Chapter 1: Exploring the Network

Introduction to Networks
Chapter 1: Objectives

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.
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
Networking Today

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)

 Doubles every 13 years
200M

 Doubled every 1.4 years

10B

 Doubles every (?) years

50B things

1995  2000  2011  2020
Networking Today

The Global Community
Interconnecting our Lives

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
Providing Resources in a Network
Networks of Many Sizes

Small Home Networks

Small Office/Home Office Networks

Medium to Large Networks

World Wide Networks
Providing Resources in a Network
Clients and Servers
Providing Resources in a Network

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
Components of a Network

There are three categories of network components:

- Devices
- Media
- Services
Components of a Network

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 smartphones, tablets, PDAs, and wireless debit/credit card readers and barcode scanners)
Components of a Network

Network Infrastructure Devices

Examples of intermediary network devices are:

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

Network Media

- Copper
- Fiber Optic
- Wireless
Components of a Network

Network Representations

End Devices
- Desktop Computer
- Laptop
- Printer
- IP Phone
- Wireless Tablet
- TelePresence Endpoint

Intermediary Devices
- Wireless Router
- LAN Switch
- Router
- Multilayer Switch
- Firewall Appliance

Network Media
- Wireless Media
- LAN Media
- WAN Media
Components of a Network

Topology Diagrams

Physical Topology

Logical Topology

- Mail Server: 192.168.2.1
- Web Server: 192.168.2.2
- File Server: 192.168.2.3

Networking components:
- Internet
- Ethernet Switch
- Admin Office
- Router
- Mail Server
- Web Server
- File Server
- Classroom Hub
- Classroom 1
- Classroom 2
- Classroom 3

Networking devices:
- Ethernet 192.168.2.0
- Admin Group
- Printer
- Classroom 1
- Classroom 2
- Classroom 3
- Router-Firewall
- Ethernet 192.168.1.0
- 192.168.1.1
- 192.168.1.2
- 192.168.1.3
- 192.168.1.4
- 192.168.1.5
- 192.168.1.6
- 192.168.1.7
- 192.168.1.8
- 192.168.1.9
LANs and WANs

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)
A network serving a home, building or campus is considered a Local Area Network (LAN).
LANs and WANs

Wide Area Networks (WAN)

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

The Internet

LANs and WANs may be connected into internetworks.
The Internet

Intranet and Extranet
LANs, WANs, and Internets

Internet Access Technologies
Connecting to the Internet

Connecting Remote Users to the Internet

Connection Options

- DSL
- Cable
- Cellular
- Satellite
- Dial-Up Telephone
- Internet Provider

Home User
Teleworker
Small Office
Connecting to the Internet

Connecting Businesses to the Internet

Connection Options

Organization

Dedicated Leased Lines
Metro Ethernet
DSL
Satellite

Internet Service Provider

Internet
Converged Networks
The Converging Network

Multiple Networks

Multiple services are running on multiple networks.
Converged Networks
Planning for the Future

Intelligent Networks Are Bringing the World Together

Intelligent networks allow handheld devices to receive news and emails, and to send text.

The Human Network is everywhere.

Video conferencing around the globe is in the palm of your hand.

Phones connect globally to share voice, text, and images.

Online gaming connects thousands of people seamlessly.
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
Reliable Network

Fault Tolerance in Circuit Switched Network

Circuit Switching in a Telephone Network

Many paths are possible, but only one path is selected per call.

Once a call is established, all communication takes place on this path, or circuit. A circuit is dedicated to this call for the duration of the call.

The circuit stays active, even if no one is speaking.

There are many, many circuits, but a finite number. During peak periods, some calls may be denied.
Reliable Network
Packet-Switched Networks

Packet Switching in a Data Network

Many paths may be used for a single communication as individual packets are routed to a destination.

Source address | Destination address | Sequence number

At the destination, packets may be reassembled into order according to their sequence number.

No fixed path is established. Packets are routed according to the best path available at the time.

Prior to transmission, each communication is broken into packets which are addressed and numbered.

During peak periods, communication may be delayed, but not denied.
Tier 3

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.
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.
Reliable Network
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.
Network Trends

New trends

Some of the top trends include:

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

Bring Your Own Device (BYOD)
Network Trends

Online Collaboration

Collaboration

IP Communication

Mobile Applications

Telepresence

Messaging

Online Conferencing
Network Trends

Video Communication

People are becoming more connected...

- World Population
- Internet Users

2.08 billion worldwide Internet users

250 million worldwide Internet users

2001 2006 2012

Internet video accounts for 40% of all consumer Internet traffic.

Internet video will become 62% of all consumer Internet traffic.

...and video is becoming the preferred channel of communication...
Network Trends

Cloud Computing

There are four primary types of clouds:

- Public clouds
- Private clouds
- Custom clouds
- Hybrid clouds
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
Networking Technologies for the Home

Technology Trends in the Home

Smart Home Technology
Networking Technologies for the Home

Powerline Networking

Powerline Networking

PLEK400
1-Port Powerline Adapter

Wireless-N Router

PLE400

PLSK400
4-Port Powerline Adapter

Wired Connection

Powerline Connection
Networking Technologies for the Home

Wireless Broadband

Wireless Broadband Service
Future of Networking
Network Security

Threats to Networks

Internet

External Threat

Internal Threat

Compromised Host
Network Security

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 attacks
- Data interception and theft
- Identity theft
Network Security

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)
Network Architectures

Cisco Network Architectures

- Collaboration
- Data Center / Virtualization
- Borderless Networks
Network Architectures

Cisco Certified Network Associate (CCNA)
Exploring the Networking

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.
Exploring the Networking

Summary

In this chapter, you learned:

- 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 device, and network media.

- 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.
Exploring the Networking

Summary

In this chapter, you learned:

- 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.