



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



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.



1.1 Hierarchical Network Design Overview



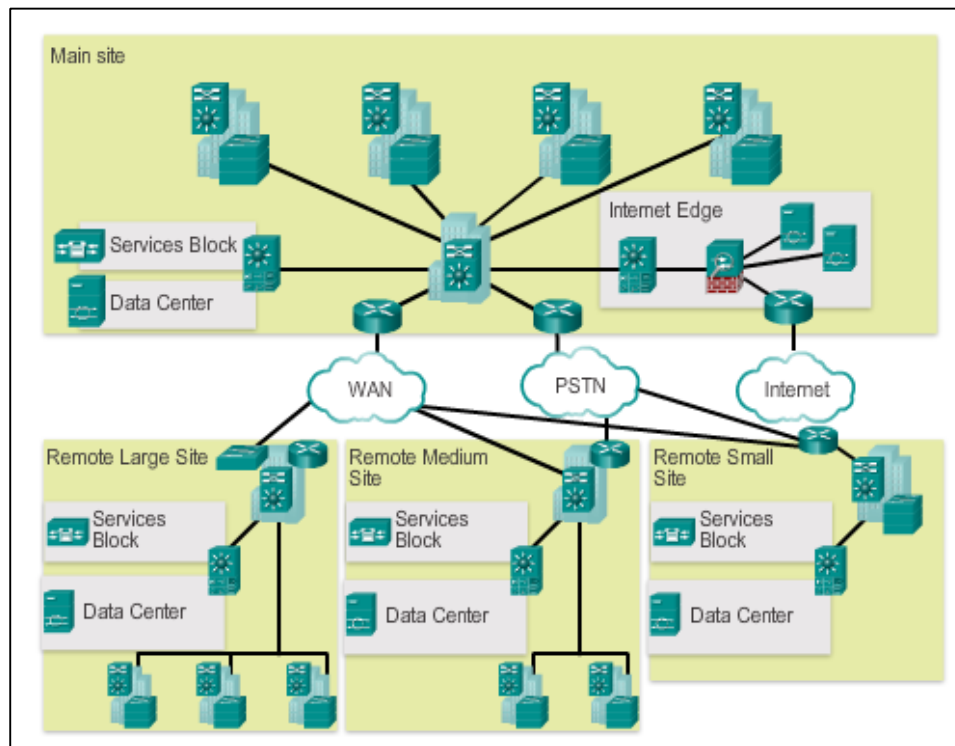
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Enterprise Network Campus Design

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.





