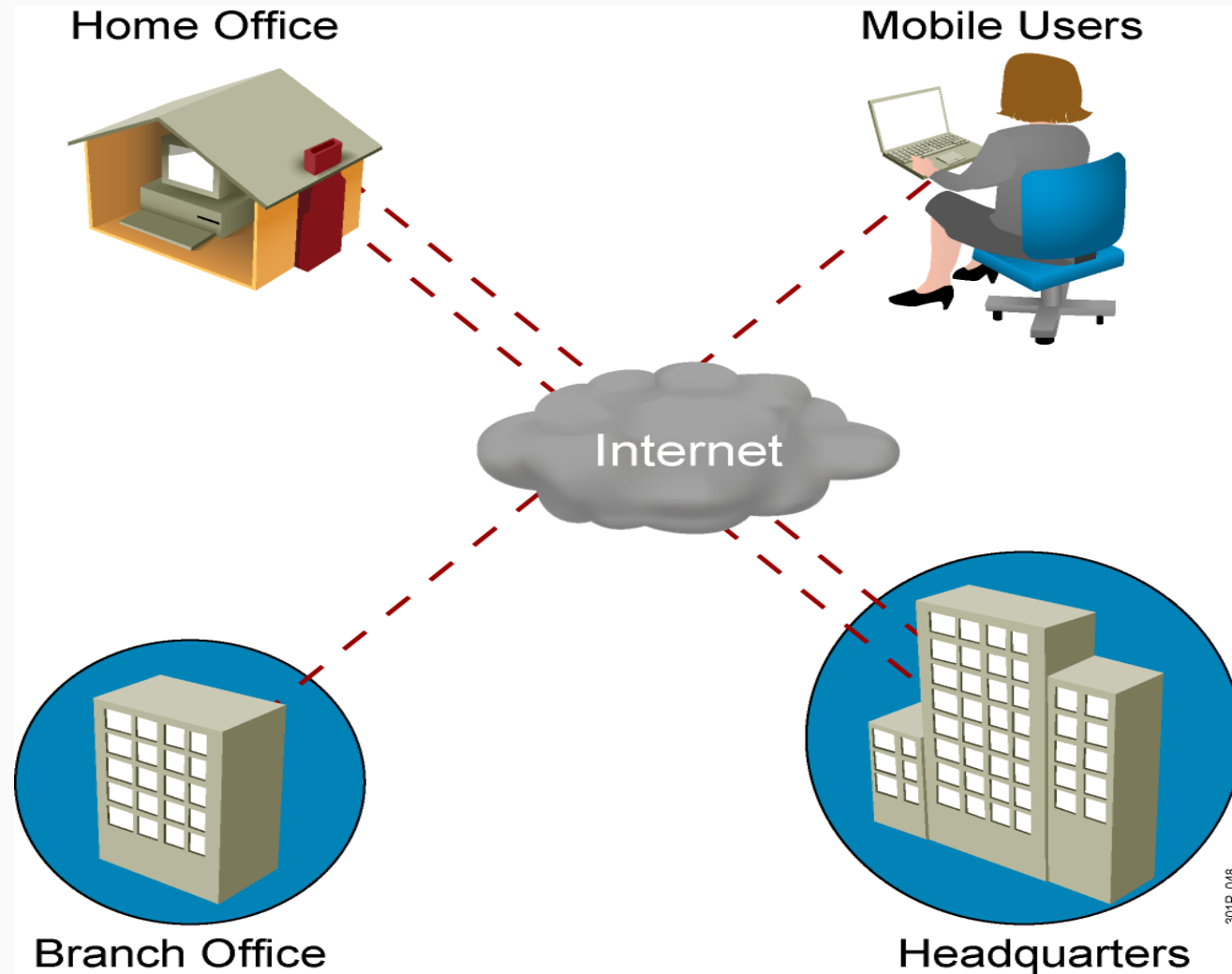**Chapter 1.**

Networking fundamentals
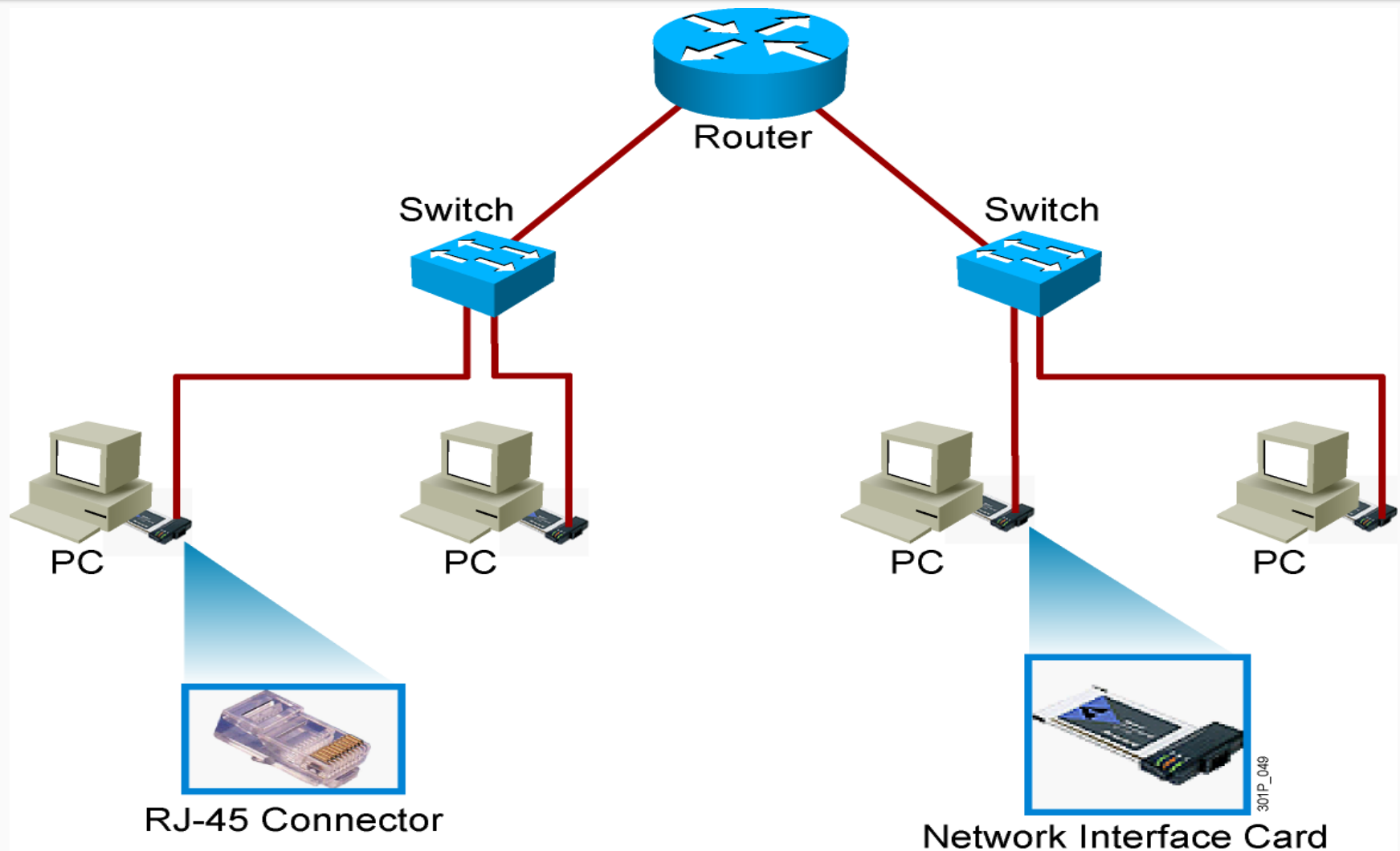
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- ✓ Introduction

