Chapter 1: Exploring the Network

Introduction to Networks

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Chapter 1: Objectives

After completing this chapter, students will be able to:

- Explain how multiple networks are used in everyday life.
- Explain the topologies and devices used in a small- to medium-sized business network.
- Explain the basic characteristics of a network that supports communication in a small- to medium-sized business.
- Explain trends in networking that will affect the use of networks in small to medium-sized businesses.

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Chapter 1

1.1 Globally Connected

1.2 LANs, WANs, and the Internet

1.3 The Network as a Platform

1.4 The Changing Network Environment

1.5 Summary

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1.1 Globally Connected

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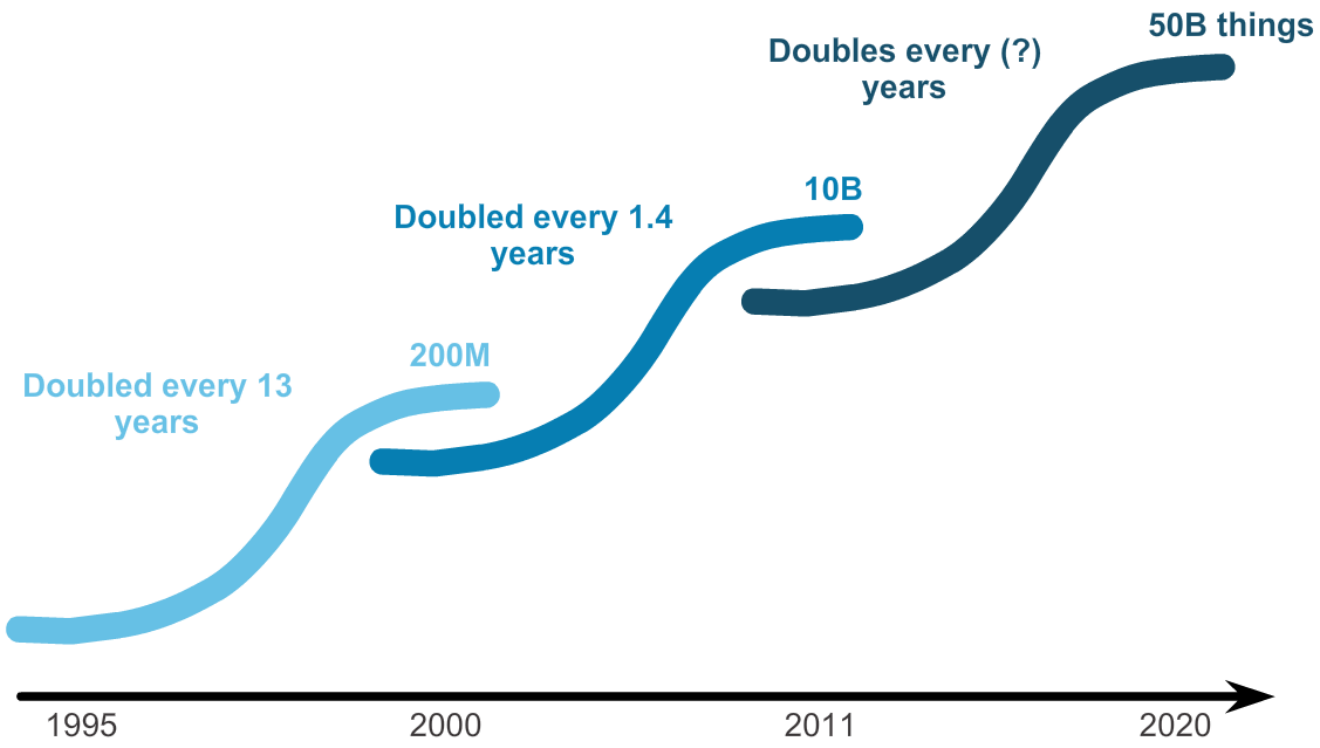
Networks in Our Past and Daily Lives

"Fixed" Computing (You go to the device)

Mobility/BYOD (The device goes with you)

Internet of Things (Age of Devices)

Internet of Everything (People, Process, Data, Things)



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Networking Today

The Global Community

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Networking Impacts in Our Daily Lives

- Networks support the way we learn.
- Networks support the way we communicate.
- Networks support the way we work.
- Networks support the way we play.

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Networks of Many Sizes

Small Home Networks

Small Office/Home Office Networks

Medium to Large Networks

World Wide Networks

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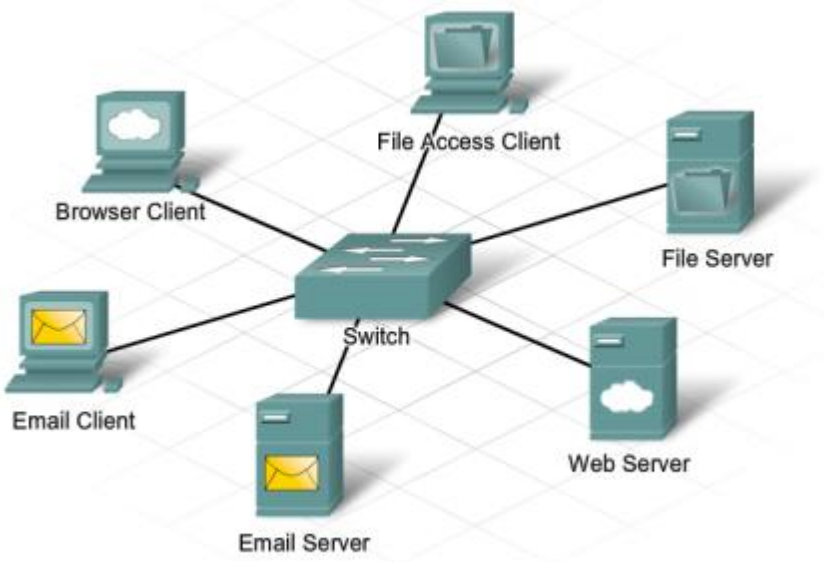
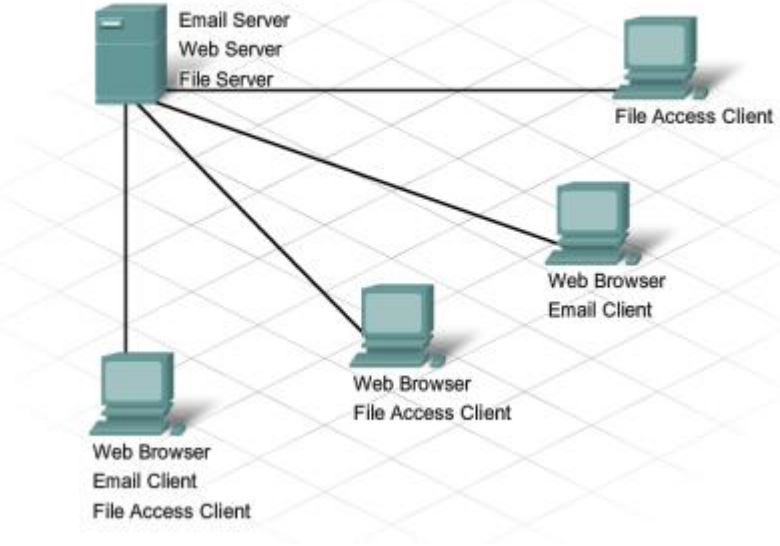
Clients and Servers





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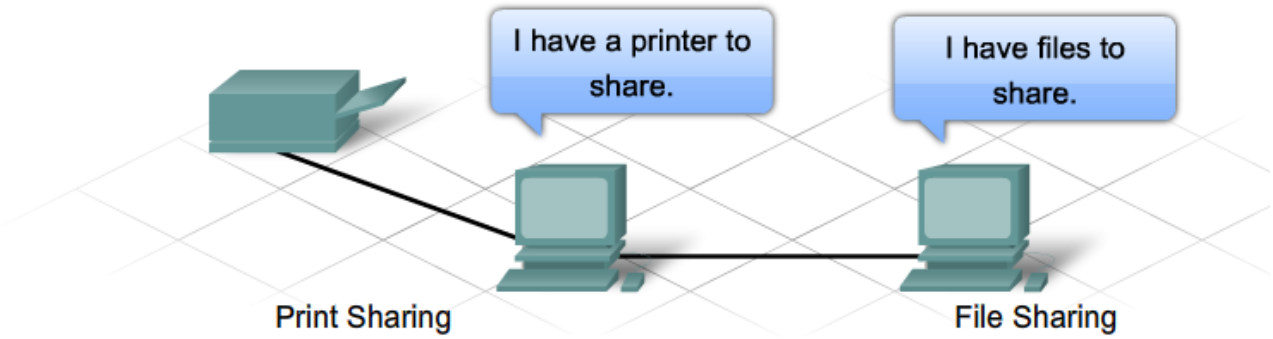
Peer-to-Peer



The advantages of peer-to-peer networking:

- Easy to set up
- Less complexity
- Lower cost since network devices and dedicated servers may not be required
- Can be used for simple tasks such as transferring files and sharing printers

The disadvantages of peer-to-peer networking:

- No centralized administration
- Not as secure
- Not scalable
- All devices may act as both clients and servers which can slow their performance

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1.2 LANs, WANs, and the Internet