Enterprise Network Campus Design

Structured Engineering Principles



Hierarchy



Modularity



Resiliency

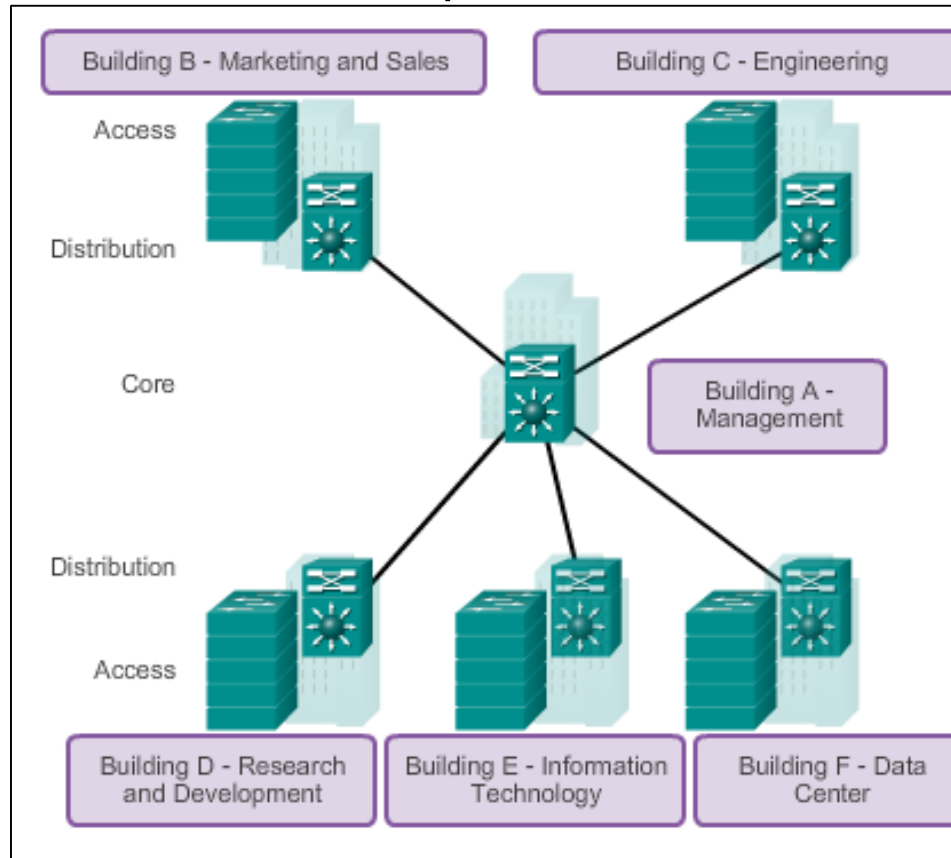


Flexibility

Hierarchical Network Design

Network Hierarchy

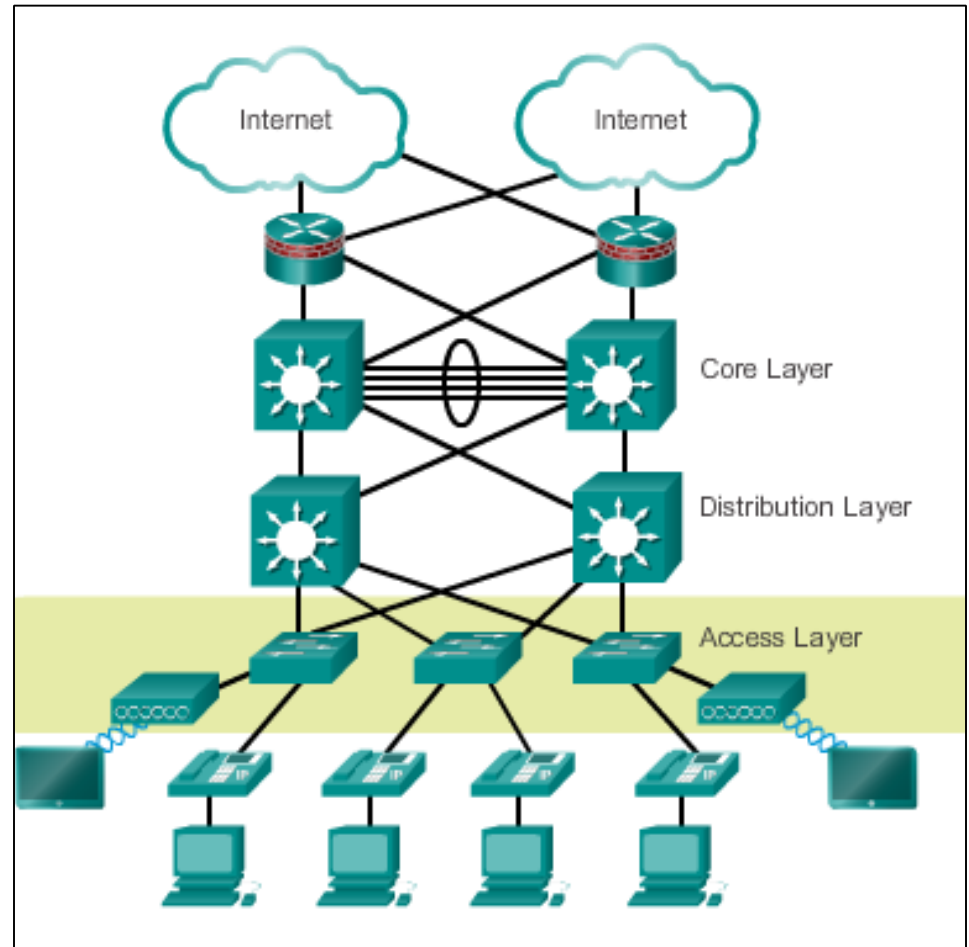
- **Access layer** – Provides workgroup or user access to the network.
- **Distribution layer** – Provides policy-based connectivity.
- **Core layer** – Provides fast transport between distribution switches.



Hierarchical Network Design

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





Hierarchical Network Design

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



Hierarchical Network Design

Core Layer

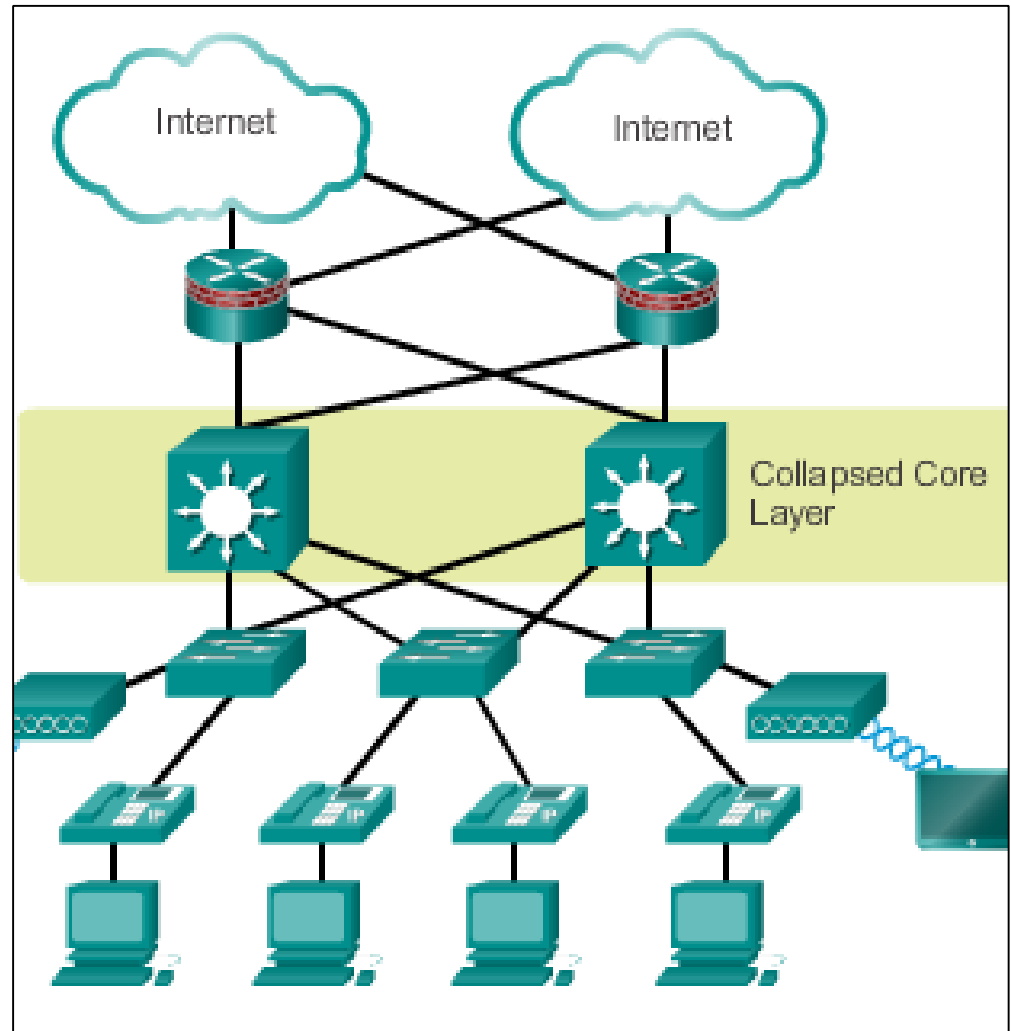
- Provides high-speed switching (i.e., fast transport)
- Provides reliability and fault tolerance
- Scales by using faster, and not more, equipment
- Avoids CPU-intensive packet manipulation caused by security, inspection, quality of service (QoS) classification, or other processes



Hierarchical Network Design

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.





