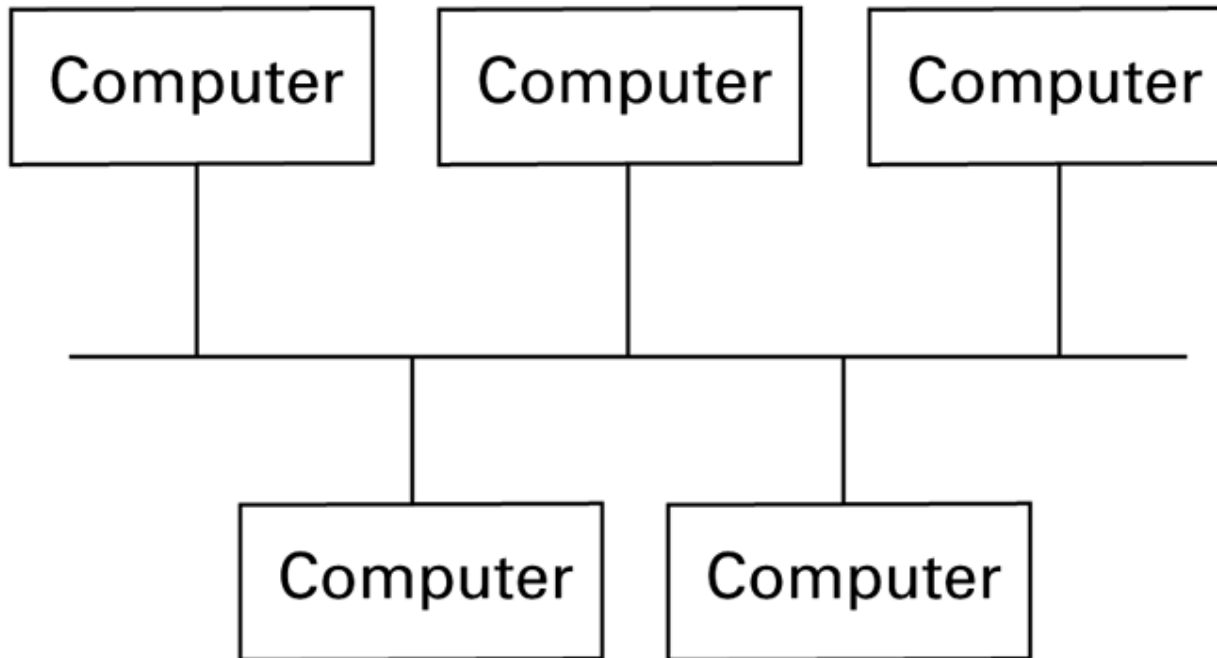


# Network Classifications

- Scope
  - Local area network (LAN)
  - Metropolitan area (MAN)
  - Wide area network (WAN)
- Ownership
  - Closed versus open
- Topology (configuration)
  - Bus (Ethernet)
  - Star (Wireless networks with central Access Point)