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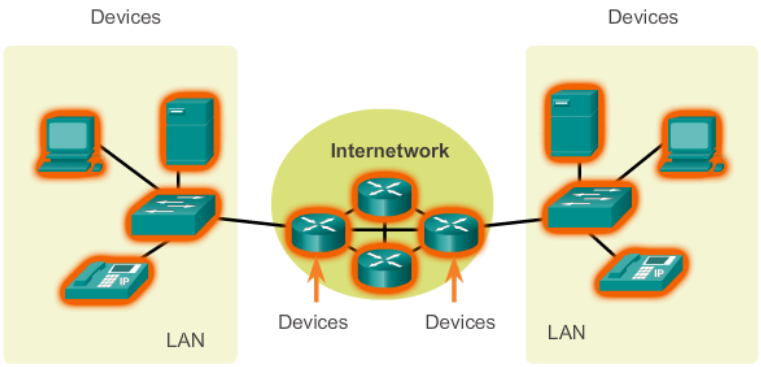
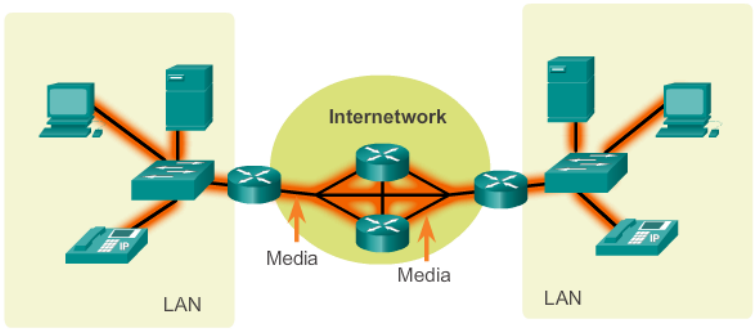
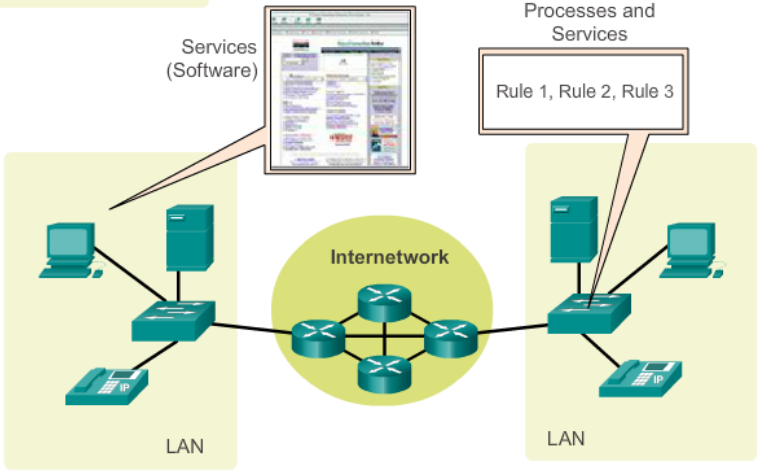
Components of a Network

There are three categories of network components:

- Devices
- Media
- Services







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End Devices

Some examples of end devices are:

- Computers (work stations, laptops, file servers, web servers)
- Network printers
- VoIP phones
- TelePresence endpoint
- Security cameras
- Mobile handheld devices (such as smart phones, tablets, PDAs, and wireless debit / credit card readers and barcode scanners)

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Network Infrastructure Devices

Examples of intermediary network devices are:

- Network Access Devices (switches, and wireless access points)
- Internetworking Devices (routers)
- Security Devices (firewalls)

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Components of a Network

Network Media

Copper

Fiber Optic

Wireless

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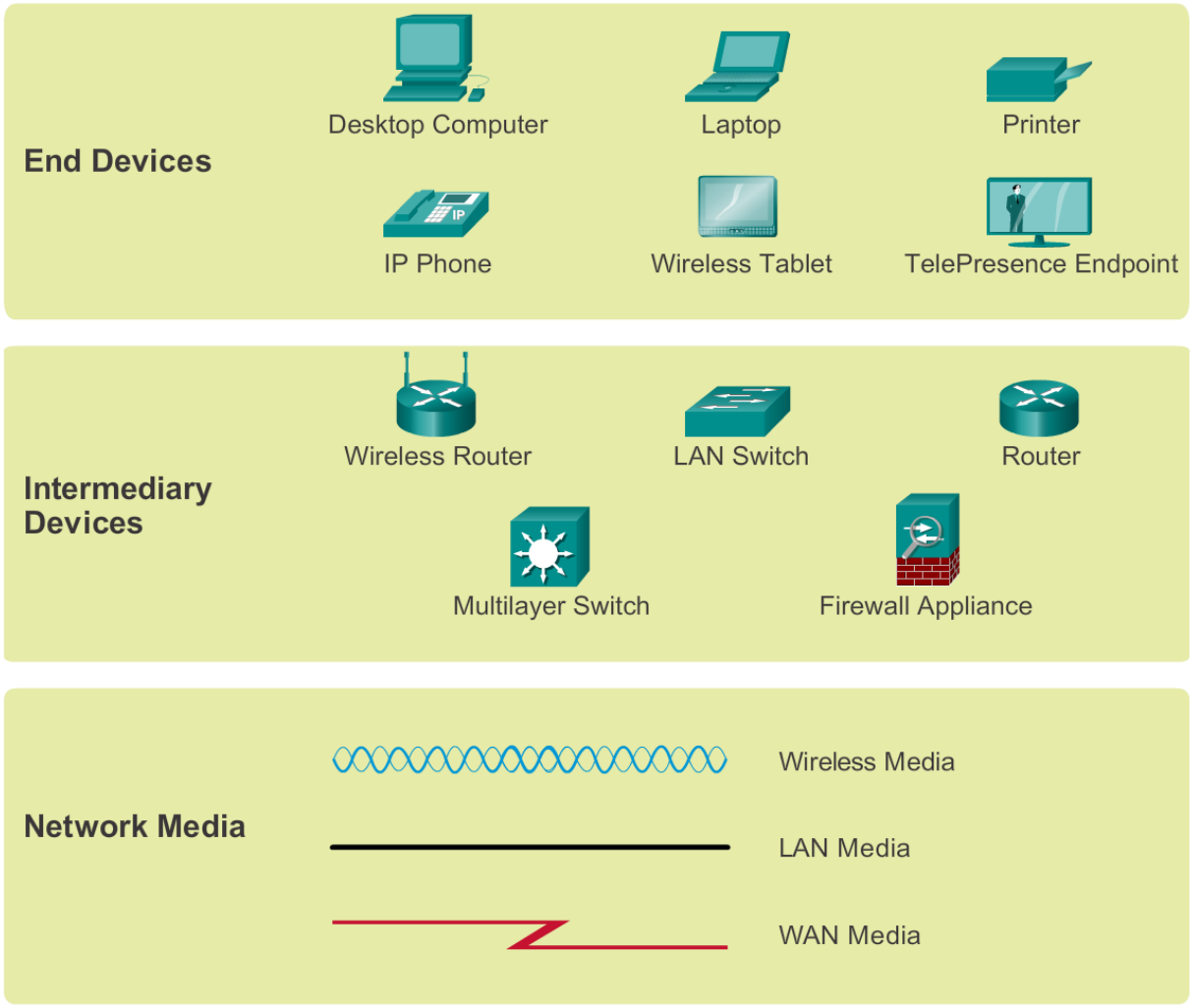
Network Representations



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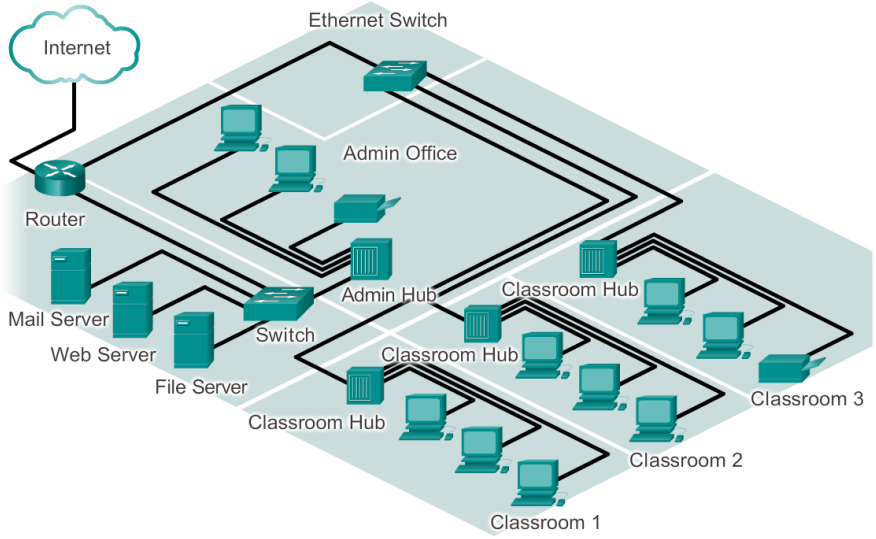
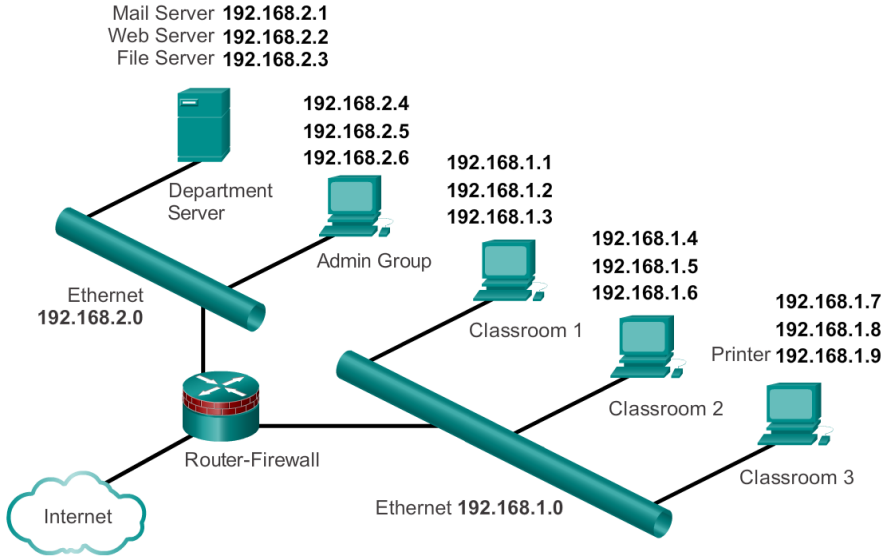
Topology Diagrams

Physical Topology



Logical Topology



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Types of Networks

The two most common types of network infrastructures are:

- Local Area Network (LAN)
- Wide Area Network (WAN).