- ✓ Computer network types

- ✓ Network Topologies

- ✓ Network security

- ✓ Characteristics of a Network
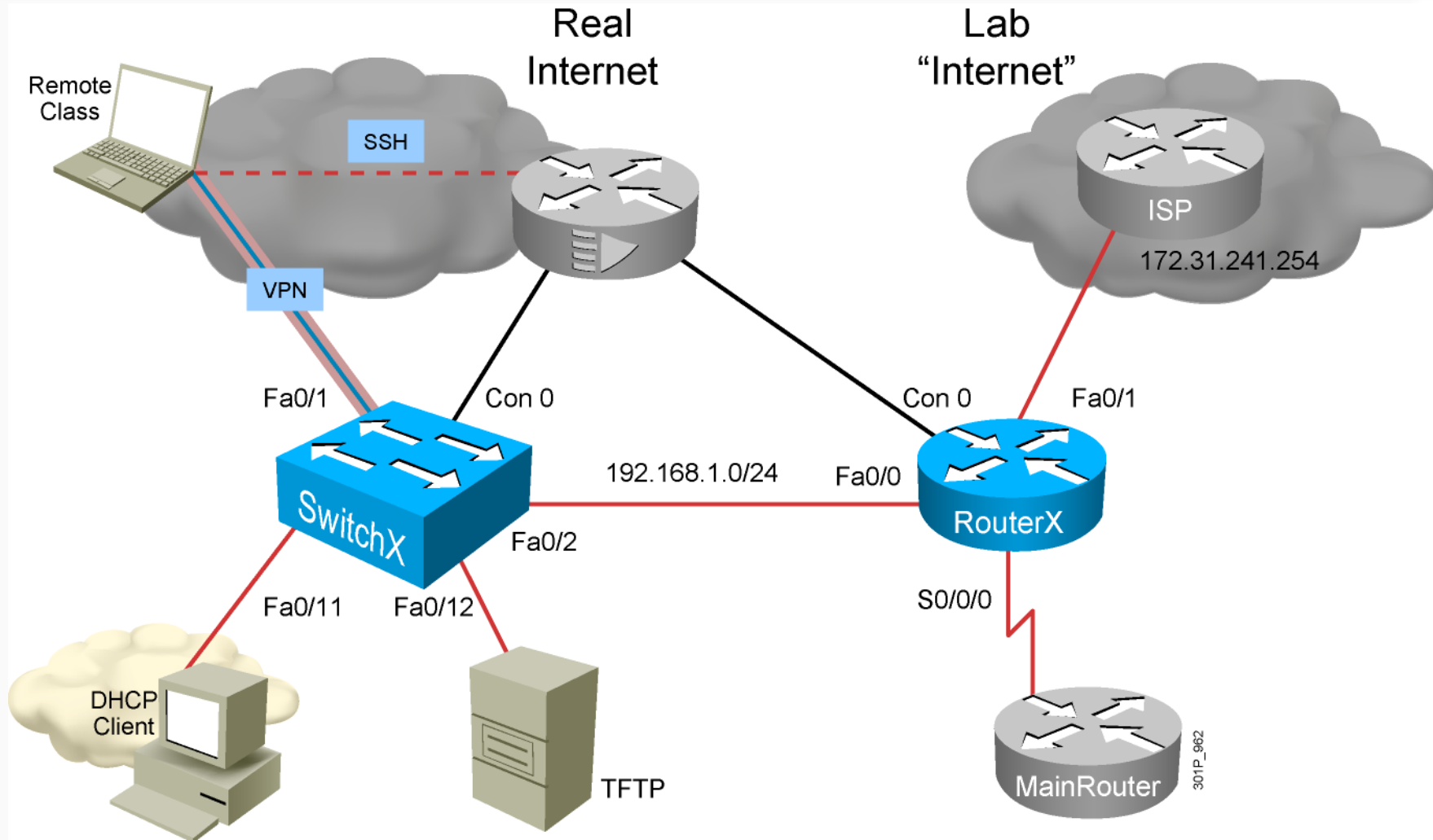
- ✓ Connection to the Internet

Introduction
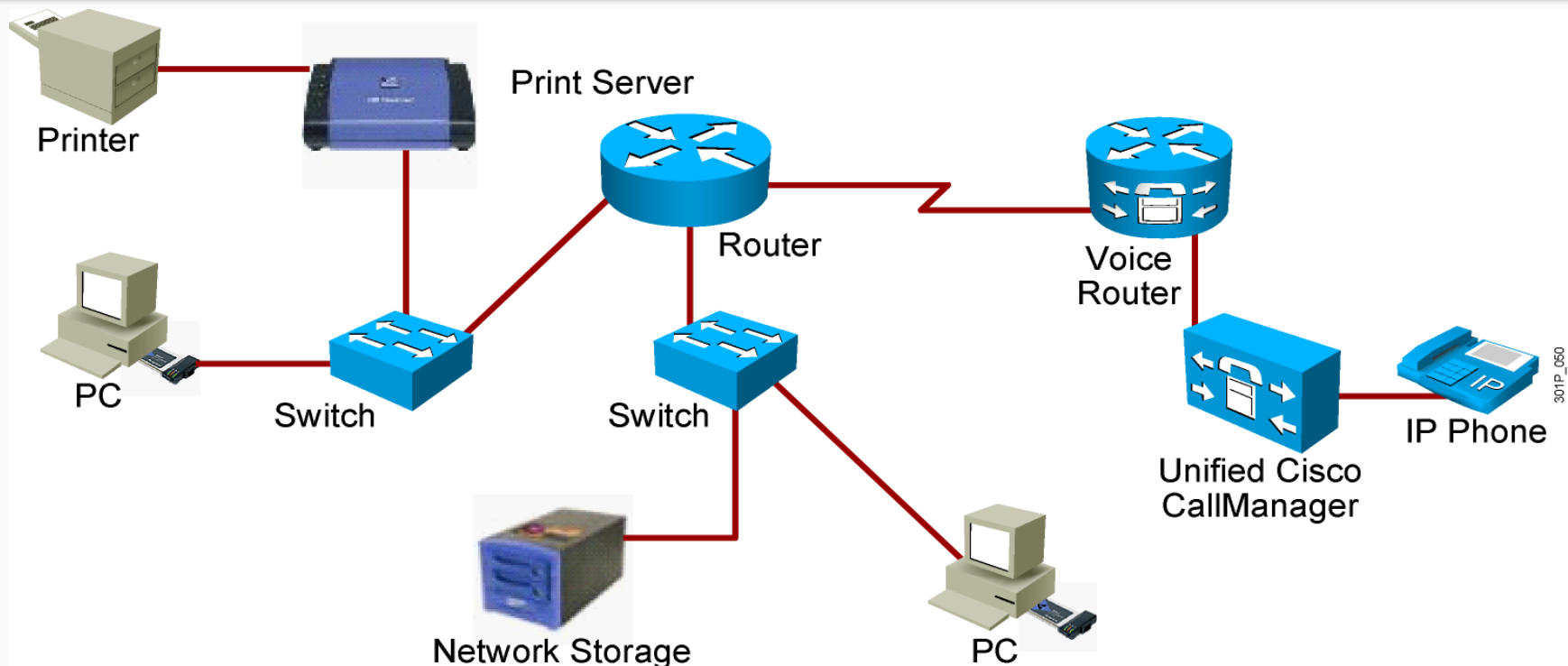
What is a network?