1.2 Cisco Enterprise Architecture



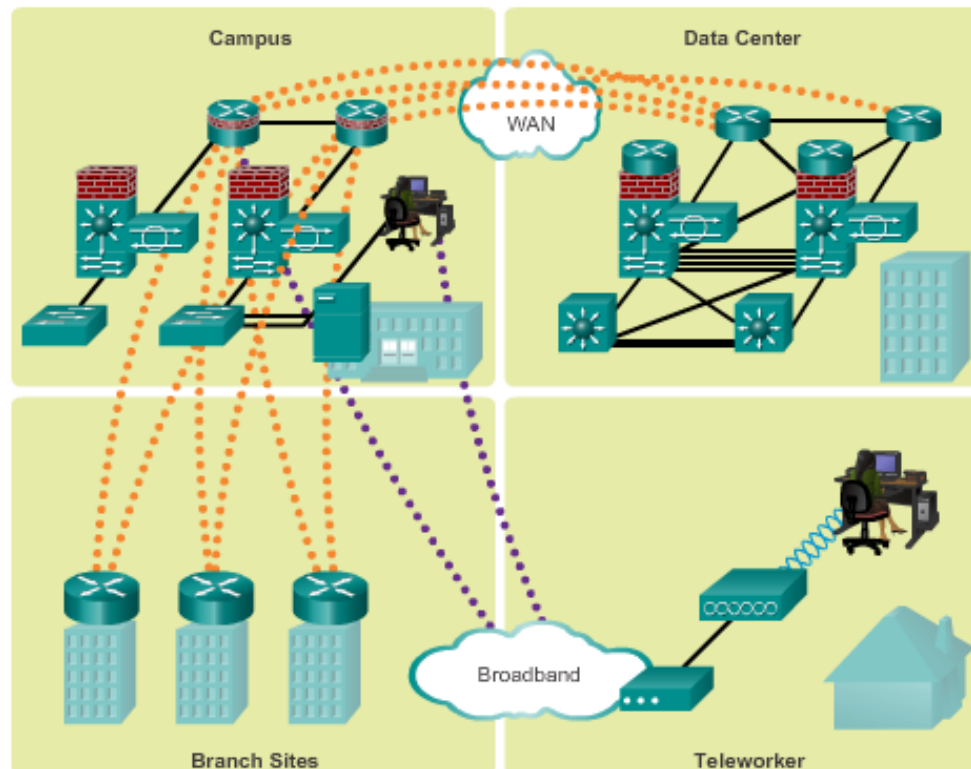
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Modular Network Design

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.

