Lecture 6

NETWORK & INTERNET

Networking and Internet

Peer-to-peer Network

Peer-to-Peer network

Client/Server Network

Server

Peer-toper vs. Client/Server Network

Peer-toper vs. Client/Server Network

| Peer to Peer	Client/Server
• Easy to set up	• More difficult to set up
• Less expensive to install	• More expensive to install
• Broader range of implementation	• Server must run on an operating system that supports networking
• Time consuming to manage software	• Less time consuming to maintain software
• Low levels of security	• High levels of security are supported
• Ideal for networks with fewer than 10 computers.	• No limit to the number of computers that can be supported
• No server required	• Requires a server
• Moderate level of skill to administer	• Network administrator needs high level of IT skills.

Networking

Computer network A collection of computing devices that are connected in various ways in order to communicate and share resources

Usually, the connections between computers in a network are made using **physical wires** or **cables**

However, some connections are **wireless**, using **radio waves** or **infrared signals**
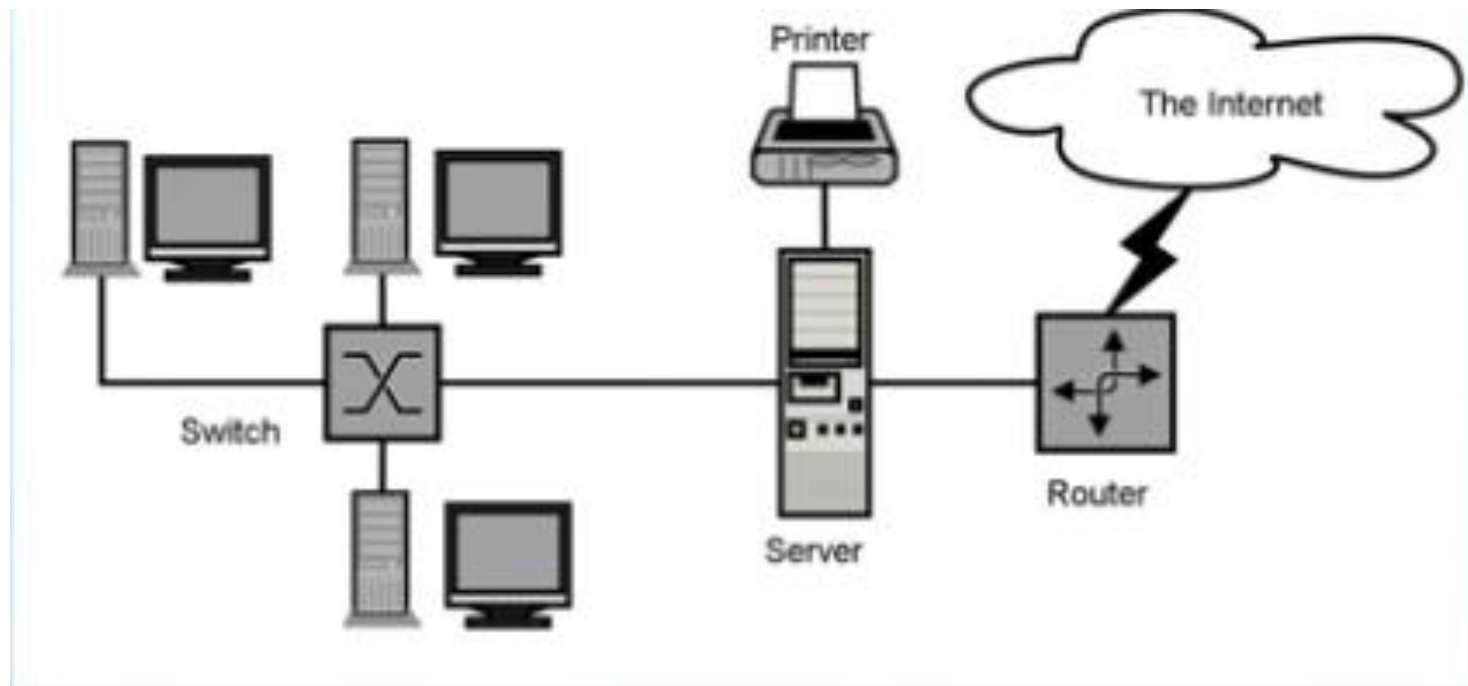
Basic Telecom Model