Common Physical Components of a Network

Interpreting a Network Diagram

Resource-Sharing Functions and Benefits

- Data and applications
- Resources
- Network storage
- Backup devices

Network User Applications

- E-mail (Outlook, POP3, Yahoo, and so on)

- Web browser (IE, Firefox, and so on)

- Instant messaging (Yahoo IM, Microsoft Messenger, and so on)

- Collaboration (Whiteboard, Netmeeting, WebEx, and so on)

- Databases (file servers)

Impact of User Applications on the Network

- **Batch applications**
  - FTP, TFTP, inventory updates
  - No direct human interaction
  - Bandwidth important, but not critical

- **Interactive applications**
  - Inventory inquiries, database updates.
  - Human-to-machine interaction.
  - Because a human is waiting for a response, response time is important but not critical, unless the wait becomes excessive.

- **Real-time applications**
  - VoIP, video
  - Human-to-human interaction
  - End-to-end latency critical

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Computer network types

Local-area networks (LANs)

- **Operate within in a limited geographic area**

- **Allow multi-access to high-bandwidth media**

- **Provide full-time connectivity to local services**

- **Connect physically adjacent device**

- **Control the network privately under local administration**

Lan topologies: Ethernet, Token Ring, FDDI, …

Wide-area networks (WANs)

- **Operate over a large geographically separated areas**

- **Allow users to have real-time communication capabilities with other users**

- **Provide full-time remote resources connected to local services**

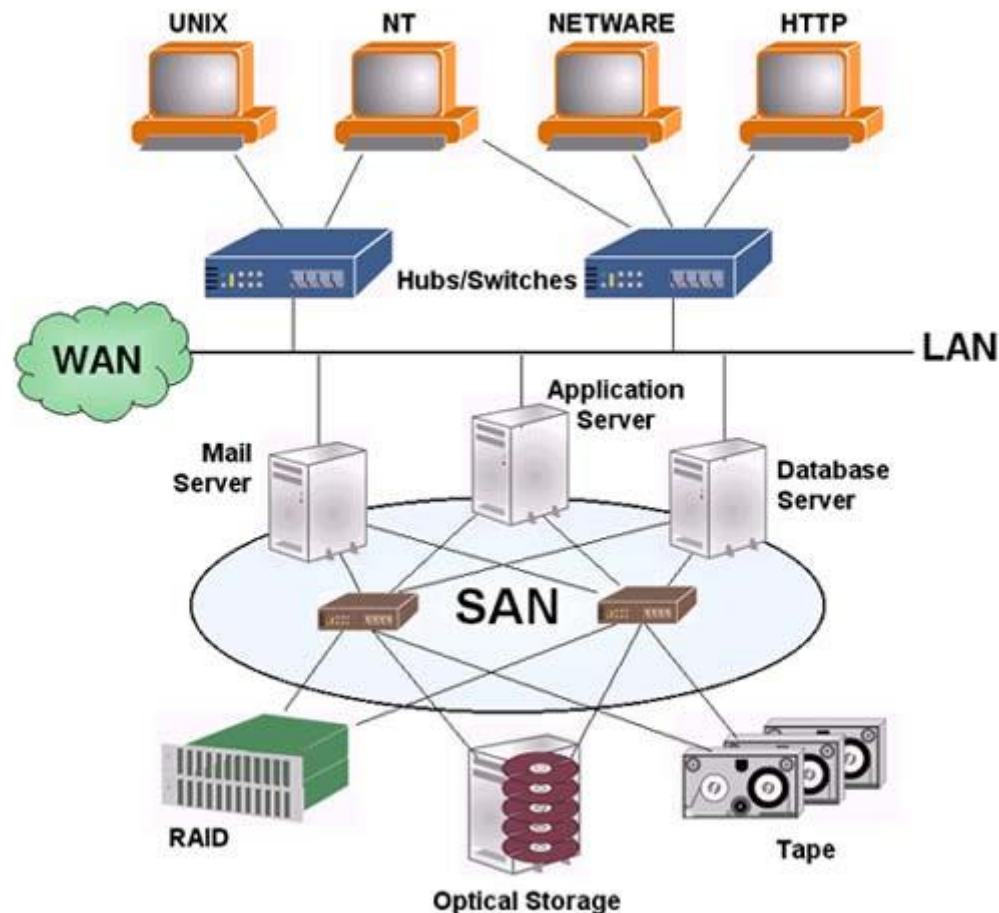- **Provide e-mail, World Wide Web, File transfer, and e-commerce services**

   Some common WAN topogolies are: modem, ISDN, xDSL, Frame Relay,…

Metropolitan-area networks (MANs)

- **A MAN is a network that spans a metropolitan area such as a city or suburban area**

- **MAN topologies: ATM, GE, 10 GE,…**

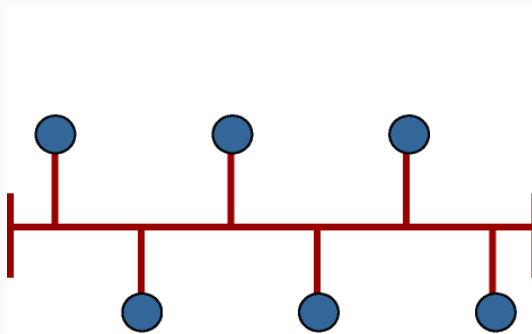# Storage-area networks (SANs)

Characteristics of a Network
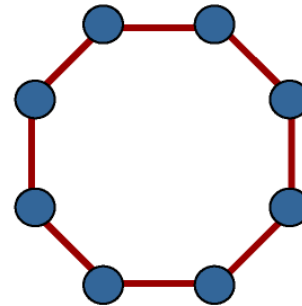
Characteristics of a Network