Other types of networks include:

- Metropolitan Area Network (MAN)
- Wireless LAN (WLAN)
- Storage Area Network (SAN)

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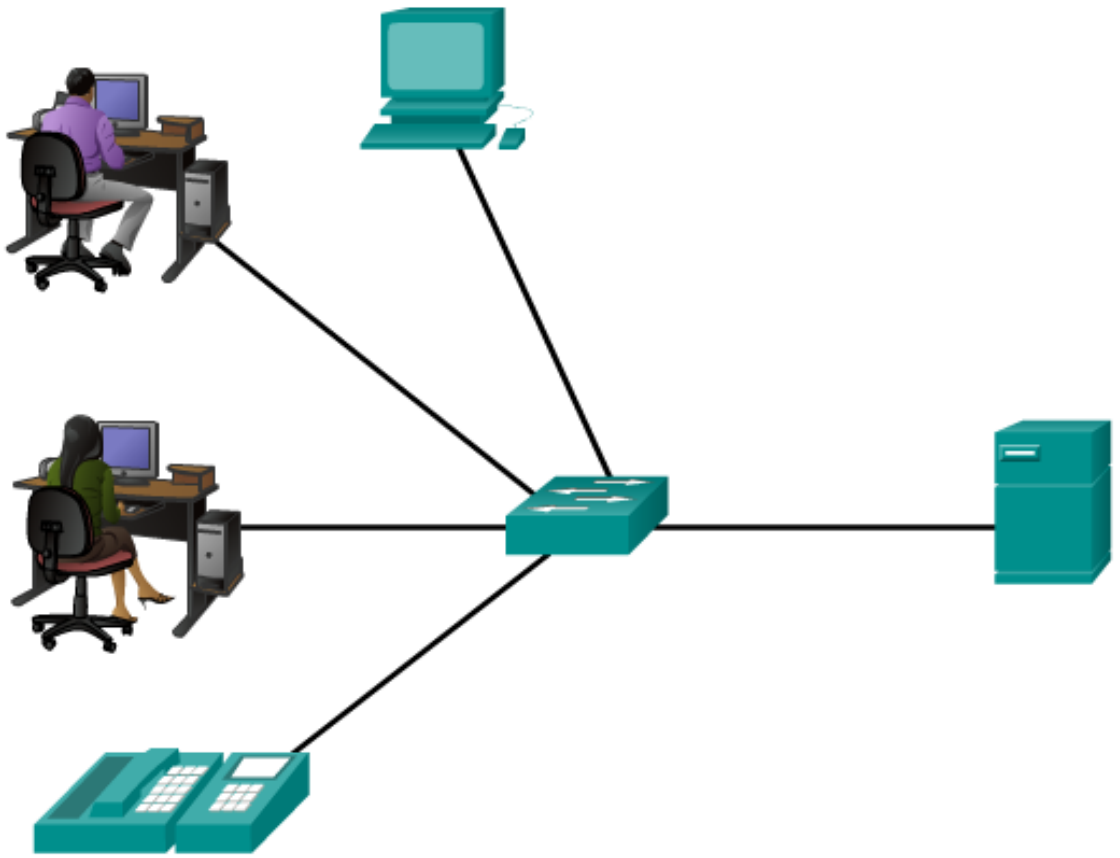
Local Area Networks (LAN)



A network serving a home, building, or campus is considered a LAN.

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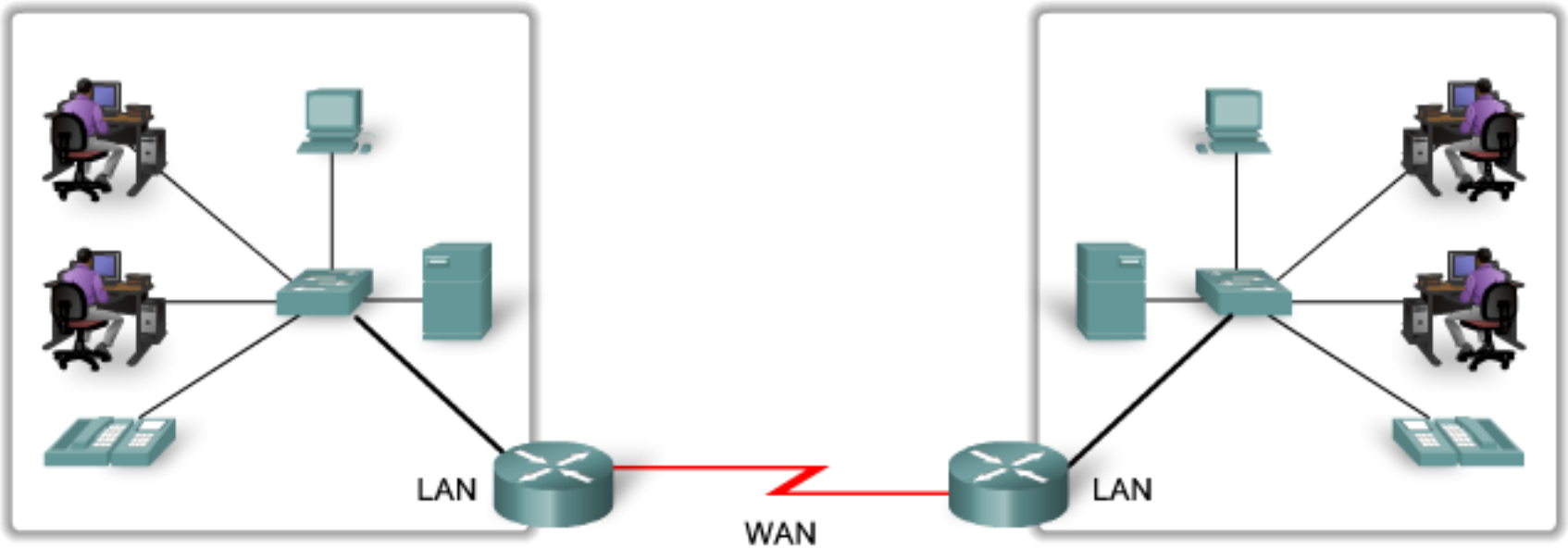
Wide Area Networks (WAN)

LANs separated by geographic distance are connected by a network known as a Wide Area Network (WAN).



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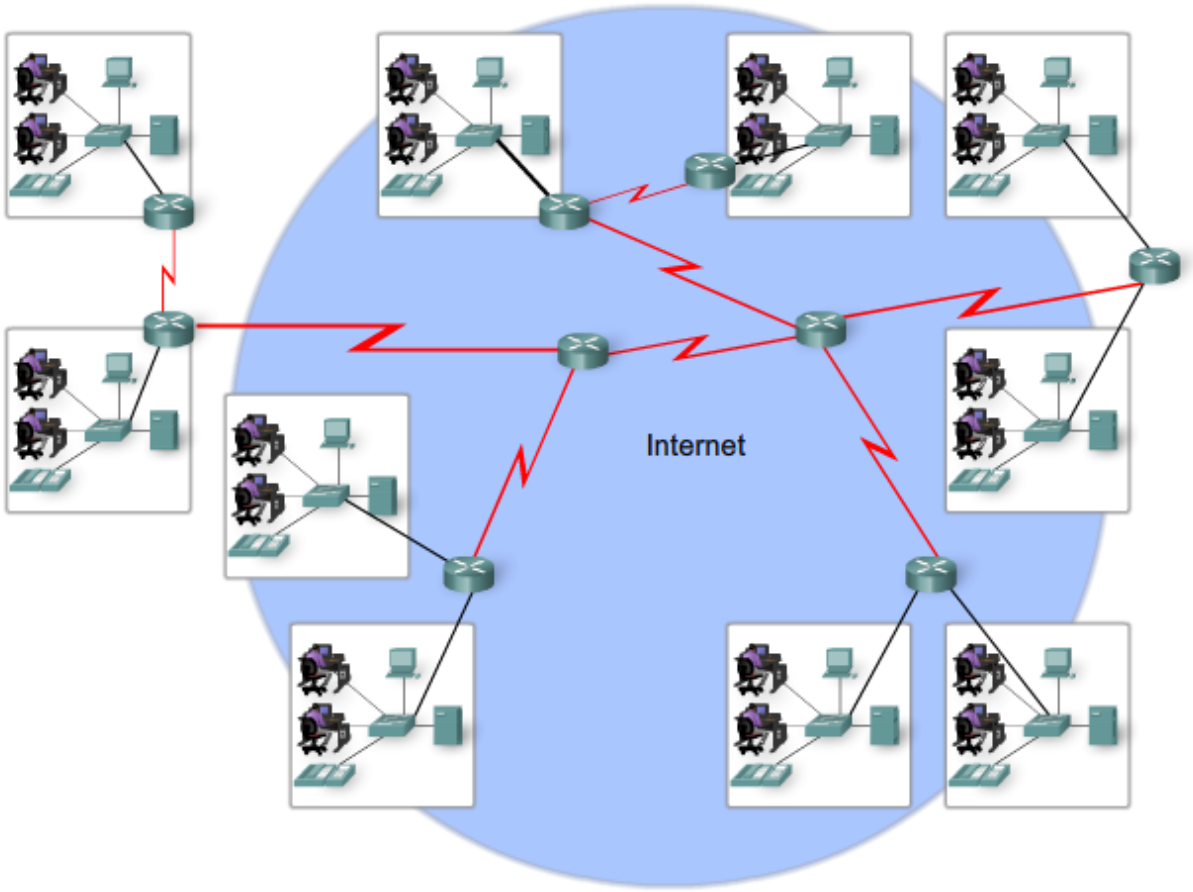
The Internet

LANs and WANs may be connected into internetworks.



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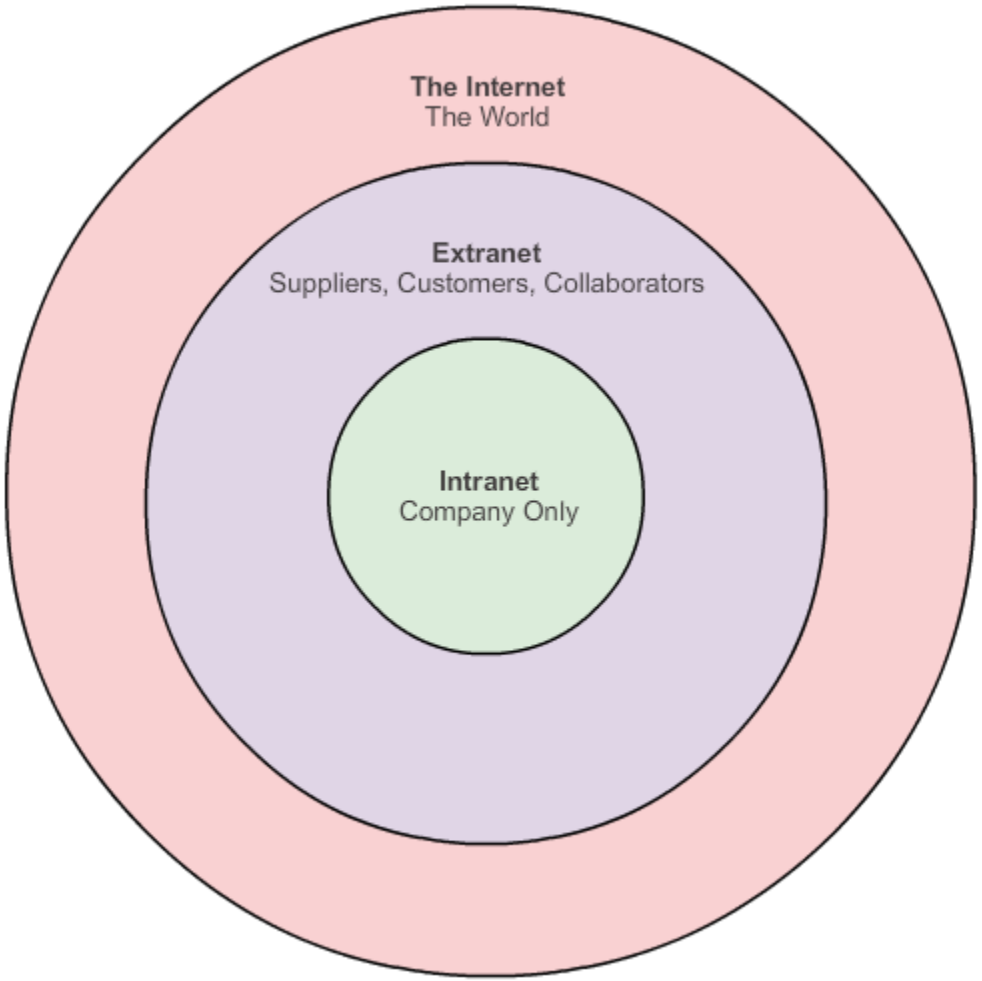
Intranet and Extranet