Computer		Computer

Channel interface	Communication Channel	Channel interface
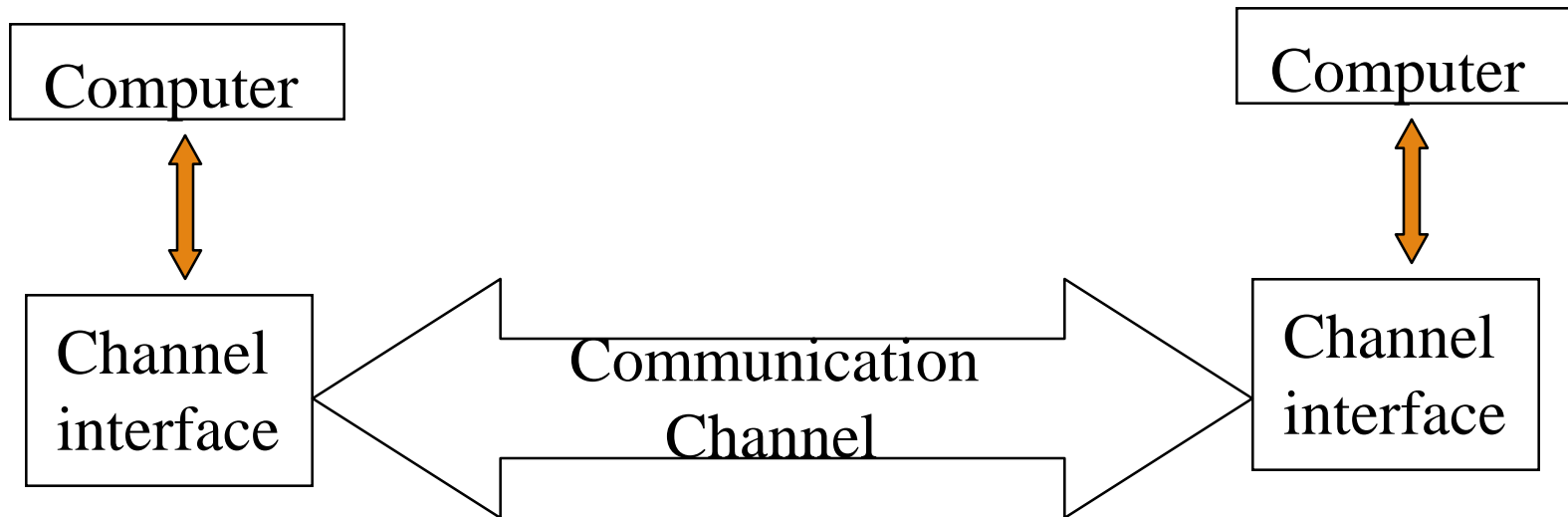
Basic Computer Components

Basic Computer Components

- At least two computers
- Cables that connect computers (if not wireless)
- A network interface card
- A switch to switch data from on point to the other
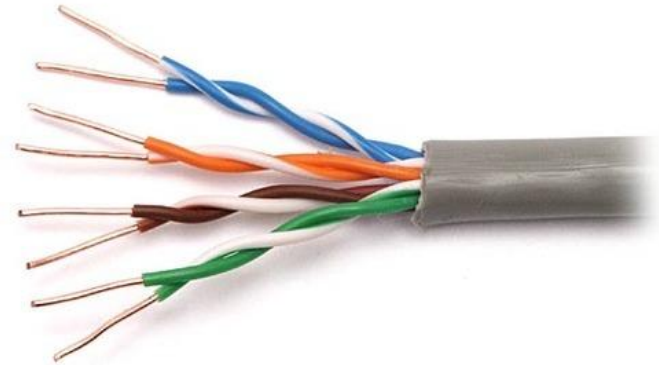- Network operating system software

Cables/Channels

❑ Twisted wire (twisted pair)

❑ Coaxial Cable

❑ Fiber Optics

❑ Newer Wireless

Twisted Pair

- Low cost

- easy to work with

- installed infrastructure

- 300bps to 100Mbps

"This modem is 56Kbps capable. However, current regulations limit download speeds to 53Kbps," the fine print from a typical modem advertisement.

DSL

- Uses existing twisted pair

- 256Kbps to 40Mbps

  More correctly ADSL (Asymmetric Digital Subscriber Line) with download speeds different from upload speeds.
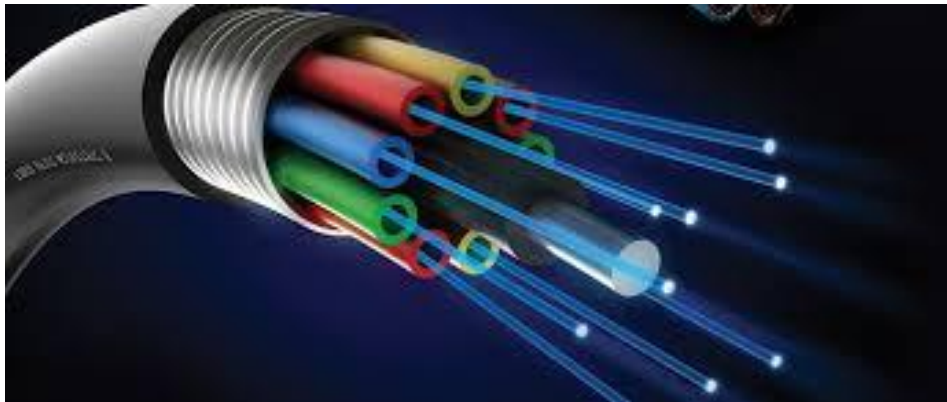
Coaxial Cable

- More expensive

- harder to work with

- not as extensive an existing infrastructure
  - cable TV companies are changing this

- 56Kbps to 550Mbps

Fiber Optics

- Very expensive

- difficult to work with existing infrastructure limit to backbones

- 500Kbps to 30Gbps

Newer Wireless

◦ Cellular

◦ mobile data networks

◦ personal communications services (PCS)

Network Interface Card(NIC)

A NIC is also known as a network card. It connects the computer to the cabling, which in turn links all of the computers on the network together. However, in new installations switches should be used instead of hubs as they are more effective and provide better performance.