- Speed
- Cost
- Security
- Availability
- Scalability
- Reliability
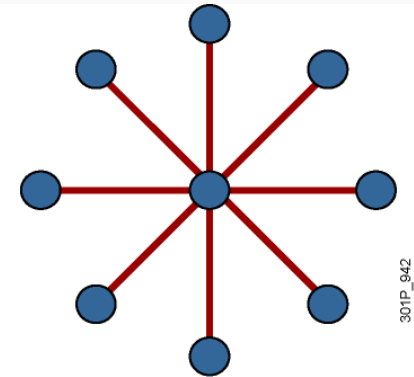- Topology

Network topologies
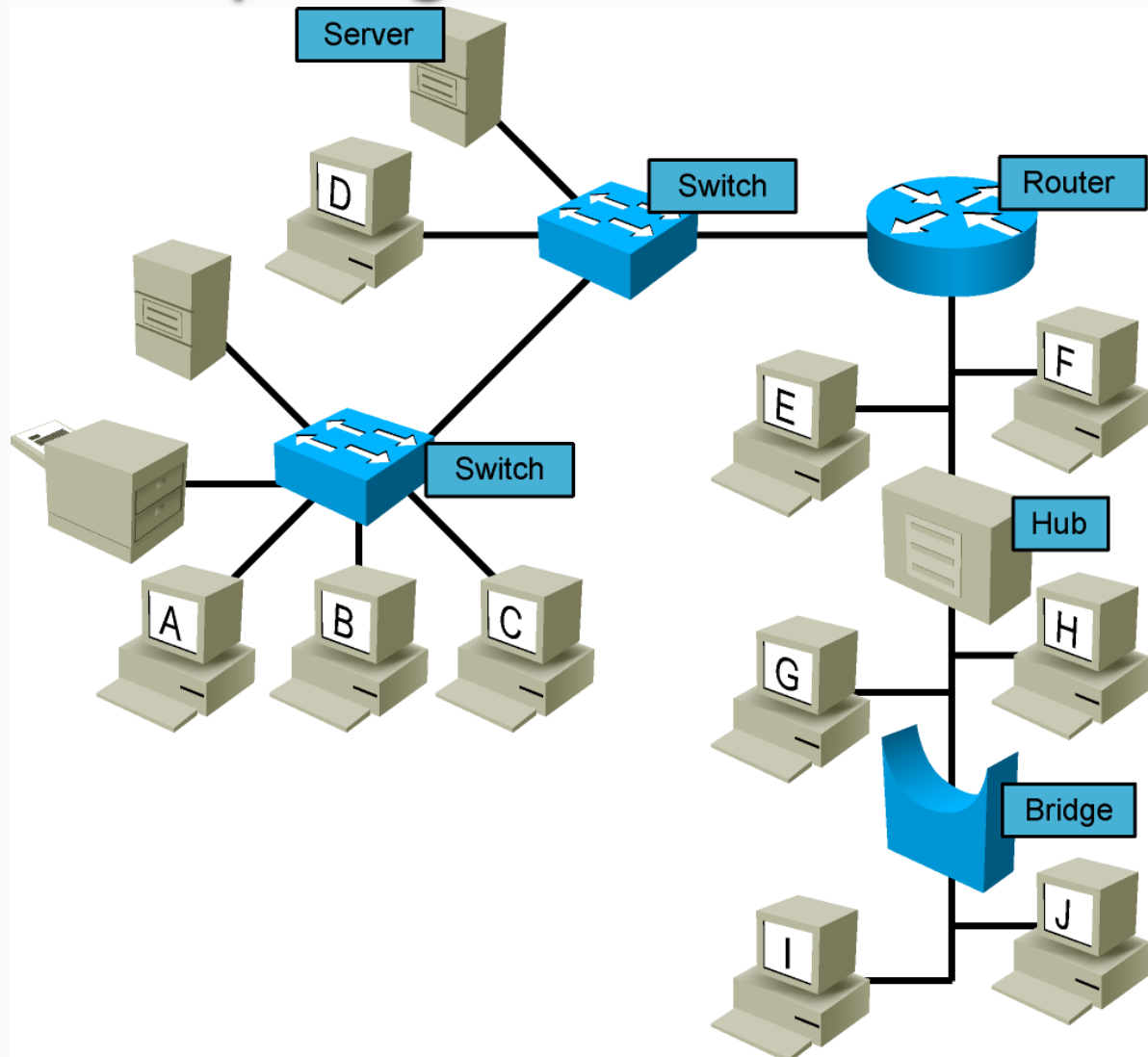
Physical Topology Categories
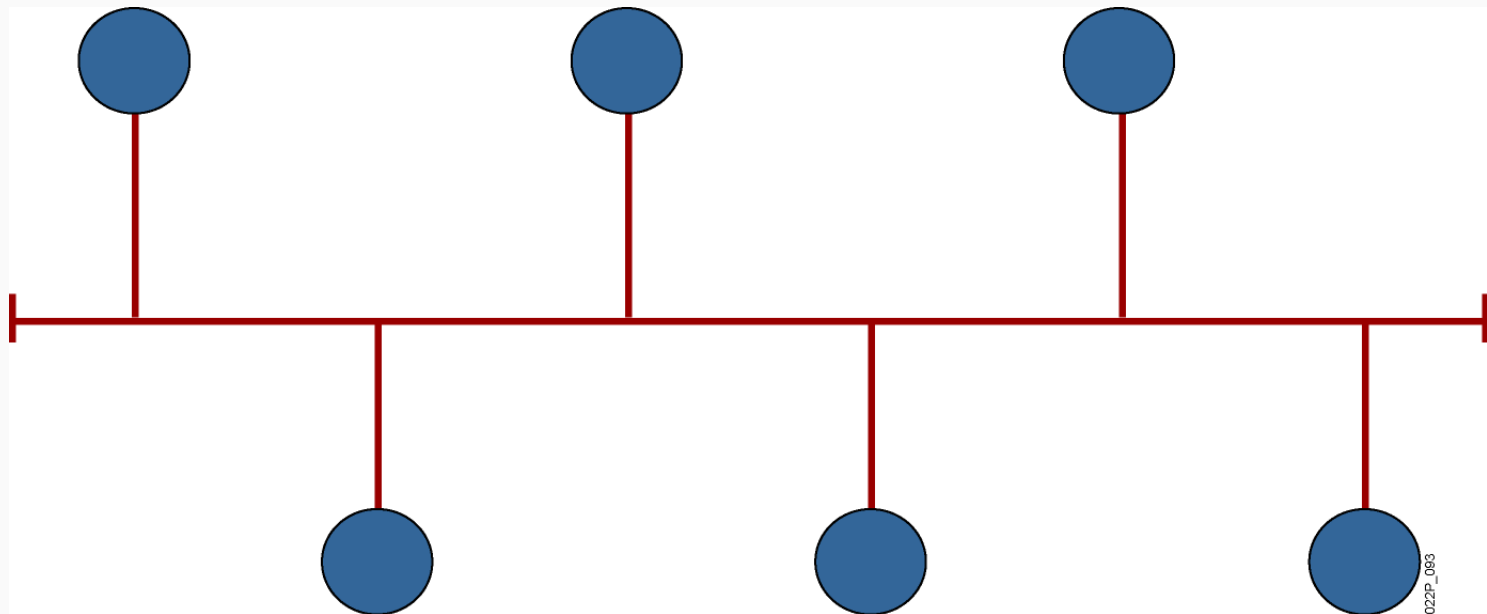