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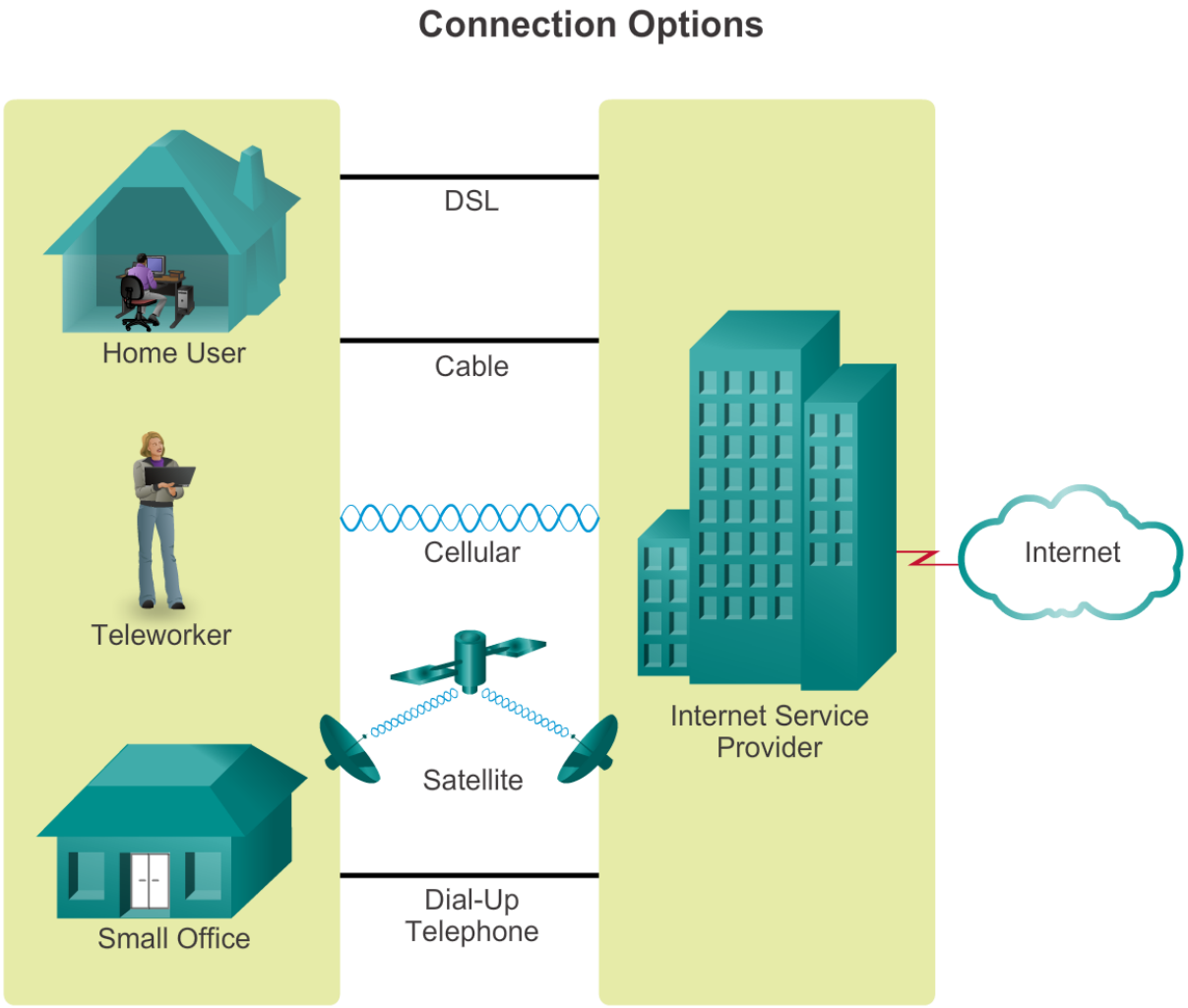
Connecting Remote Users to the Internet



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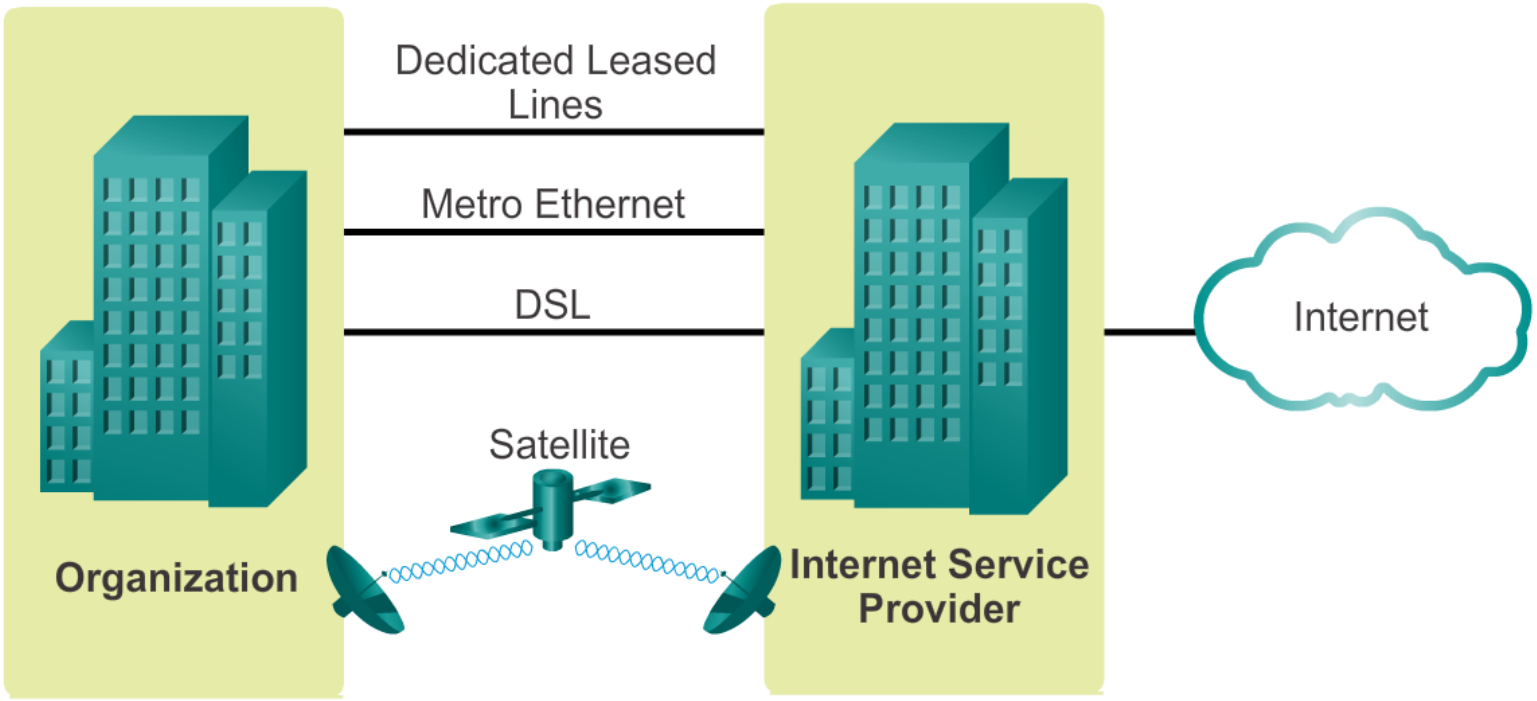
Connecting Businesses to the Internet

Connection Options



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1.3 The Network as a Platform

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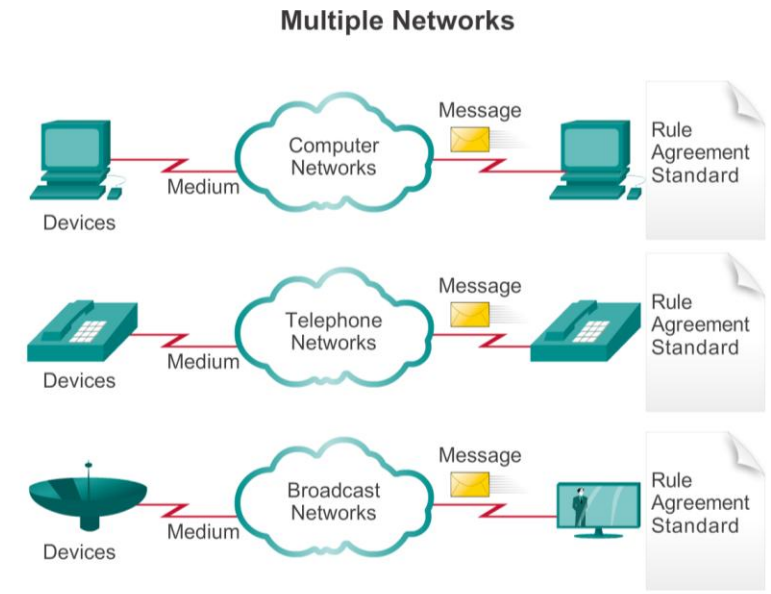
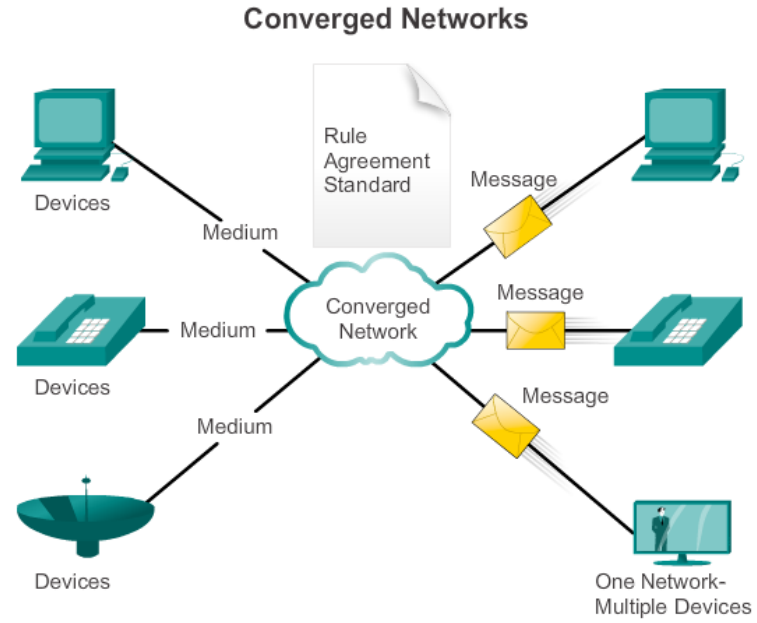
The Converging Network