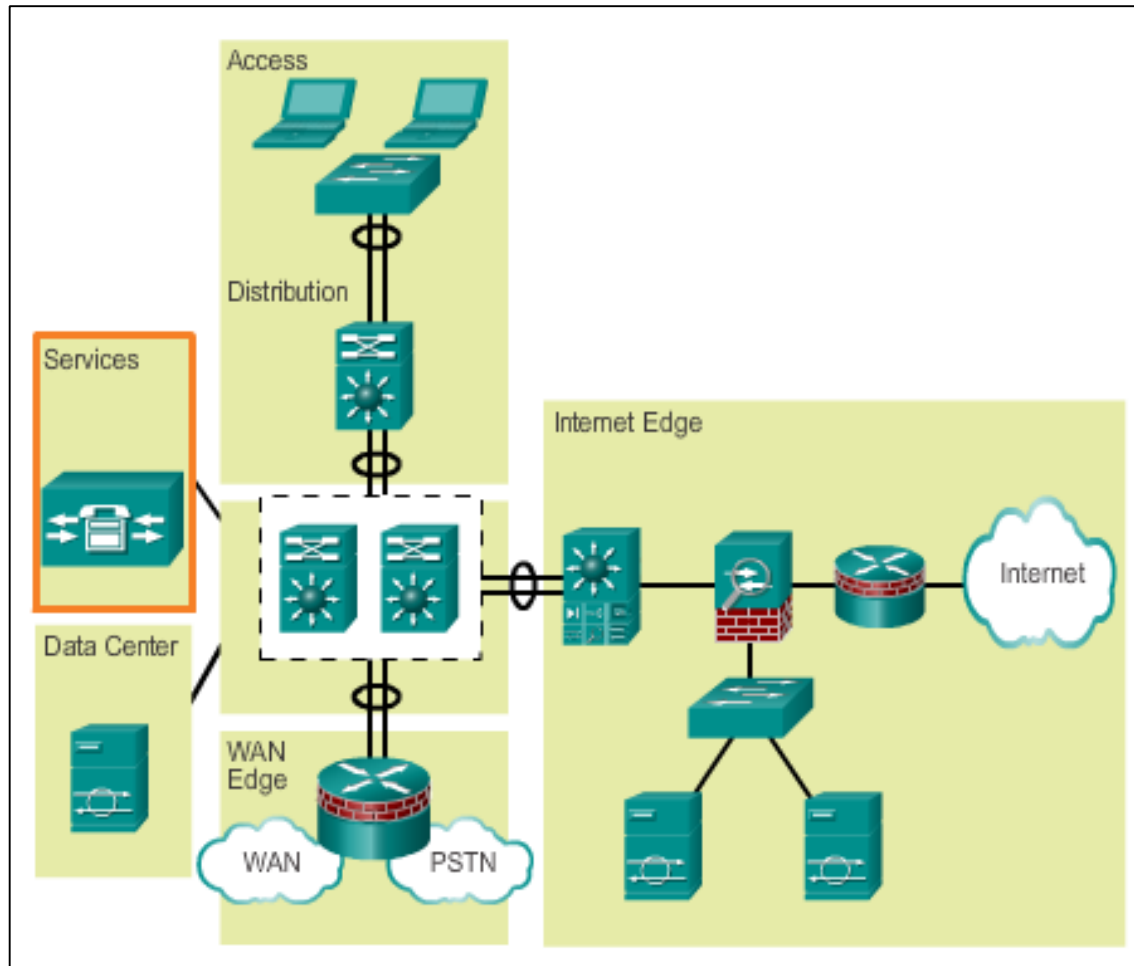




Modular Network Design

Modules in the Enterprise Architecture

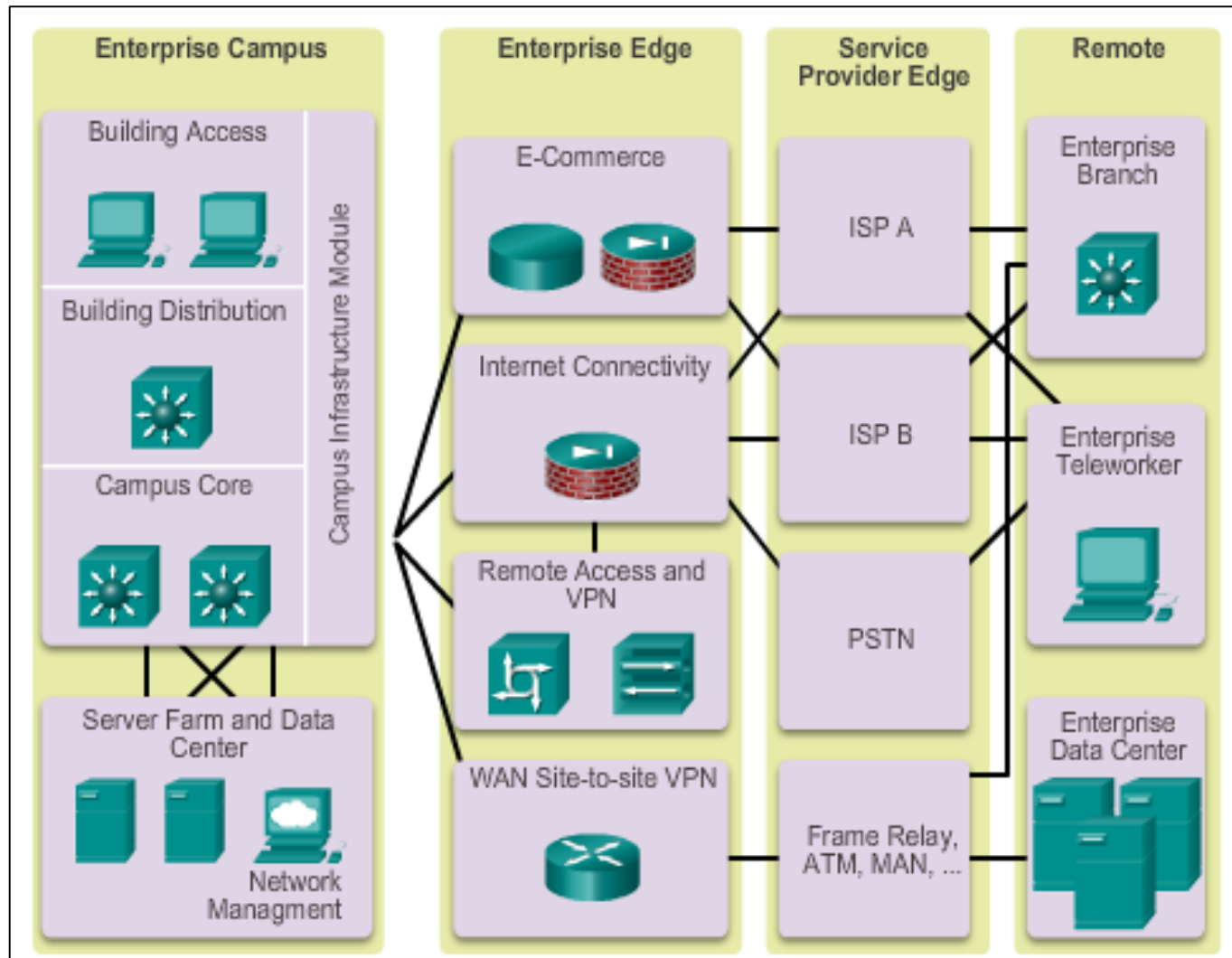
- Access-distribution module – Also called the *distribution block*.
- Services module – A generic block used to identify services, such as centralized Lightweight Access Point Protocol (LWAPP).
- Data center module – Originally called the *server farm*.
- Enterprise Edge module – Consists of the Internet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