HUB

Hub

DATA IS COPIED TO ALL OTHER PORTS
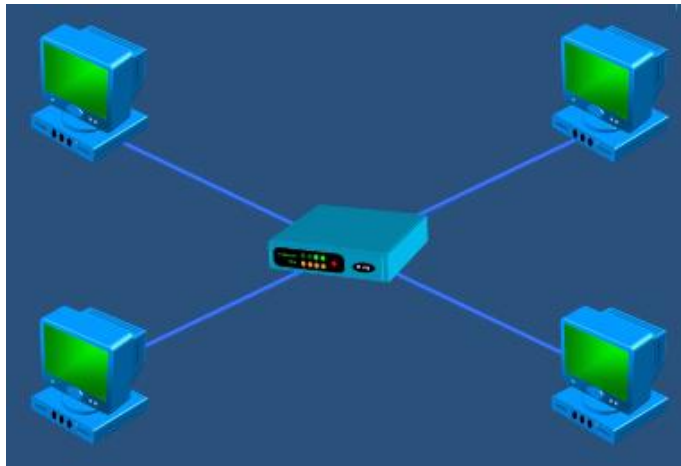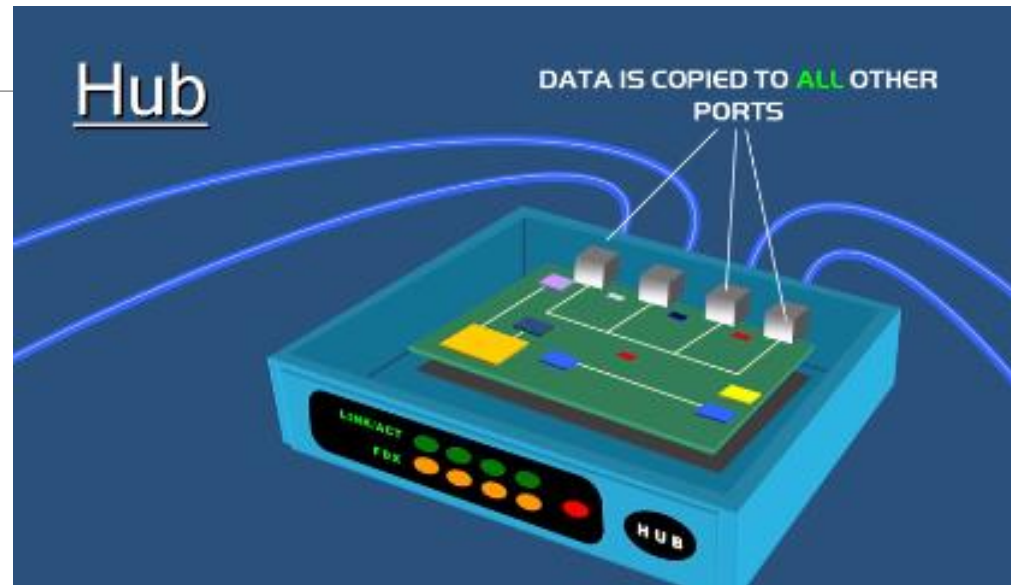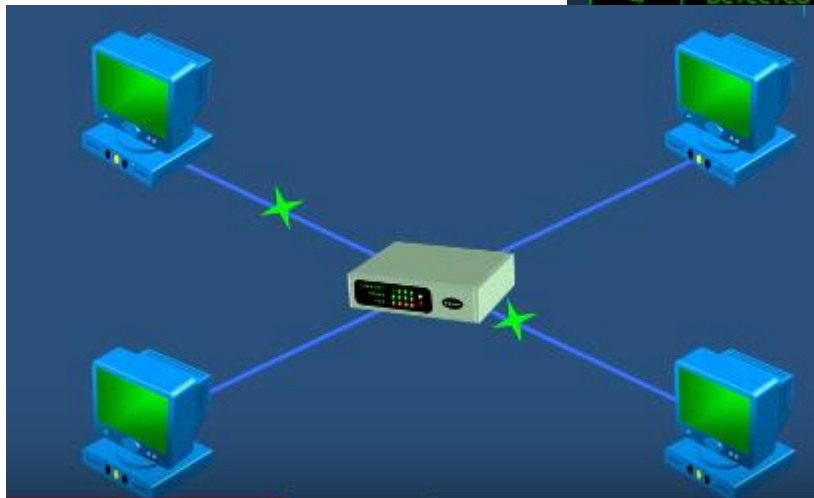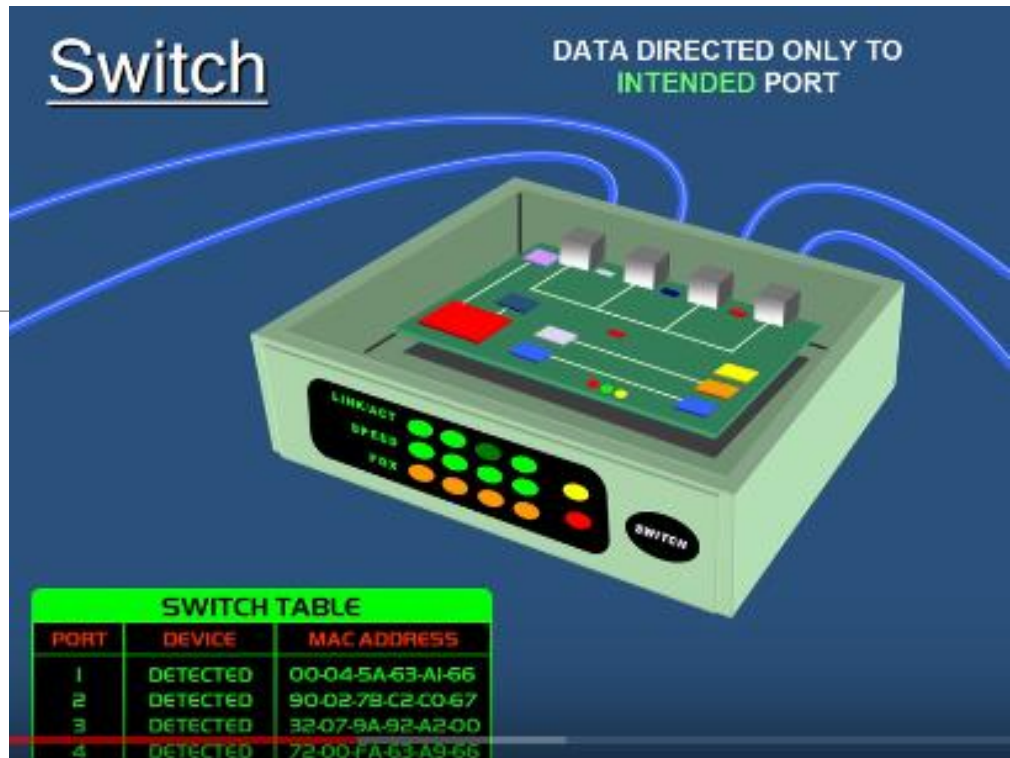
Switch