Multiple services are running on multiple networks.



Converged data networks carry multiple services on one network.

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Planning for the Future

Intelligent Networks Are Bringing the World Together

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Supporting Network Architecture

As networks evolve, we are discovering that there are four basic characteristics that the underlying architectures need to address in order to meet user expectations:

- Fault Tolerance
- Scalability
- Quality of Service (QoS)
- Security

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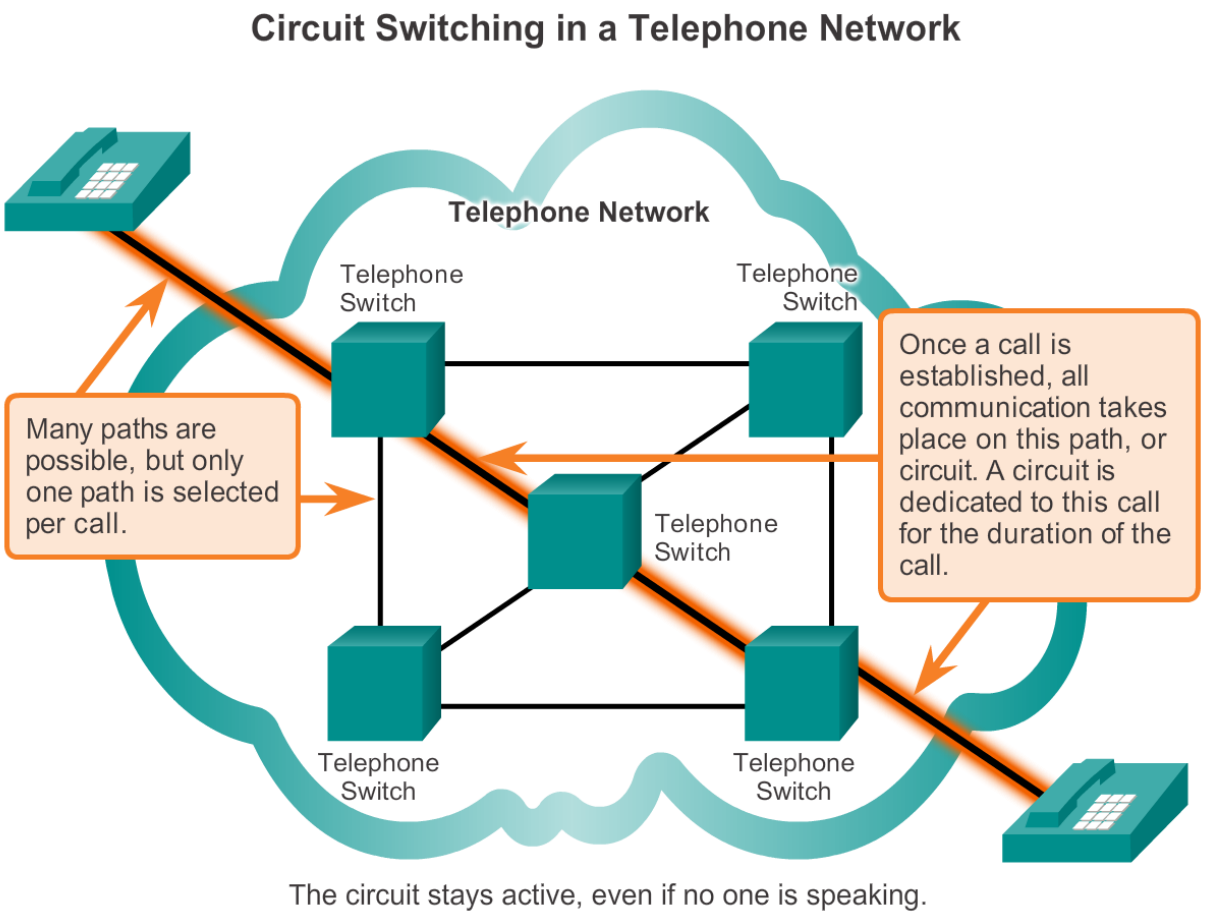
Fault Tolerance in Circuit Switched Network



There are many, many circuits, but a finite number. During peak periods, some calls may be denied.

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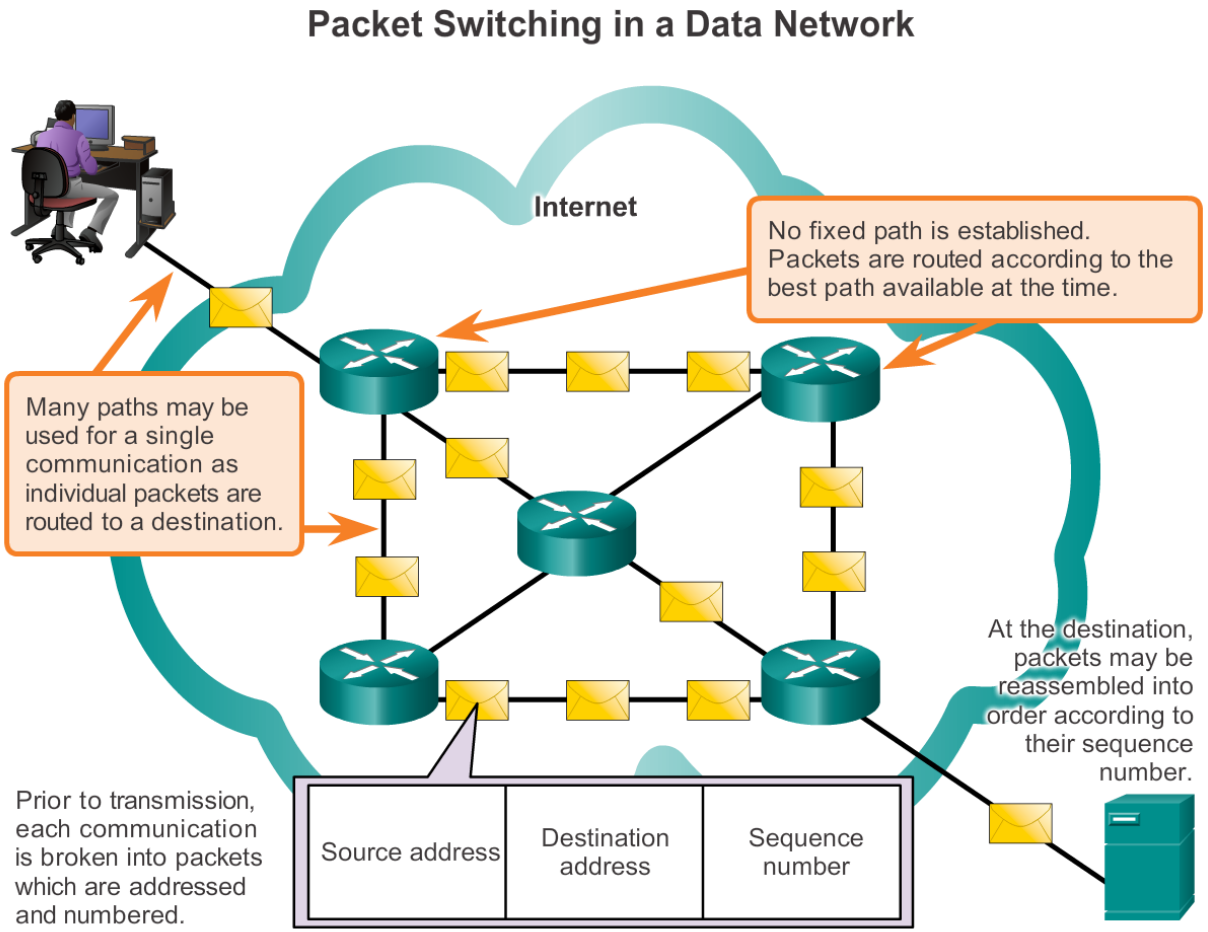
Packet-Switched Networks



During peak periods, communication may be delayed, but not denied.

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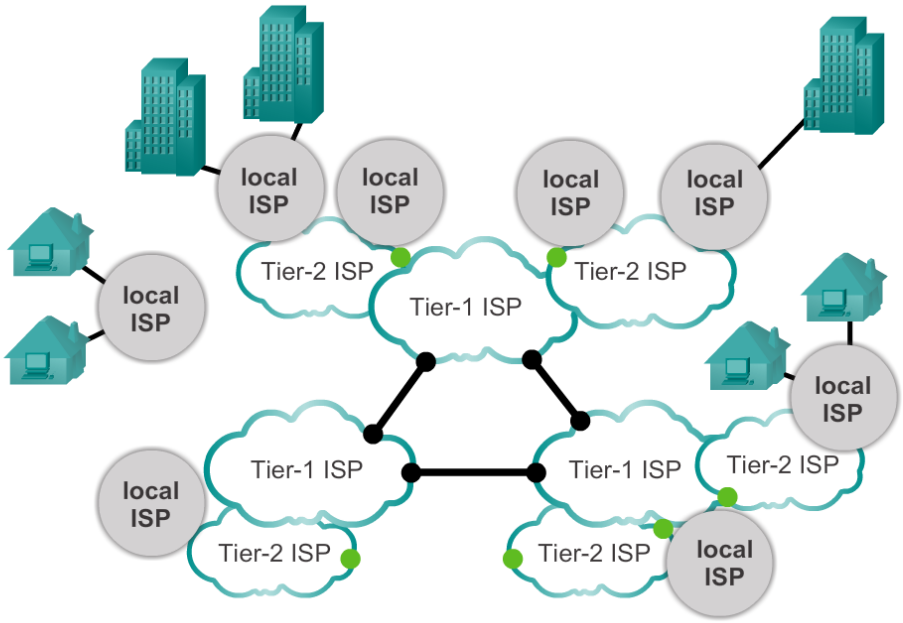
Scalable Networks

At the center of the Internet, Tier-1 ISPs provide national and international connections. These ISPs treat each other as equals.