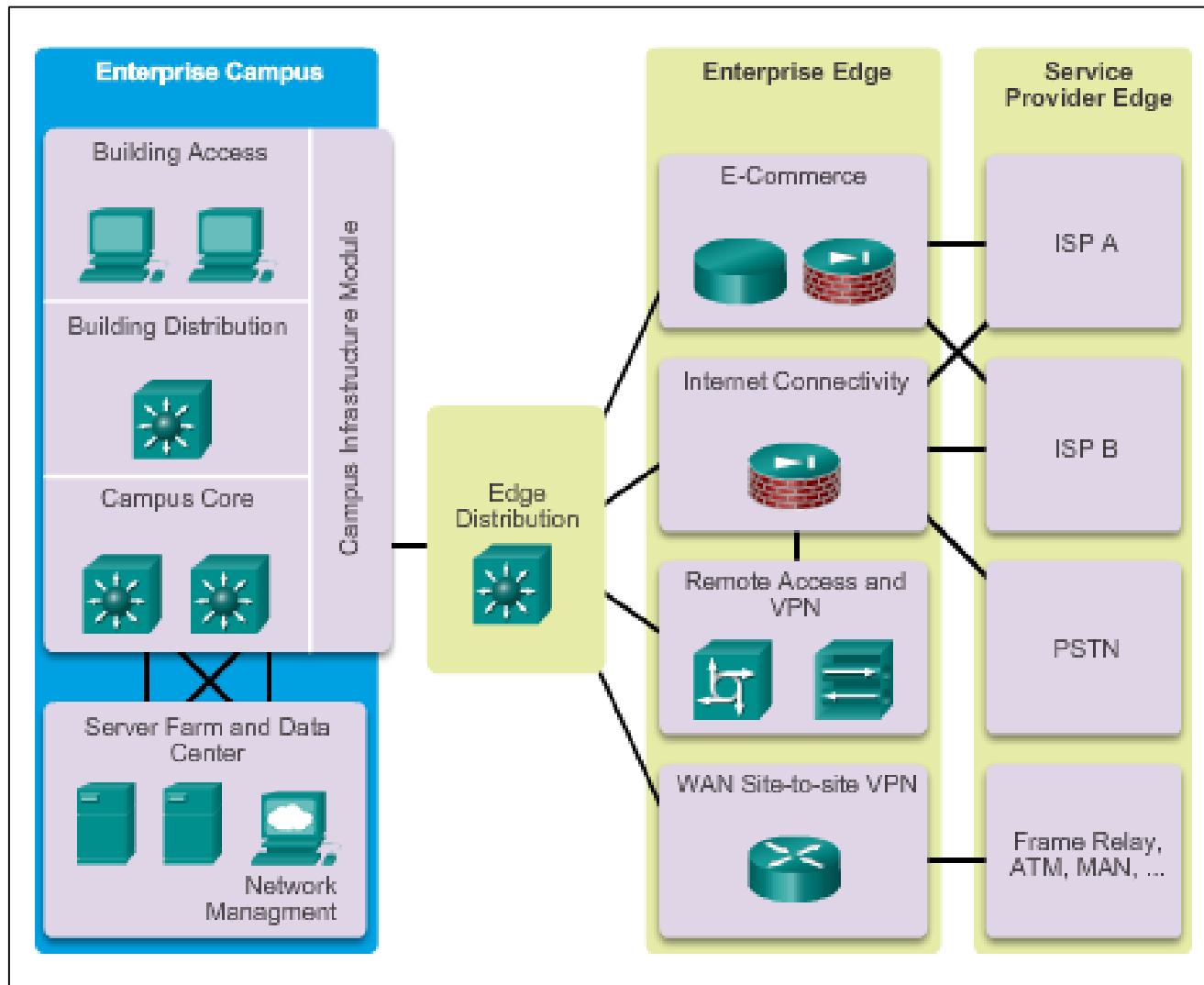
Cisco Enterprise Architecture Model

Cisco Enterprise Architecture Model



Cisco Enterprise Architecture Model

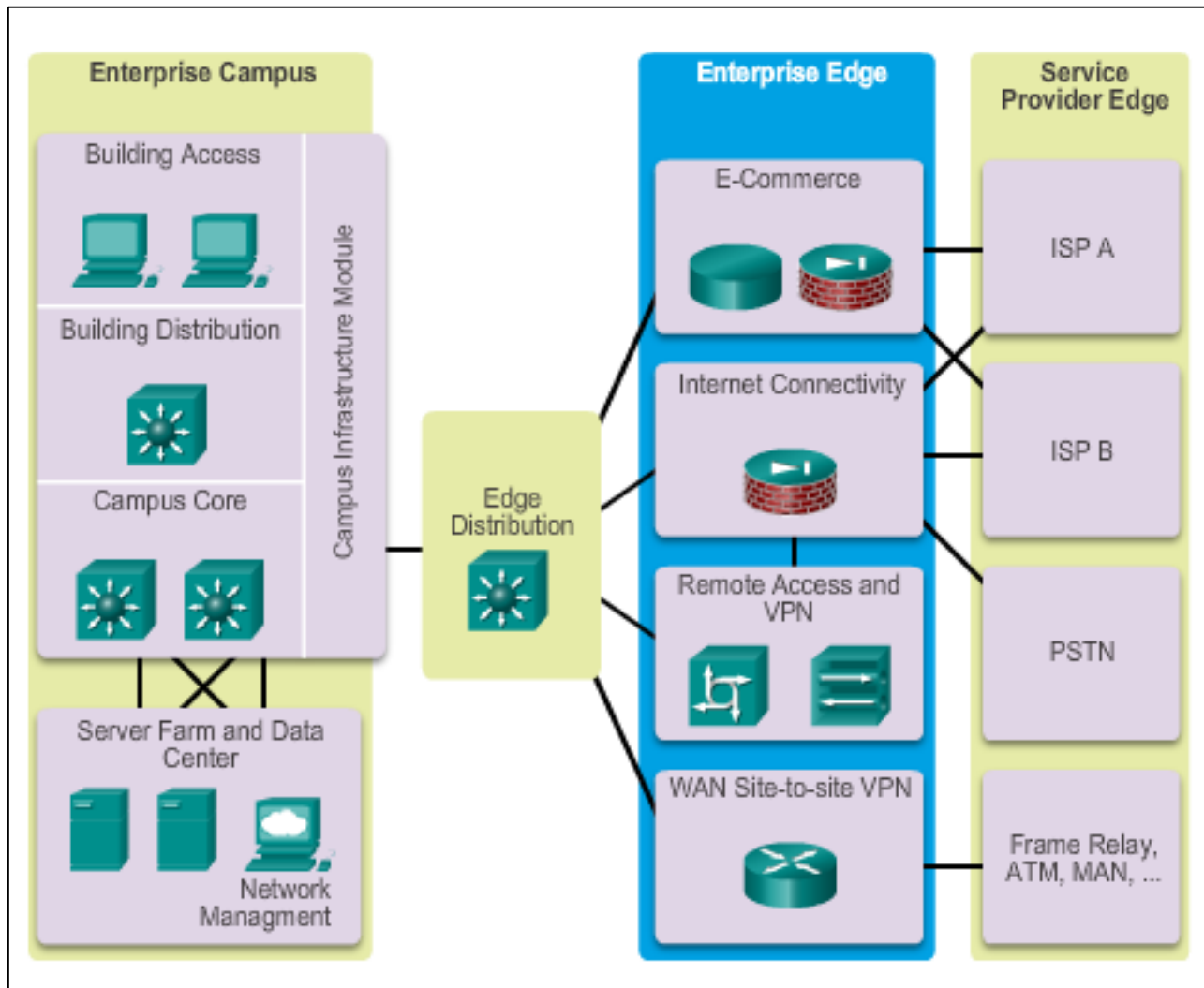
Cisco Enterprise Campus





Cisco Enterprise Architecture Model

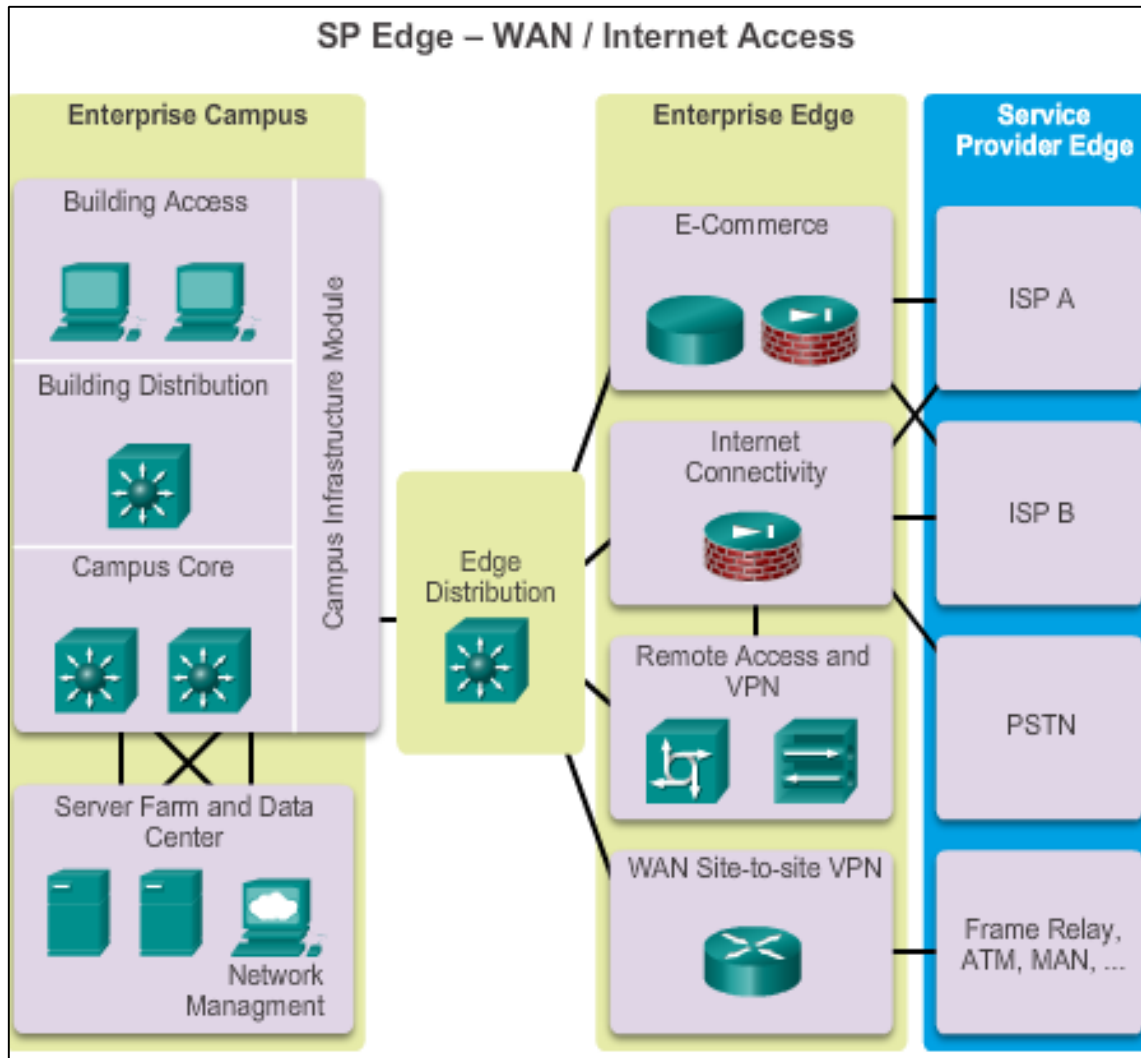