HUB/SWITCH

HUB

Only detects that a device is physically connected to it.

SWITCH

Can detect specific devices that are connected to it.

Keeps a record of the MAC addresses of those devices

HUB/SWITCH

Hubs and Switches are used to exchange data within a local area network.

Not used to exchange data outside their own network.

To exchange data outside their own network, a device needs to be able to read I.P. addresses.

ROUTER

The router is the gateway of a network.

ROUTER

Routes data from one network to another based on their IP address.

HUB/SWITCH/ROUTER

Hubs & Switches are used to create networks.

Routers are used to connect networks.

Client/Server Networking

Computer networks have opened up an entire frontier in the world of computing called the **client/server model**
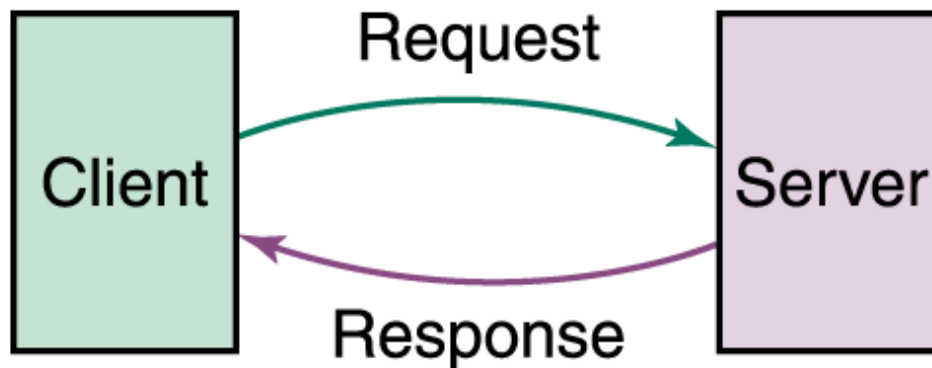
Client/Server interaction

Networking

The generic term **node** or **host** refers to any device on a network

File server A computer that stores and manages files for multiple users on a network

Web server A computer dedicated to responding to requests (from the browser client) for web pages

Transmission Speed

❑**Data transfer rate**   The speed with which data is moved from one place on a network to another

❑Data transfer rate is a key issue in computer networks

❑BPS, *bits-per-second*, the amount of information that can be transmitted through a channel

❑Bandwidth = *range of frequencies that a channel* can support (difference between highest and lowest frequency).

❑Greater range means greater bandwidth.

❑Greater bandwidth means greater transmission capacity.
  ◦ 56K modem   0.056 Mbps
  ◦ ADSL   40   Mbps
  ◦ Cable Modem   50   Mbps

Types of Networks

Local-area network (LAN) A network that connects a relatively small number of machines in a relatively close geographical area

Wide-area network (WAN) A network that connects two or more local-area networks over a potentially large geographic distance