Tier-2 ISPs are smaller and often provide regional service. Tier-2 ISPs usually pay Tier-1 ISPs for connectivity to rest of the Internet.

Peer connections between networks at the same level provide direct connections, bypassing longer routes and preventing congestion on the backbone.



Tier-3 ISPs are the local providers of service directly to end users. Tier-3 ISPs are usually connected to Tier 2 ISPs and pay Tier 2 providers for Internet access.

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Providing QoS

Examples of priority decisions for an organization might include:

- Time-sensitive communication - increase priority for services like telephony or video distribution.
- Non time-sensitive communication - decrease priority for web page retrieval or email.
- High importance to organization - increase priority for production control or business transaction data.
- Undesirable communication - decrease priority or block unwanted activity, like peer-to-peer file sharing or live entertainment.

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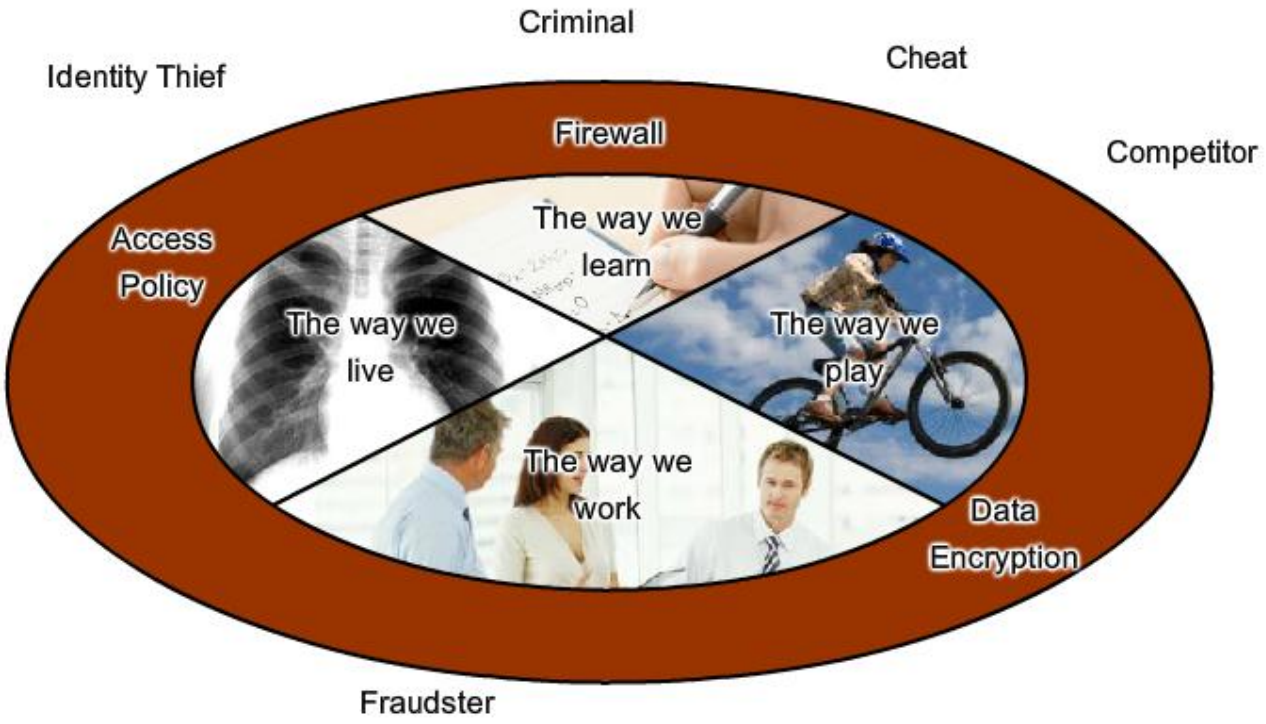
Providing Network Security



The communication and information that we would like to be private is protected from those who would make unauthorized use of it.

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1.4 The Changing Network Environment

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New trends

Some of the top trends include:

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

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Bring Your Own Device (BYOD)

The concept of any device, to any content, in anyway is a major global trend that requires significant changes to the way devices are used. This trend is known as Bring Your Own Device (BYOD).

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Online Collaboration

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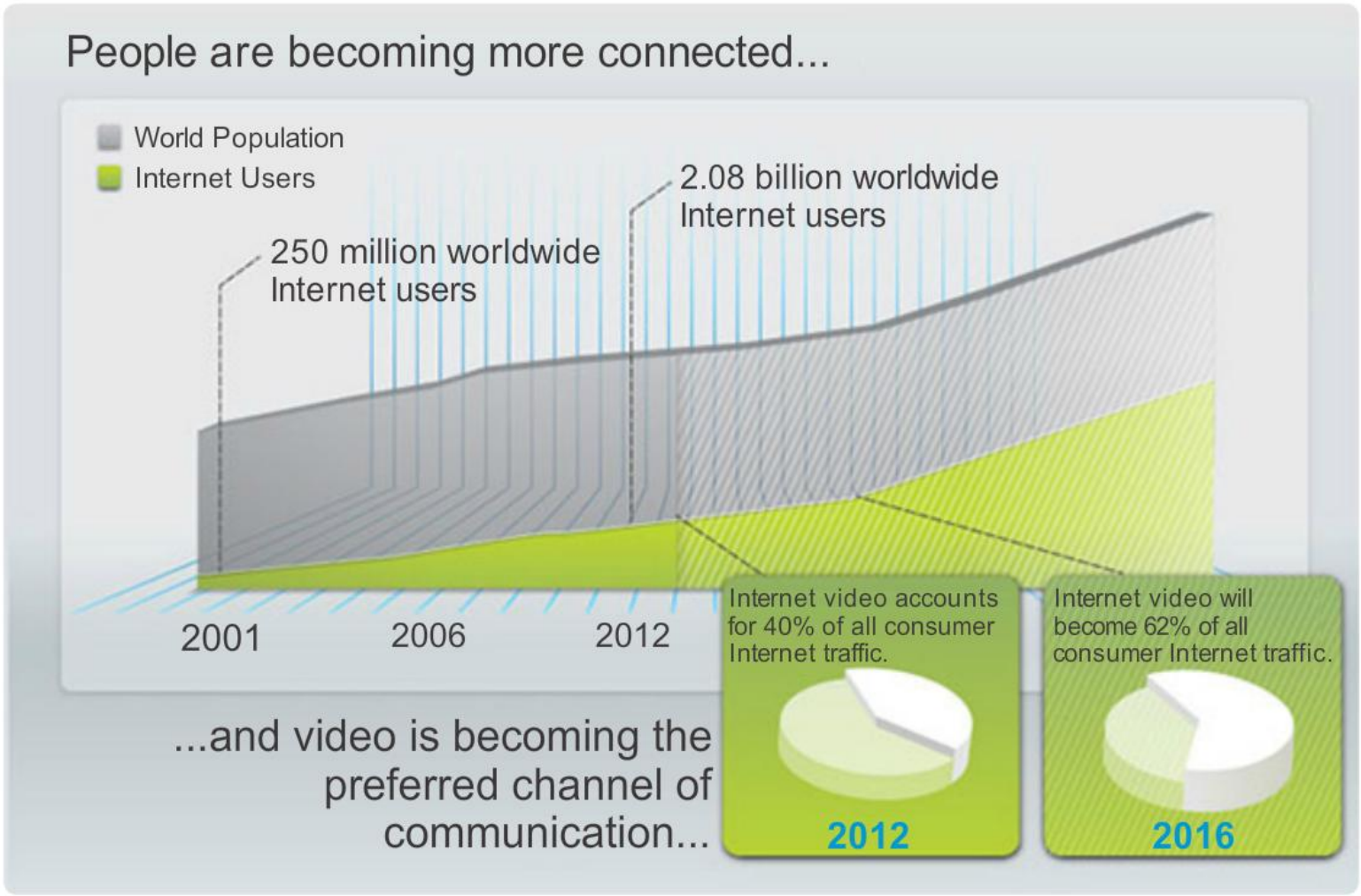
Video Communication



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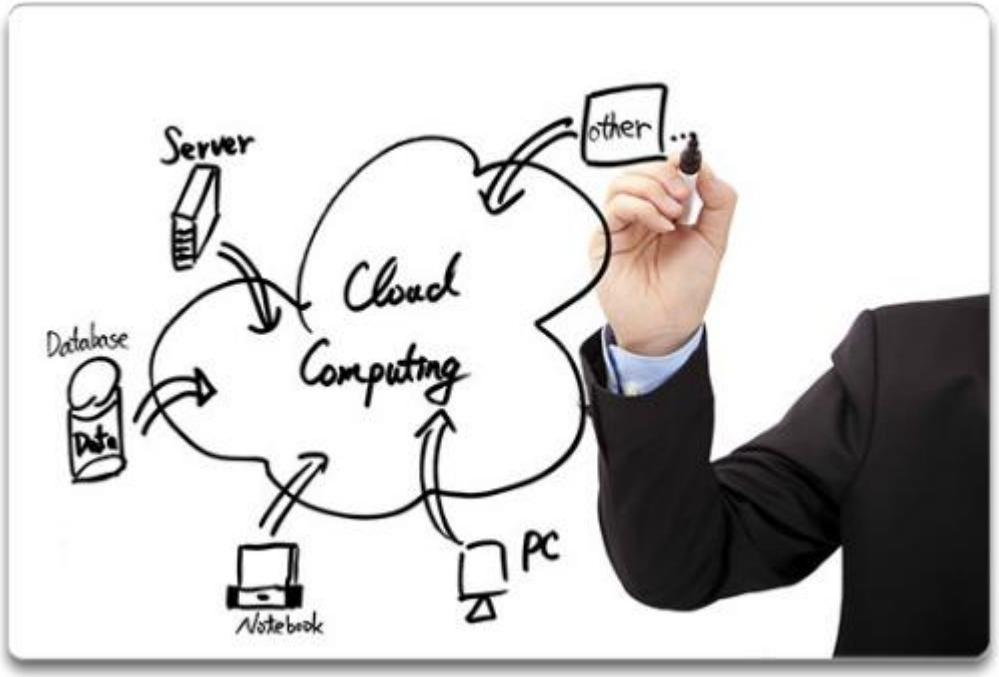
Cloud Computing