Cisco Enterprise Edge





Cisco Enterprise Architecture Model

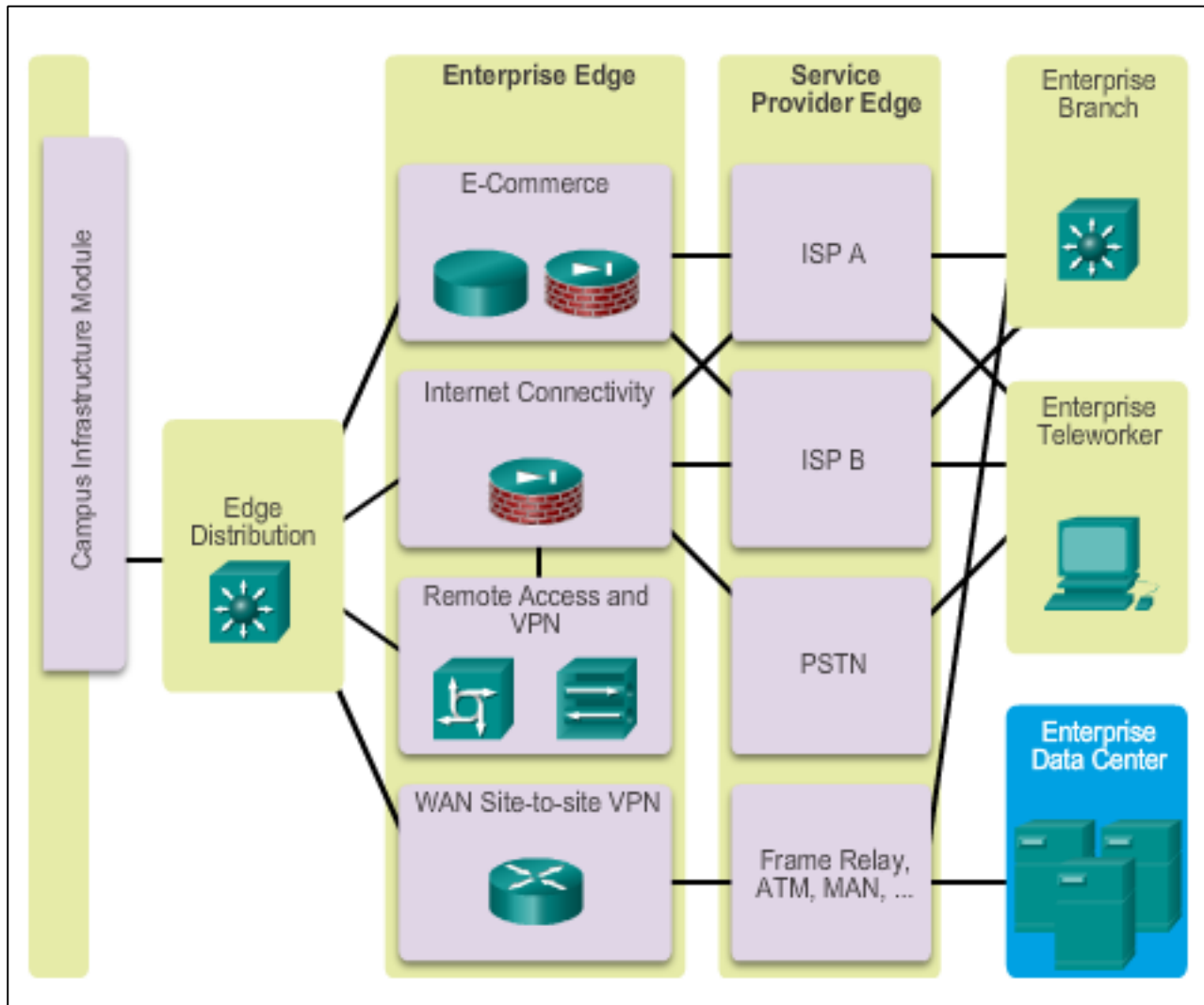
Service Provider Edge





Cisco Enterprise Architecture Model

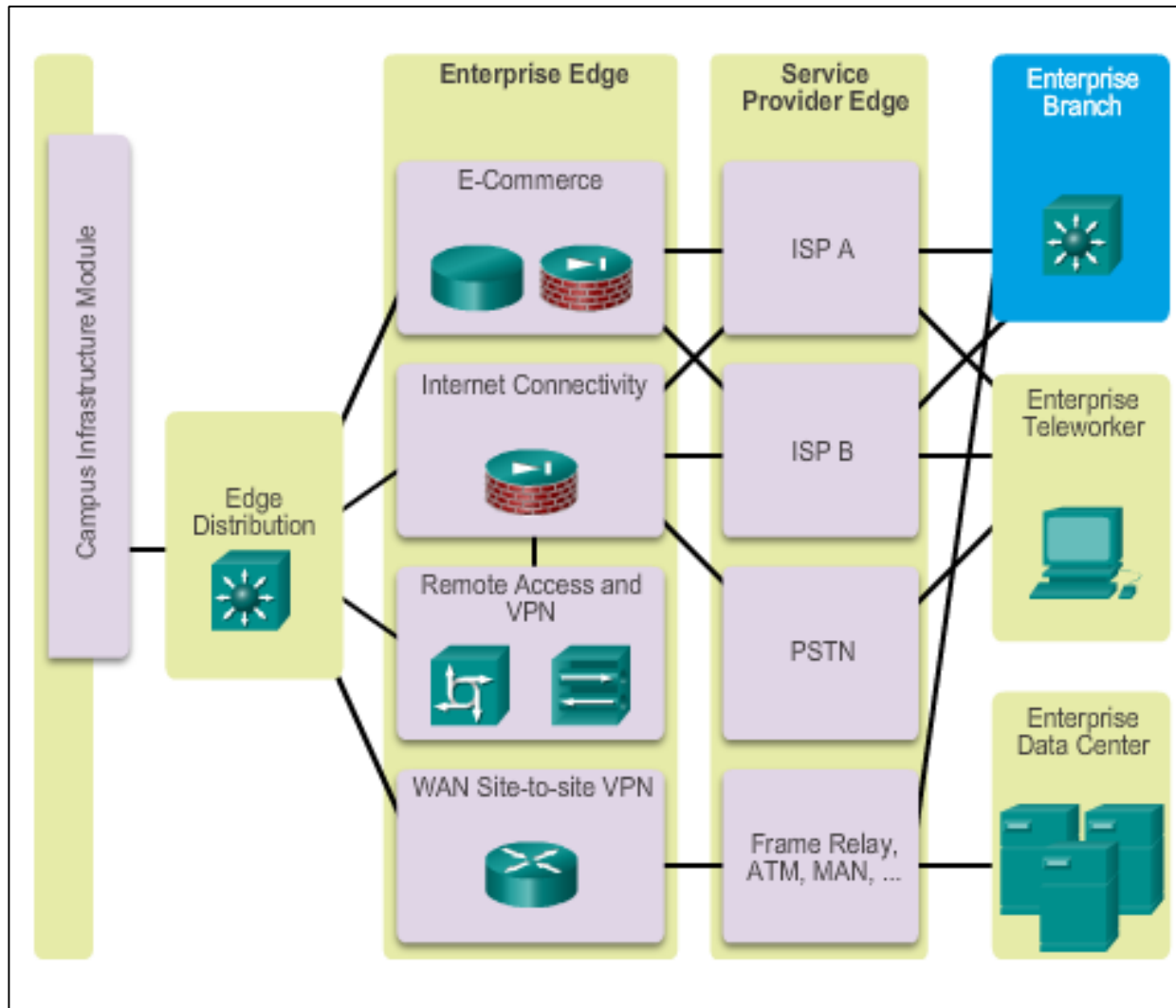
Cisco Enterprise Data Center