Metropolitan-area network (MAN) The communication infrastructures that have been developed in and around large cities
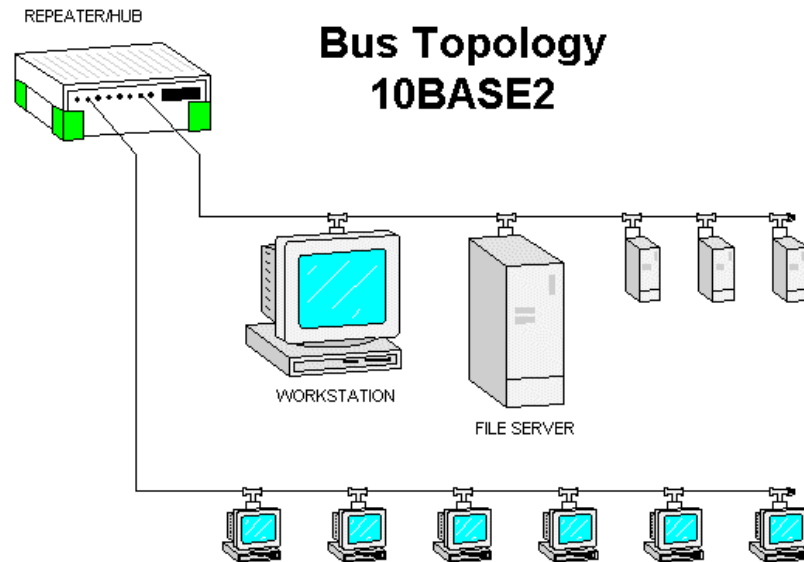
❑Often one particular node on a LAN is set up to serve as a **gateway** to handle all communication going between that LAN and other networks Communication between networks is called internetworking

The **Internet,** as we know it today, is essentially the ultimate wide-area network, spanning the entire globe
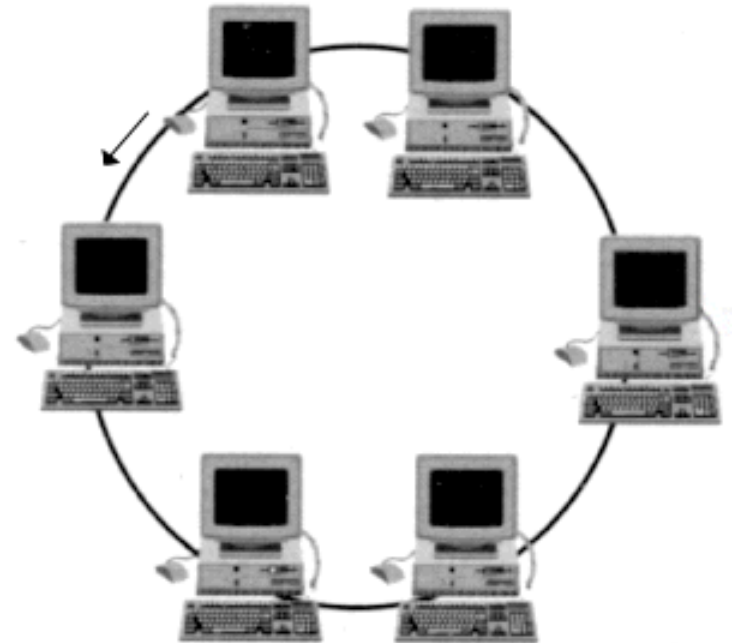
Network Physical Topology

Bus Topology

"A bus topology uses a single backbone segment (length of cable) that all the hosts connect to directly."

Ring Topology
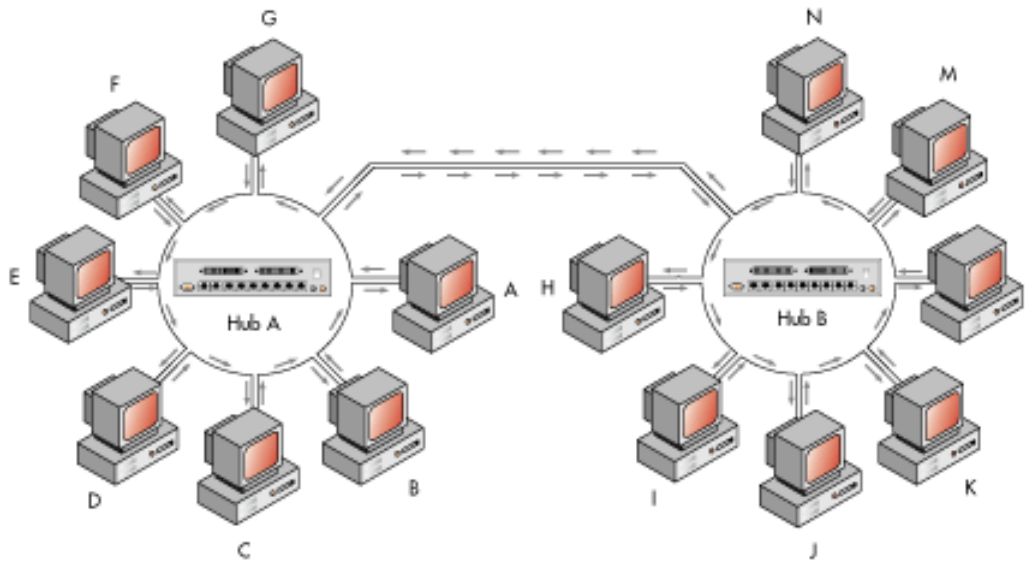
"A ring topology connects one host to the next and the last host to the first. This creates a physical ring of cable."