Bus Topology   Ring Topology   Star Topology
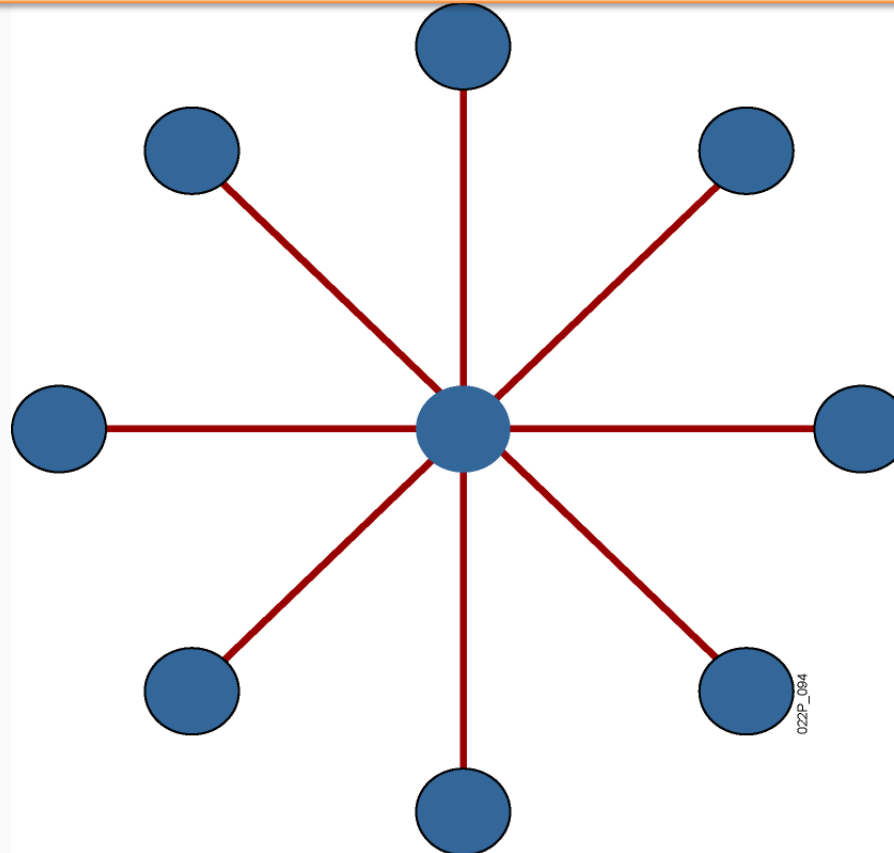
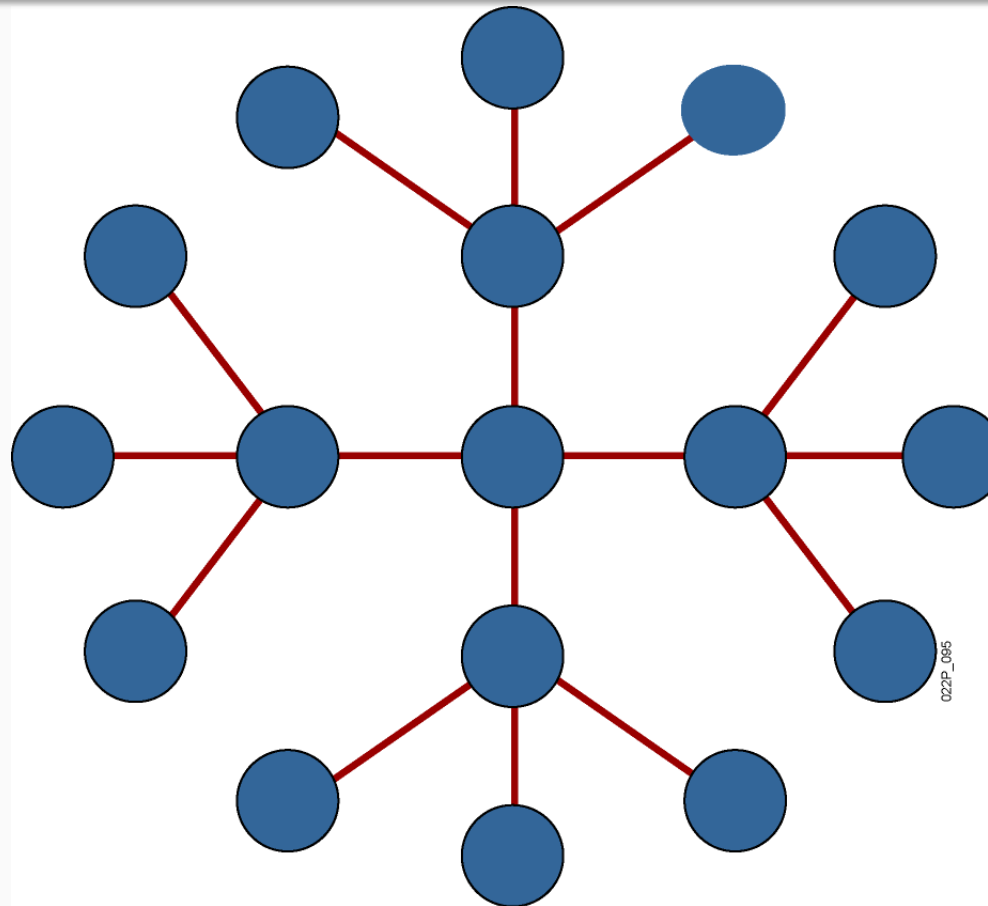# Logical Topologies