Cloud computing offers the following potential benefits:

- Organizational flexibility
- Agility and rapid deployment
- Reduced cost of infrastructure
- Refocus of IT resources
- Creation of new business models



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Data Centers

A data center is a facility used to house computer systems and associated components including:

- Redundant data communications connections
- High-speed virtual servers (sometimes referred to as server farms or server clusters)
- Redundant storage systems (typically uses SAN technology)
- Redundant or backup power supplies
- Environmental controls (e.g., air conditioning, fire suppression)
- Security devices

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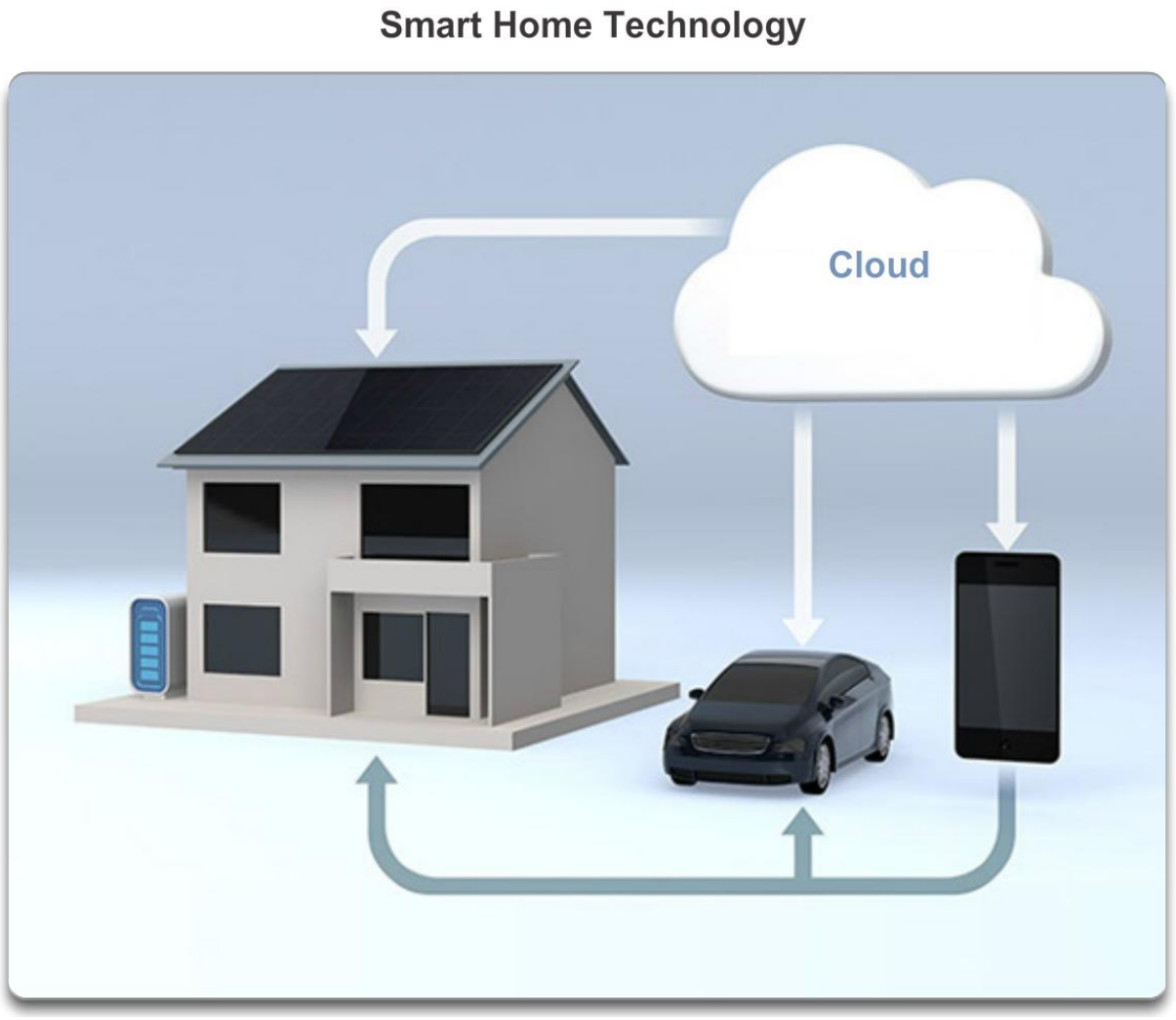
Technology Trends in the Home



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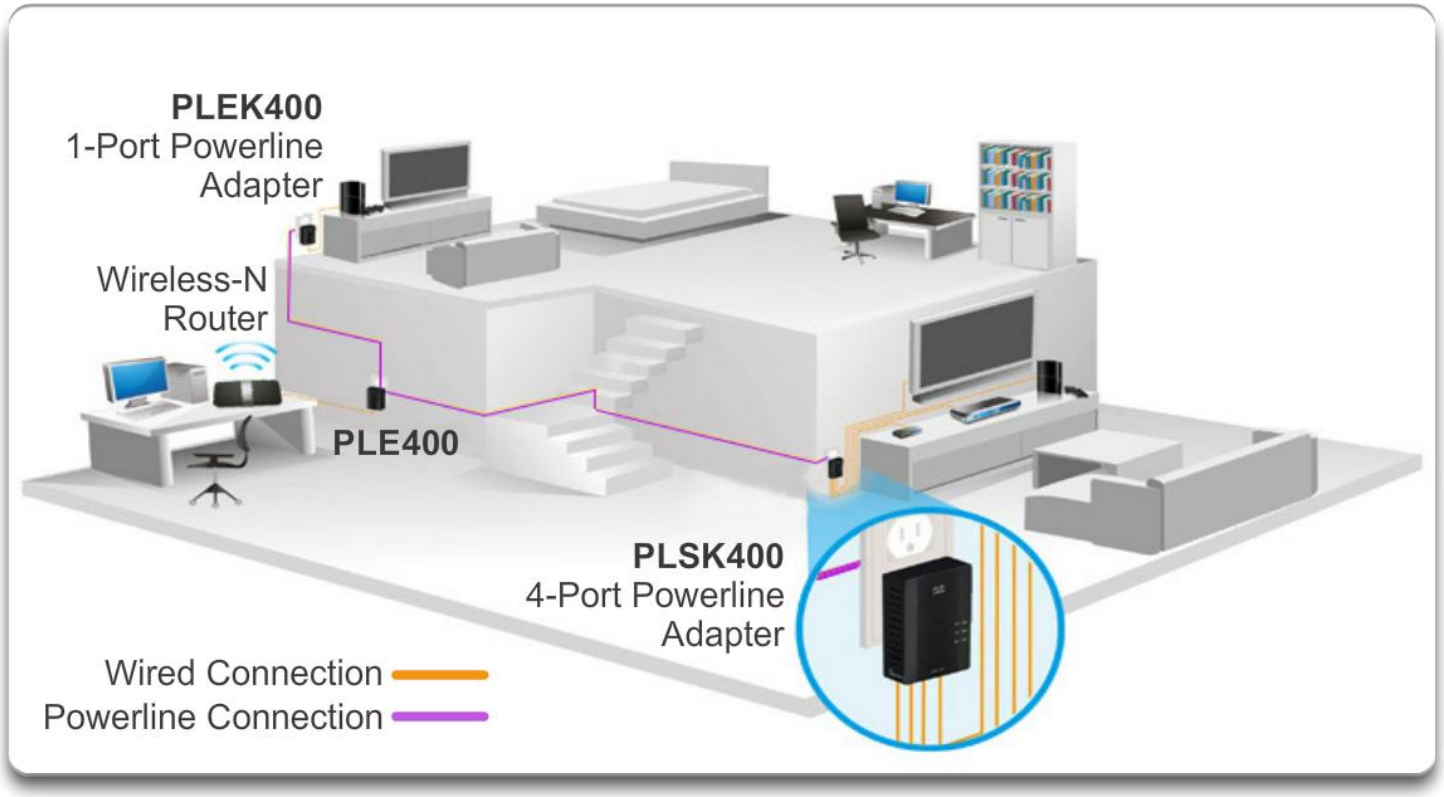
Powerline Networking