Star Topology
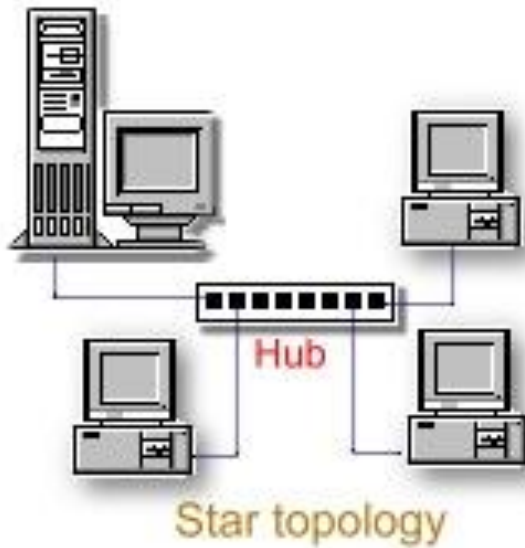
Star topology

"A star topology connects all cables to a central point of concentration. This point is usually a hub or switch, which will be described later in the chapter."

Extended Star Topology
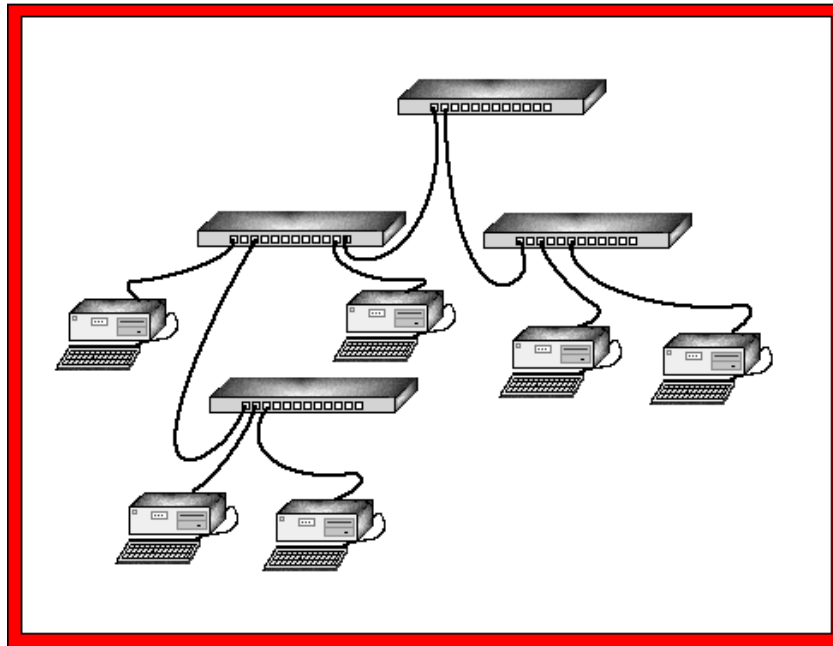
"An extended star topology uses the star topology to be created. It links individual stars together by linking the hubs/switches. This, as you will learn later in the chapter, will extend the length and size of the network."

Network Physical Topology

Hierarchical

◦ Similar to extended star

◦ Links star LANs to a computer that controls network traffic
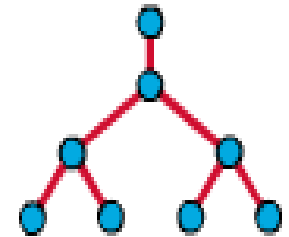
Hierarchical
Topology

Mesh

◦ Each host is connected to all other hosts

◦ No breaks, ever!
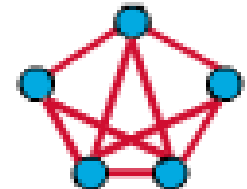
Mesh
Topology

So, who owns the Internet?

Well, nobody does. No single person or company owns the Internet or even controls it entirely.

As a wide-area network, it is made up of many smaller networks.

These smaller networks are often owned and managed by a person or organization.

The Internet, then, is really defined by how connections can be made between these networks.

World Wide Web

Set of standards for storing, retrieving, formatting, and displaying information using a client/server architecture

Hypertext markup Language (HTML)