Cisco Enterprise Architecture Model

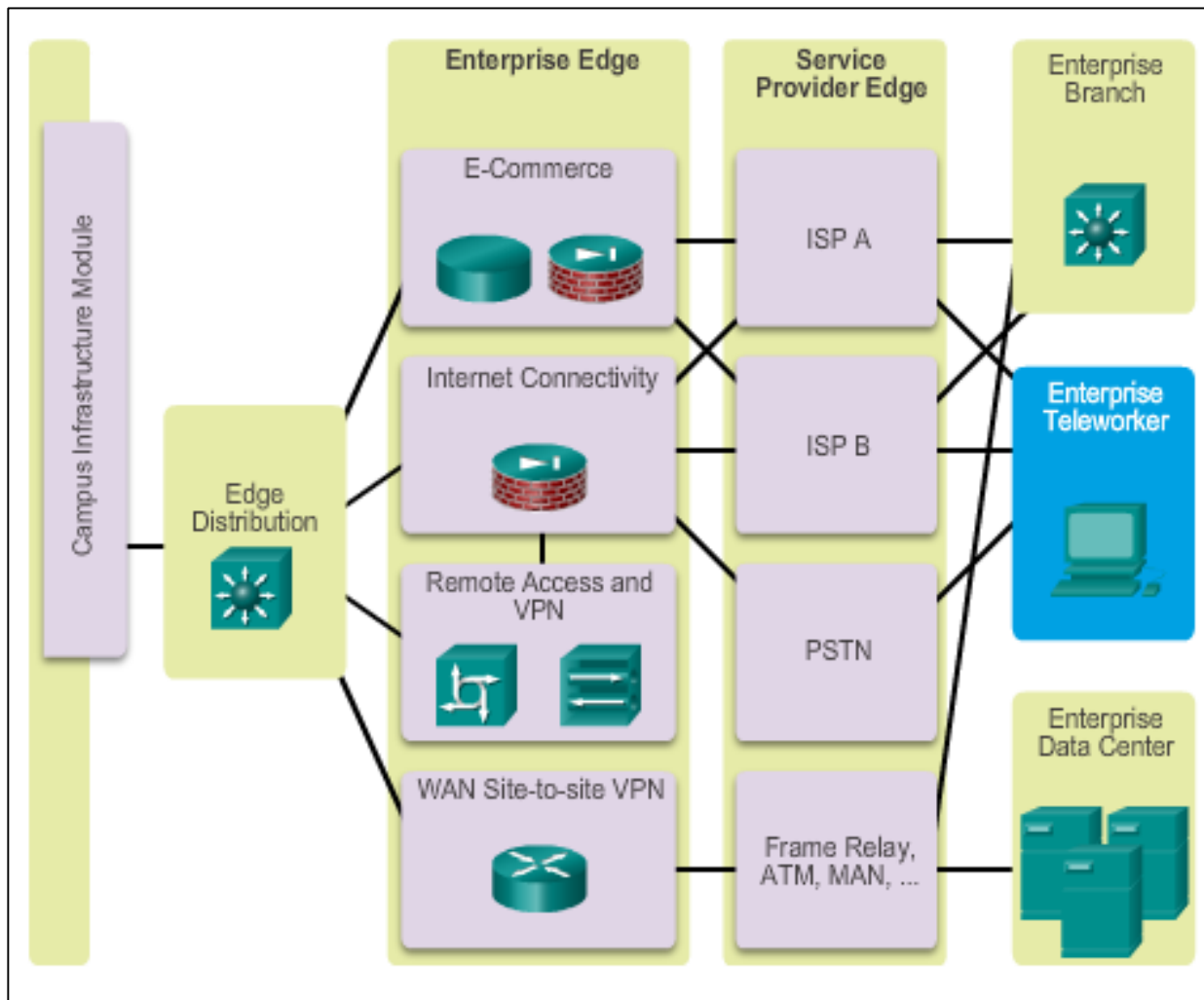
Cisco Enterprise Branch





Cisco Enterprise Architecture Model

Cisco Enterprise Teleworker





1.3 Evolving Network Architectures



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Cisco Enterprise Architectures

