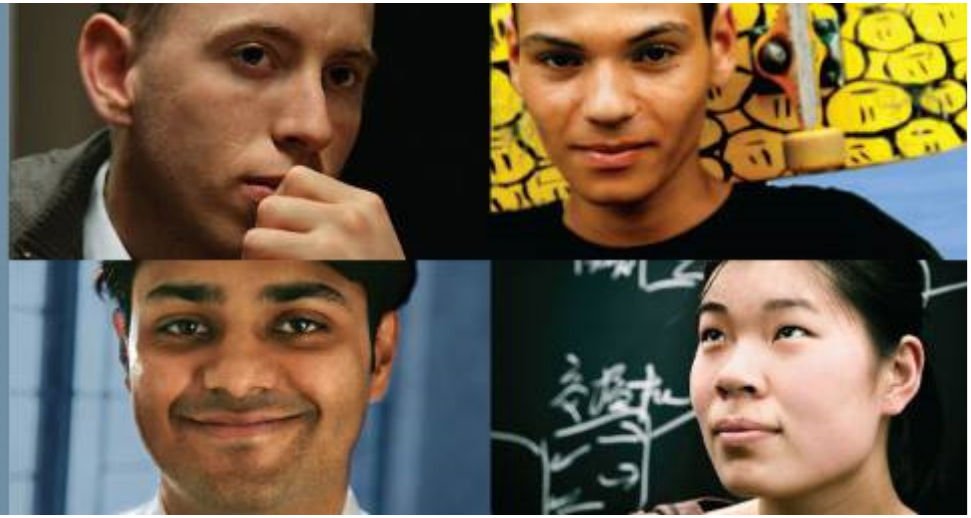
1.4 Summary



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Chapter 1: Summary

This chapter:

- Introduced the structured engineering principles of good network design that include hierarchy, modularity, resiliency, and flexibility.
- Explained that the typical enterprise hierarchical LAN campus network design incorporates the access layer, distribution layer, and the core layer.
- Identified that smaller enterprise networks may use a “collapsed core” hierarchy, whereas the distribution and core layer functions are implemented in a single device.
- Described the benefits of a hierarchical network as scalability, redundancy, performance, and ease of maintenance.

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Chapter 1: Summary (cont.)

- Explained that a modular design, which separates the functions of a network, enables flexibility and facilitates implementation and management.
- Discussed that the Cisco Enterprise Architecture modules are used to facilitate the design of large, scalable networks.
- Identified the primary modules, including the Enterprise Campus, Enterprise Edge, Service Provider Edge, Enterprise Data Center, Enterprise Branch, and Enterprise Teleworker.

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