browser

search engines

Types of Networks
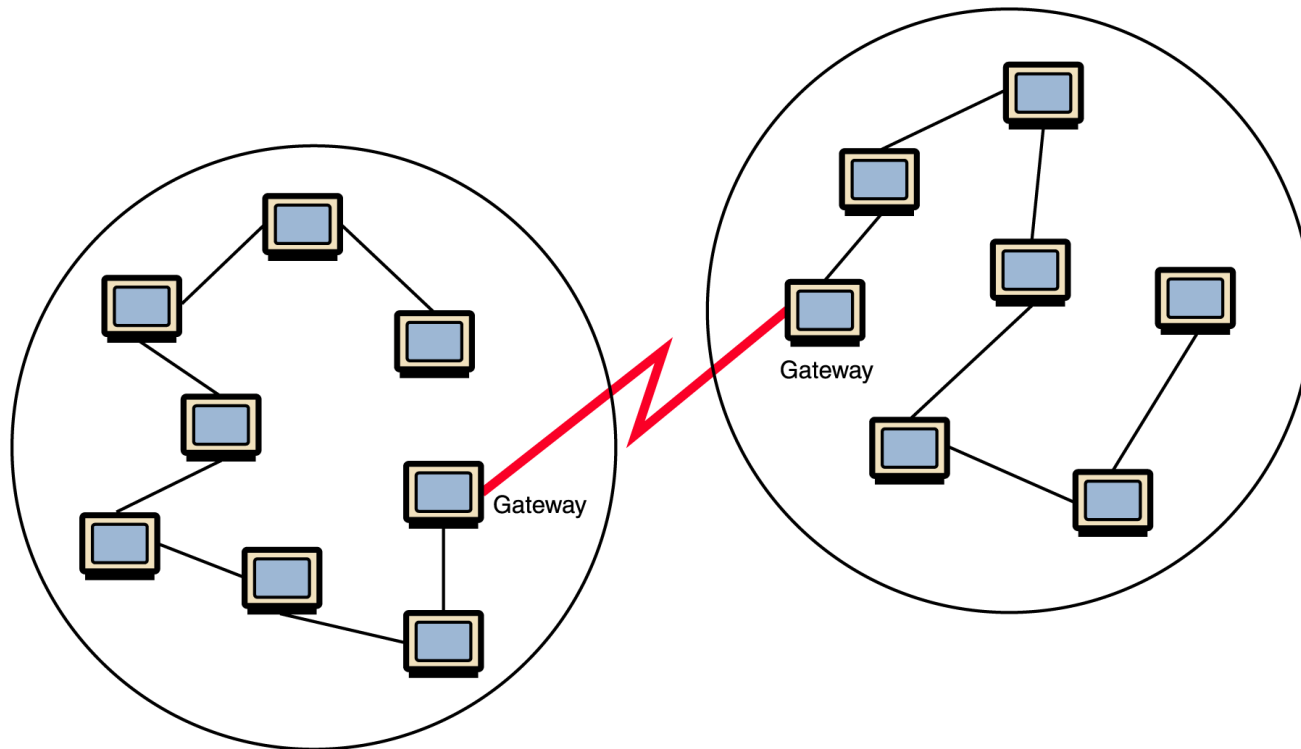
Local-area networks connected across a distance to create a wide-area network

Internet Connections

Internet backbone A set of high-speed networks that carry Internet traffic

These networks are provided by companies such as IBM

Internet service provider (ISP) A company that provides other companies or individuals with access to the Internet

Internet Connections

There are various technologies available that you can use to connect a home computer to the Internet

- ◦ A **phone modem** converts computer data into an analog audio signal for transfer over a telephone line, and then a modem at the destination converts it back again into data

- ◦ A **digital subscriber line** **(DSL)** uses regular copper phone lines to transfer digital data to and from the phone company's central office

- ◦ A **cable modem** uses the same line that your cable TV signals come in on to transfer the data back and forth

Internet Connections
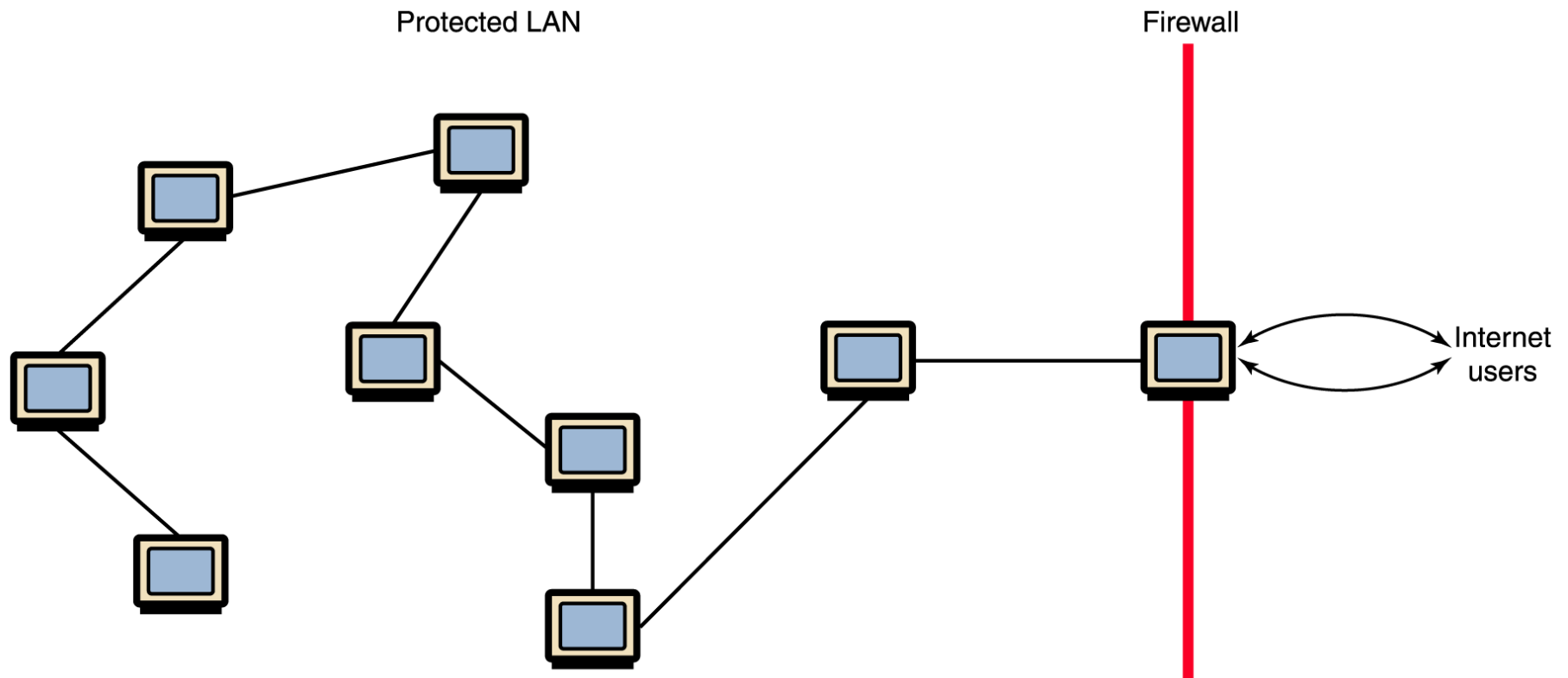
Broadband A connection in which transfer speeds are faster than 128 bits per second