IT Challenges

Some of the top trends include:

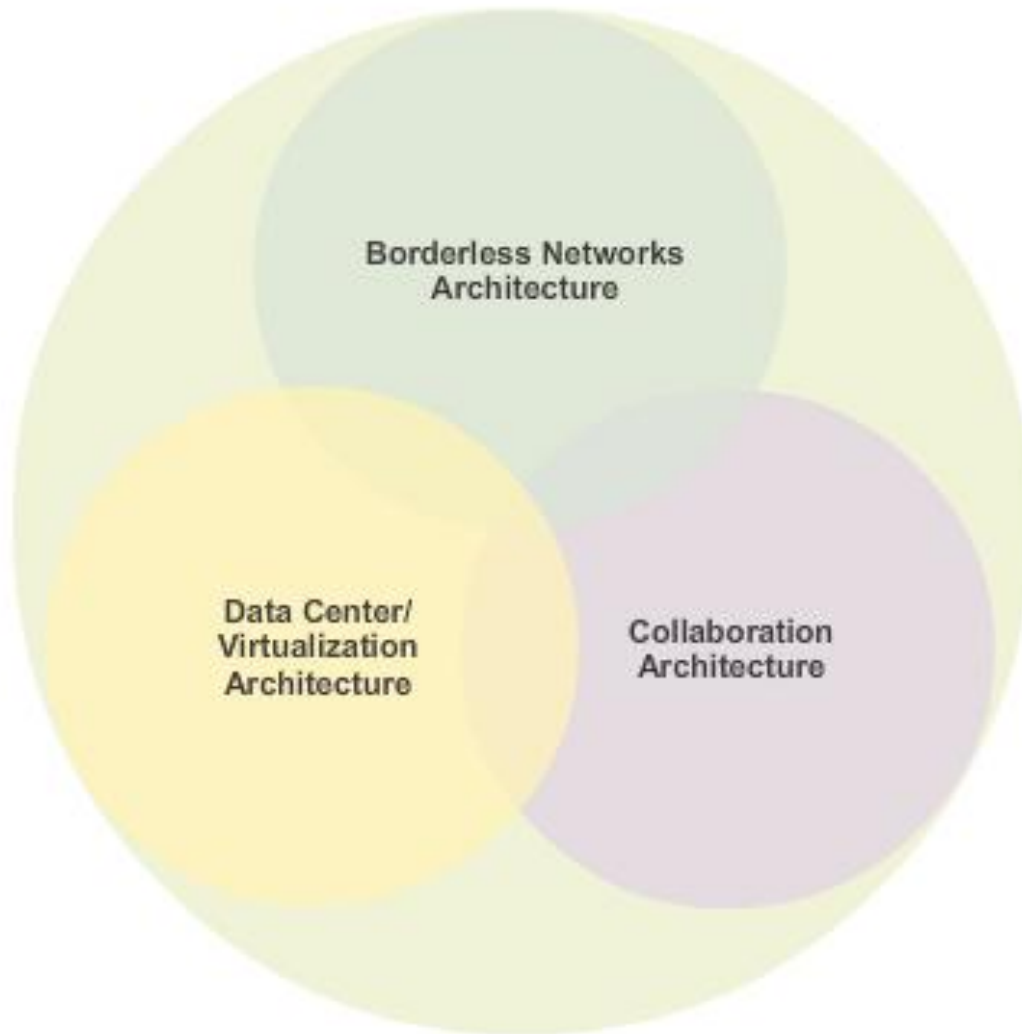
- Bring Your Own Device (BYOD)
- Online collaboration
- Video communication
- Cloud computing





Cisco Enterprise Architectures

Emerging Enterprise Architectures





Emerging Network Architectures

Cisco Borderless Networks

Borderless End-Point/User Services



Devices must connect securely, reliably, and seamlessly =
Cisco AnyConnect

Borderless Network Services

Security:
TrustSec

Mobility:
Motion

Application Performance:
App Velocity

Multimedia Optimization:
Medianet

Energy Management:
EnergyWise

Borderless Infrastructure

Wireless

Routing

Switching

Application Networking/
Optimization

Security

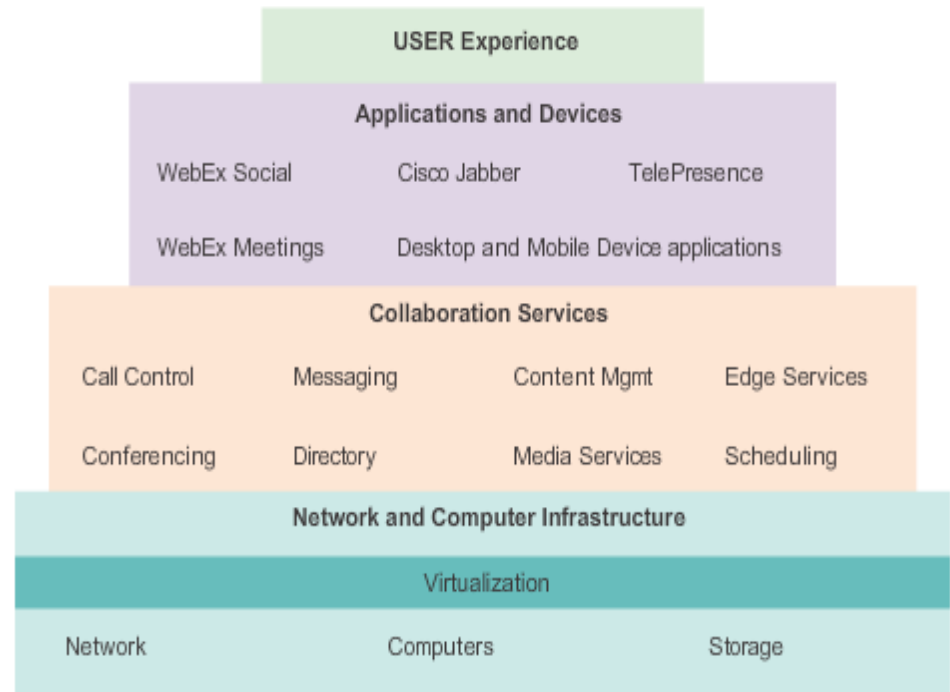


Emerging Network Architectures

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.





Emerging Network Architectures

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).



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.



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.