Bus Topology

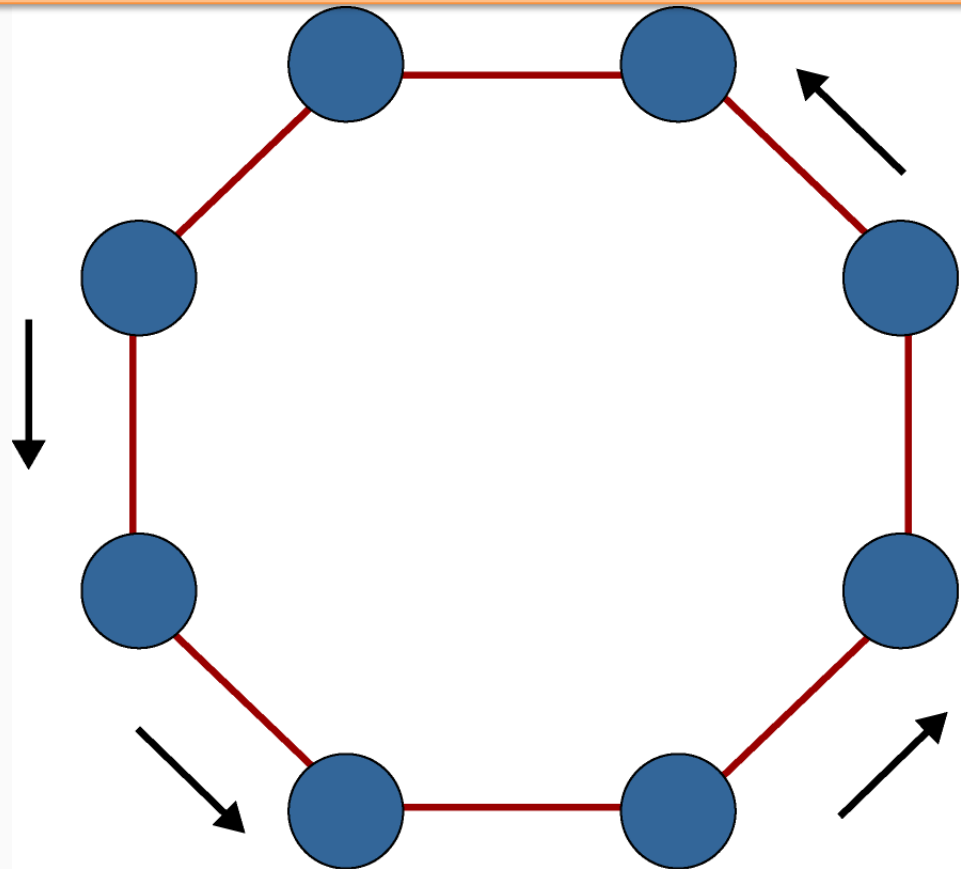– All devices receive the signal.

Star Topology

– Transmission through a central point.
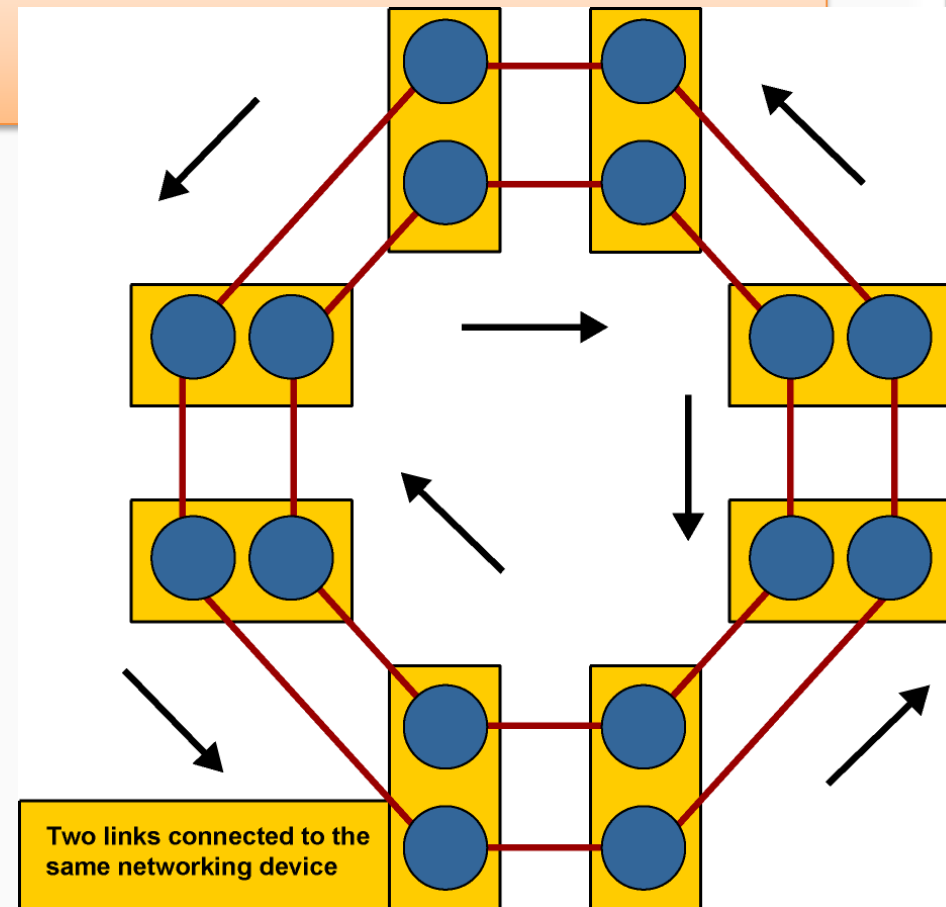– Single point of failure.

Extended-Star Topology

– More resilient than star topology.

Ring Topology

- Signals travel around ring.
- Single point of failure.

Dual-Ring Topology

Two links connected to the same networking device

– Signals travel in opposite directions.
– More resilient than single ring.

Full-Mesh Topology
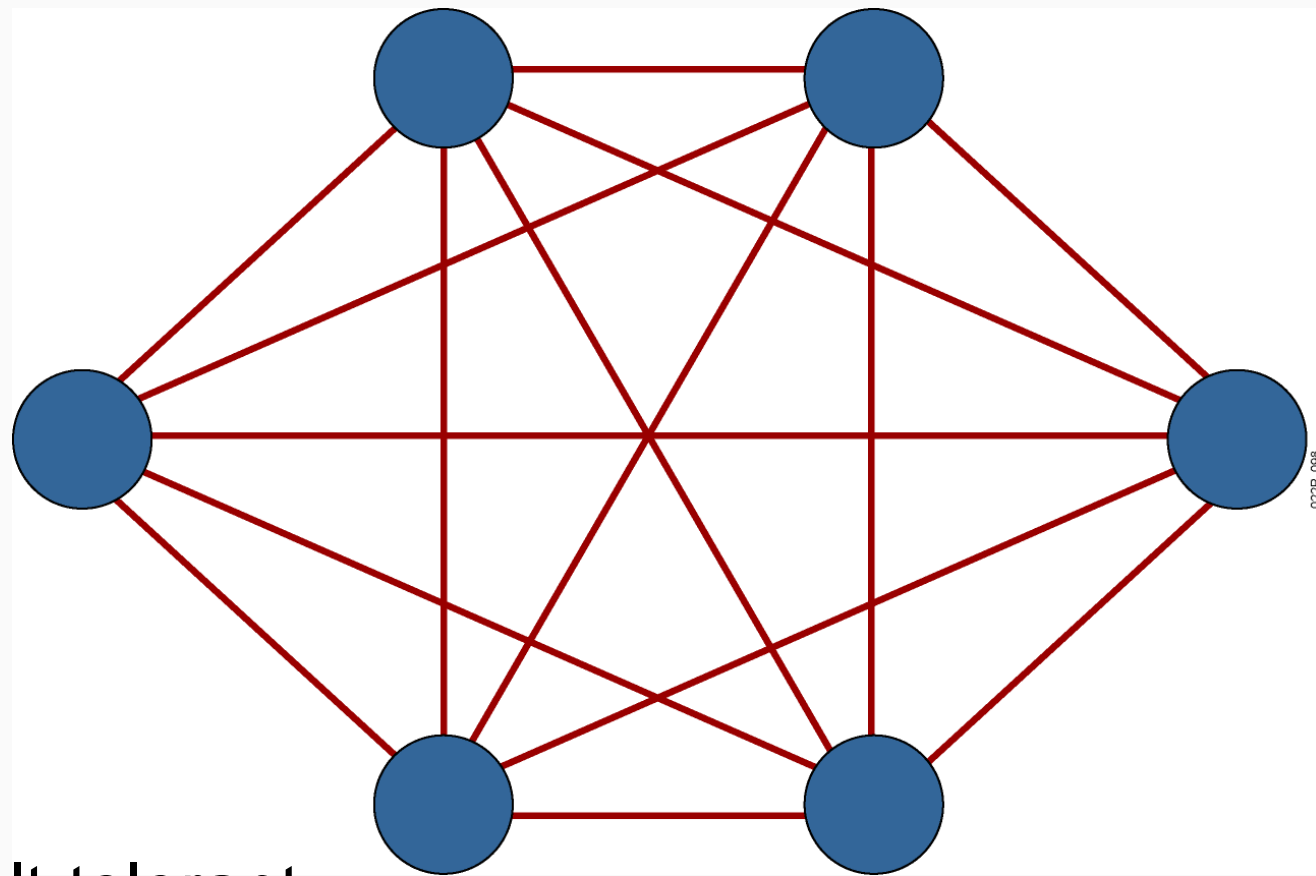
– Highly fault-tolerant
– Expensive to implement