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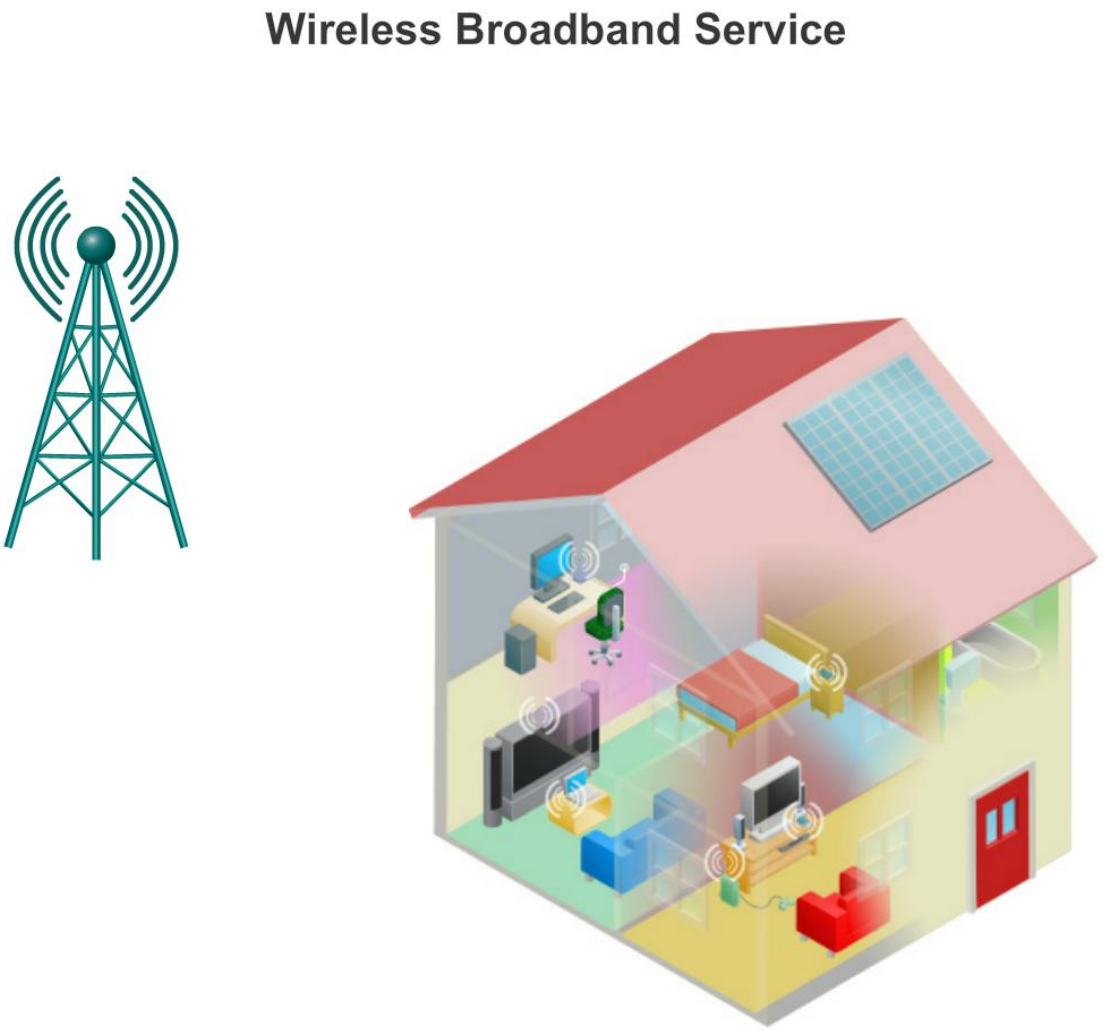
Wireless Broadband



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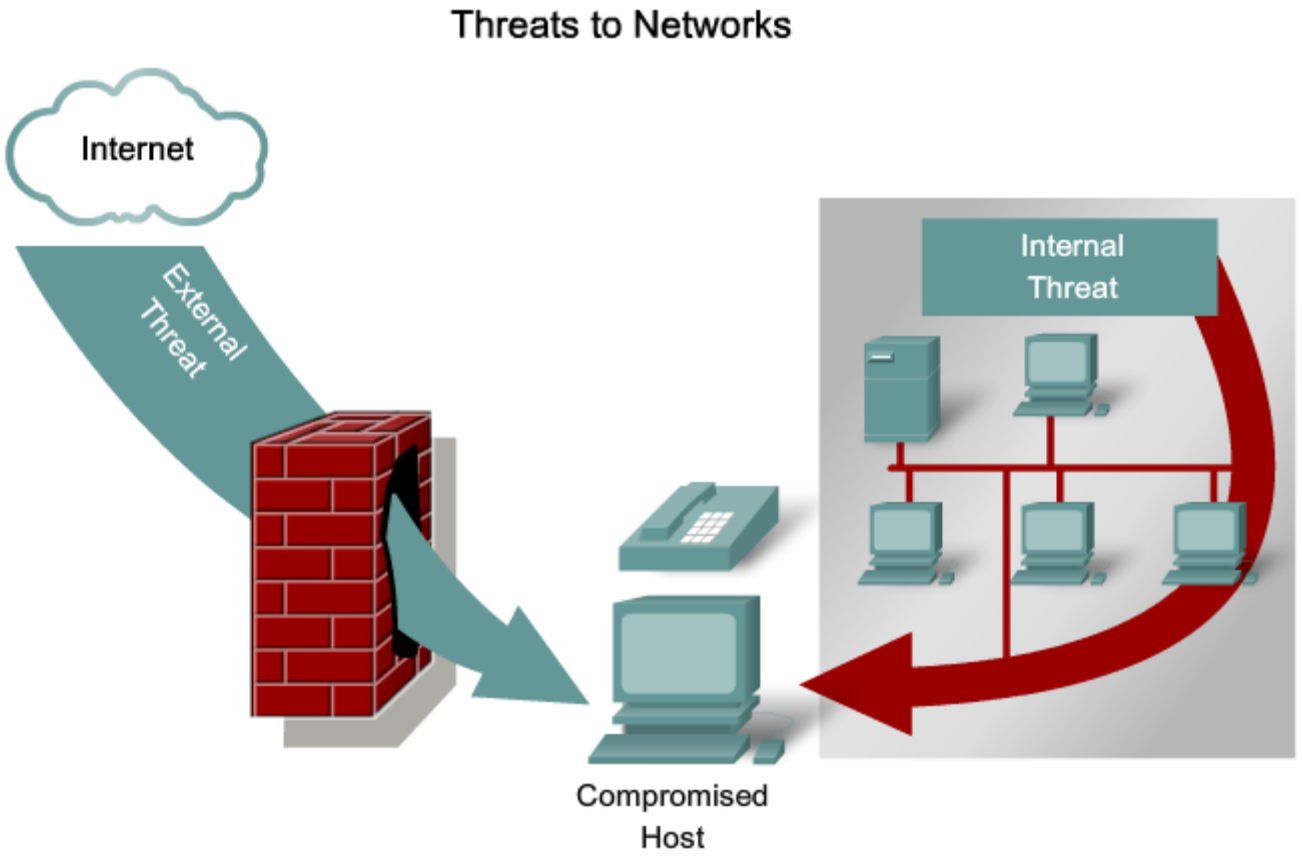
Network Security



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Security Threats

The most common external threats to networks include:

- Viruses, worms, and Trojan horses
- Spyware and adware
- Zero-day attacks, also called zero-hour attacks
- Hacker attacks
- Denial of service (DoS) attacks
- Data interception and theft
- Identity theft

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Security Solutions

Network security components often include:

- Antivirus and antispyware
- Firewall filtering
- Dedicated firewall systems
- Access control lists (ACL)
- Intrusion prevention systems (IPS)
- Virtual Private Networks (VPNs)

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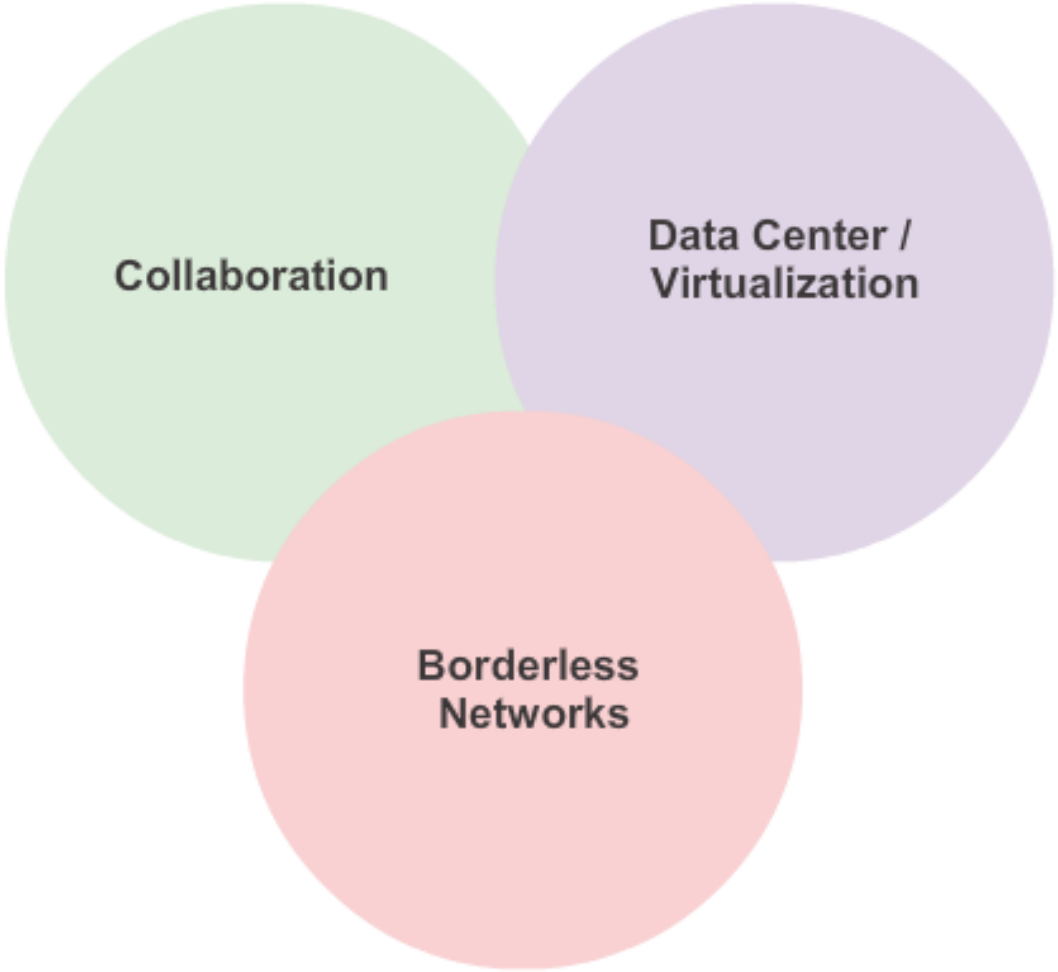
Cisco Network Architectures



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Cisco Certified Network Associate (CCNA)

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Summary

In this chapter, you learned:

- Networks and the Internet have changed the way we communicate, learn, work, and even play.
- Networks come in all sizes. They can range from simple networks consisting of two computers, to networks connecting millions of devices.
- The Internet is the largest network in existence. In fact, the term Internet means a ‘network of networks. The Internet provides the services that enable us to connect and communicate with our families, friends, work, and interests.
- The network infrastructure is the platform that supports the network. It provides the stable and reliable channel over which communication can occur. It is made up of network components including end devices, intermediate devices, and network media.

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Summary (cont.)

In this chapter, you learned:

- Networks must be reliable.
- Network security is an integral part of computer networking, regardless of whether the network is limited to a home environment with a single connection to the Internet, or as large as a corporation with thousands of users.
- The network infrastructure can vary greatly in terms of size, number of users, and number and types of services that are supported on it. The network infrastructure must grow and adjust to support the way the network is used. The routing and switching platform is the foundation of any network infrastructure.

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