- ◦ DSL connections and cable modems are broadband connections

- ◦ The speed for **downloads** (getting data from the Internet to your home computer) may not be the same as **uploads** (sending data from your home computer to the Internet)

Firewalls

Figure 15.8 A firewall protecting a LAN

Firewalls

Firewall A machine and its software that serve as a special gateway to a network, protecting it from inappropriate access

◦ Filters the network traffic that comes in, checking the validity of the messages as much as possible and perhaps denying some messages altogether

◦ Enforces an organization's **access control policy**

Network Addresses

Hostname A unique identification that specifies a particular computer on the Internet

For example

matisse.csc.villanova.edu

condor.develocorp.com

Network Addresses

Network software translates a hostname into its corresponding IP address
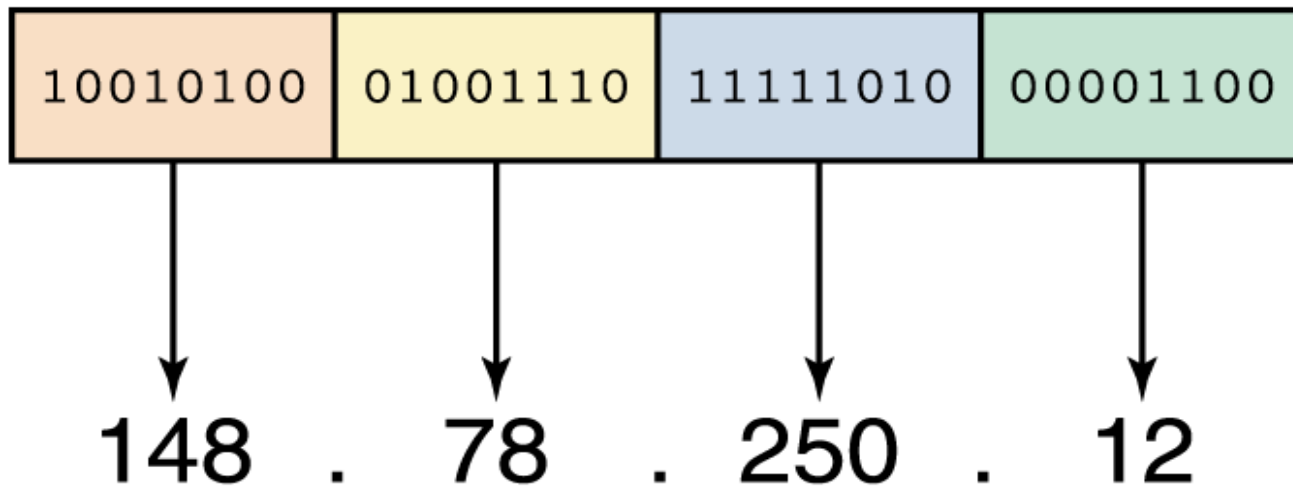
For example
   205.39.145.18

Network Addresses

An **IP address** can be split into

- ◦ **network address**, which specifies a specific network
- ◦ **host number**, which specifies a particular machine in that network

| 10010100 | 01001110 | 11111010 | 00001100 |

148 . 78 . 250 . 12

Figure 15.9
An IP address is stored in four bytes

Domain Name System

A hostname consists of the computer name followed by **the domain name**

csc.villanova.edu is the domain name

◦ A domain name is separated into two or more sections that specify the organization, and possibly a subset of an organization, of which the computer is a part

◦ Two organizations can have a computer named the same thing because the domain name makes it clear which one is being referred to

Domain Name System

The very last section of the domain is called its **top-level domain (TLD)** name

Top-Level Domain	General Purpose	New TLDs	General Purpose
.com	U.S. Commercial	.biz	Business
.net	Network	.info	Information
.org	Nonprofit organization	.pro	Professional
.edu	U.S. Educational	.museum	Museums
.int	International	.aero	Aerospace industry
.mil	U.S. Military	.coop	Cooperative
.gov	U.S. Government		

Figure 15.10 **Top-level domains, including some relatively new ones**

Domain Name System

Organizations based in countries other than the United States use a top-level domain that corresponds to their two-letter country codes

Country Code TLD	Country
.au	Australia
.br	Brazil
.ca	Canada
.gr	Greece
.in	India
.ru	Russian Federation
.uk	United Kingdom

Some of the top-level domain names based on country codes

Domain Name System

The **domain name system** (DNS) is chiefly used to translate hostnames into numeric IP addresses

- ◦ DNS is an example of a distributed database

- ◦ If that server can resolve the hostname, it does so

- ◦ If not, that server asks another domain name server

Internet Capabilities

Communications
- E-mail
- Usenet
- Chatting
- Telnet

- Information Retrieval