Partial-Mesh Topology

– Trade-off between fault tolerance and cost

Securing the network

Closed Networks

Attacks from inside the network remain a threat.

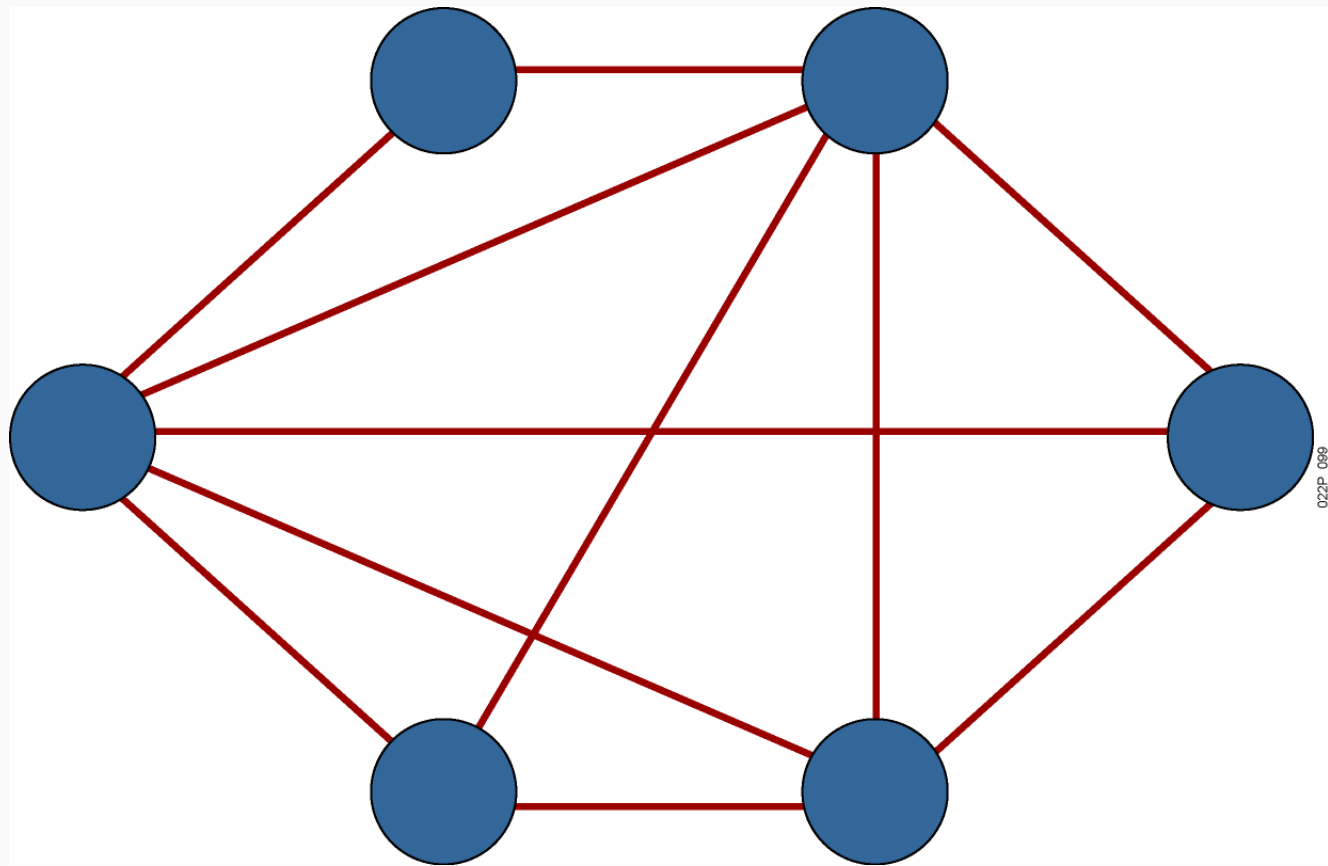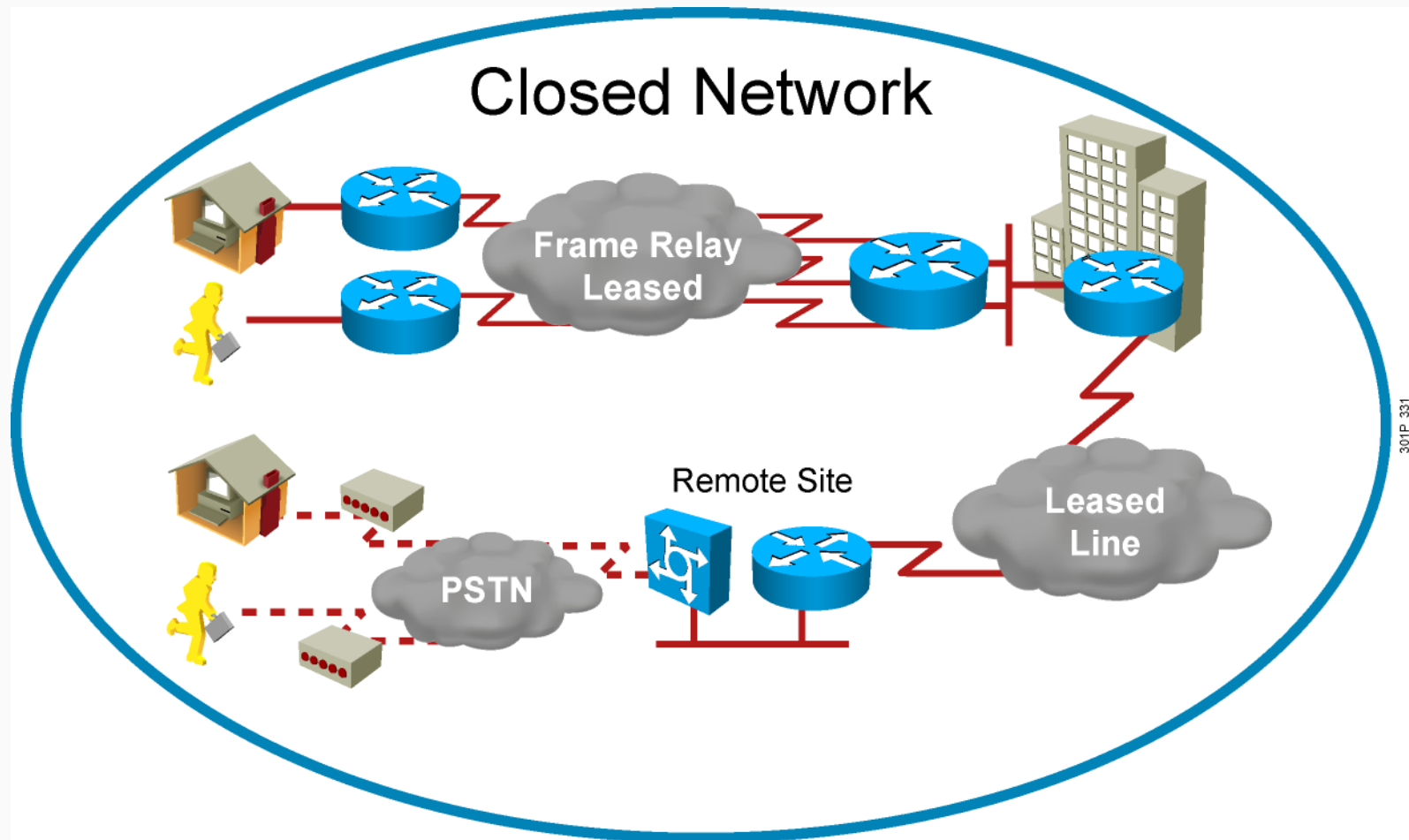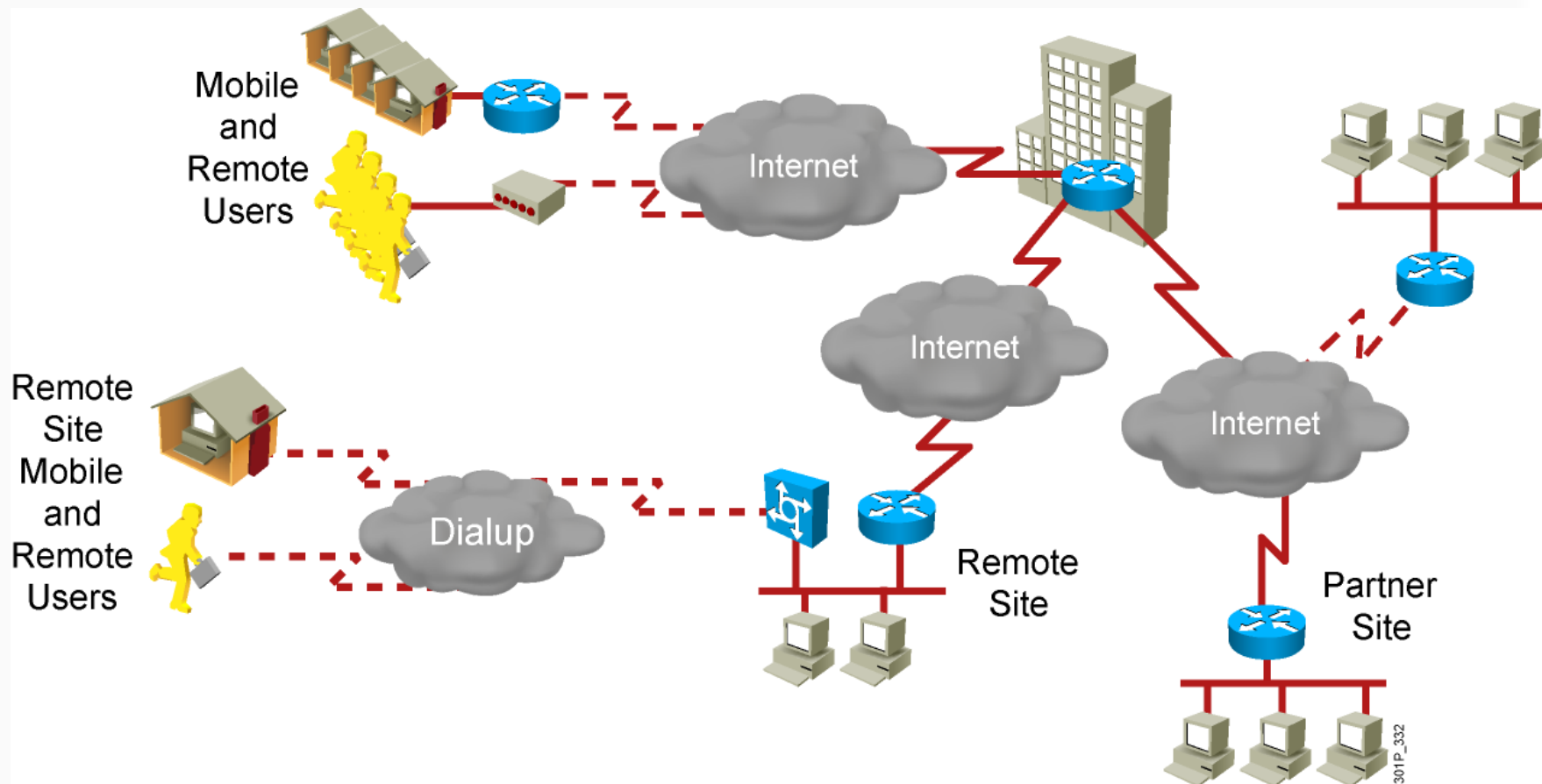# Open Networks

Adversaries, Motivations, and Classes of Attack

Adversaries	Motivations	Classes of Attack
- Nation-states - Terrorists - Criminals - Hackers - Crackers - Competitors "Script kiddies" - Disgruntled employees - Government	- Intelligence - Theft - DoS - Embarrassiment - Challenge	- Passive - Active - Outside - Inside - Distributed

Common Threats

- Physical installations
  - o Hardware threats
  - o Environmental threats
  - o Electrical threats
  - o Maintenance threats
- Reconnaissance attacks—Learning information about a target network by using readily available information and applications
- Access attacks—Attacks on networks or systems for these reasons:
  - o Retrieve data
  - o Gain access
  - o Escalate their access privileges
- Password attacks—Tools used by hackers to compromise passwords

Password Attack Threat Mitigation

Here are password attack threat-mitigation techniques:

- Do not allow users to use the same password on multiple systems.
- Disable accounts after a certain number of unsuccessful login attempts.
- Do not use cleartext passwords.
- Use "strong" passwords; for example, "mY8!Rthd8y" rather than "mybirthday."

Connection to the Internet

Connection to the Internet

- DSL
- Cable TV
  - FTTH
  - Leased Lined
  - 3G, 4G
  - Vệ tinh