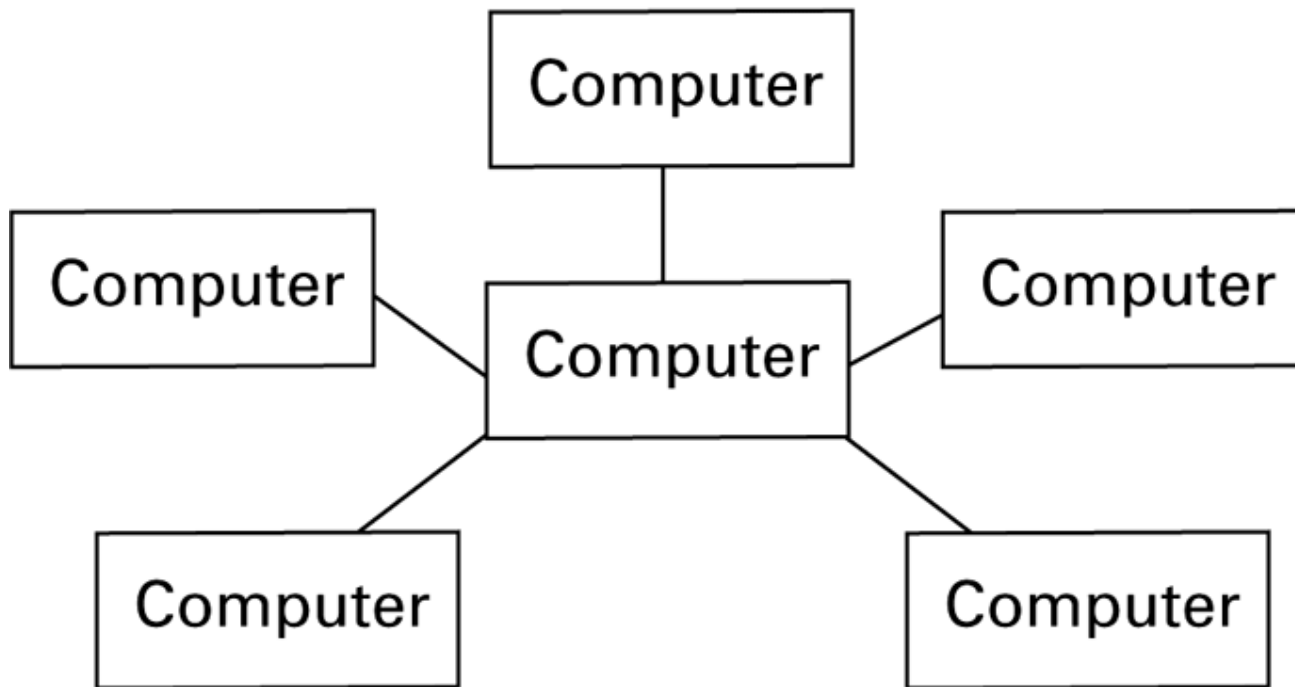
# Figure 4.1 Network topologies

## a. Bus



# Figure 4.1 Network topologies (continued)

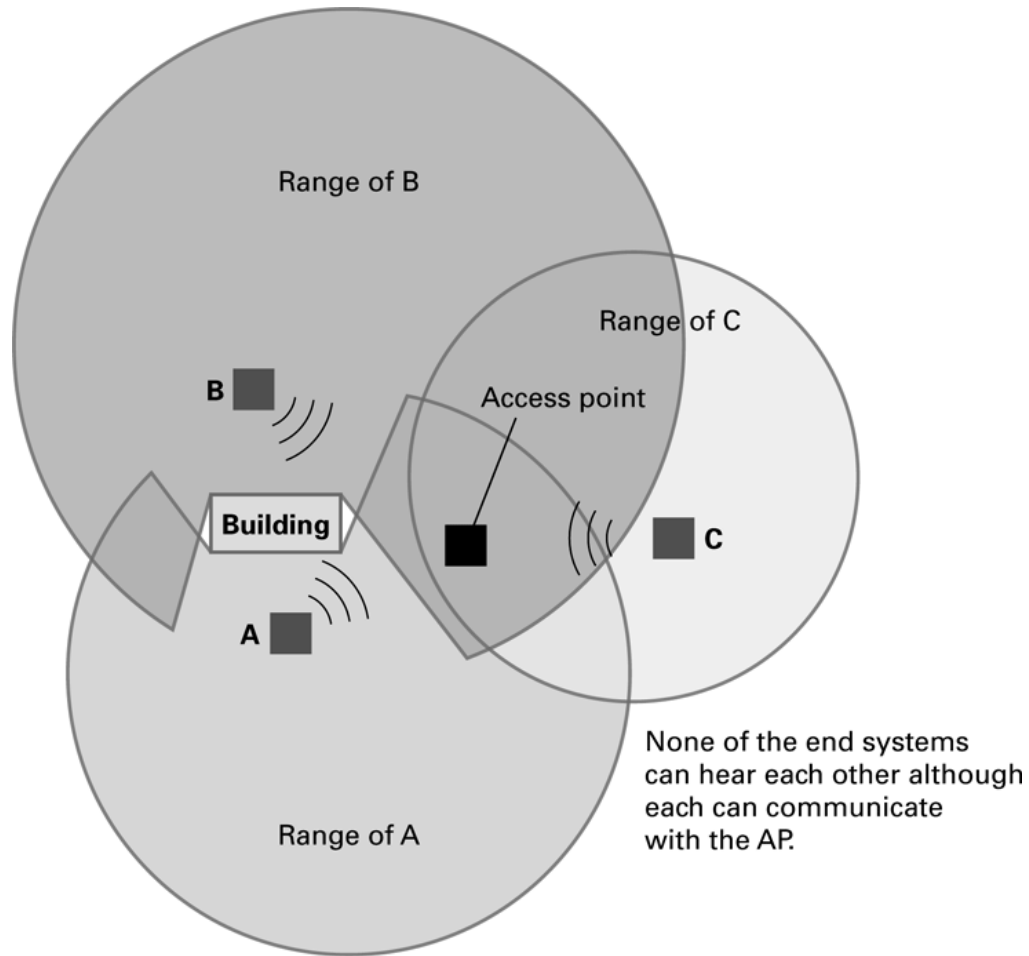
## b. Star



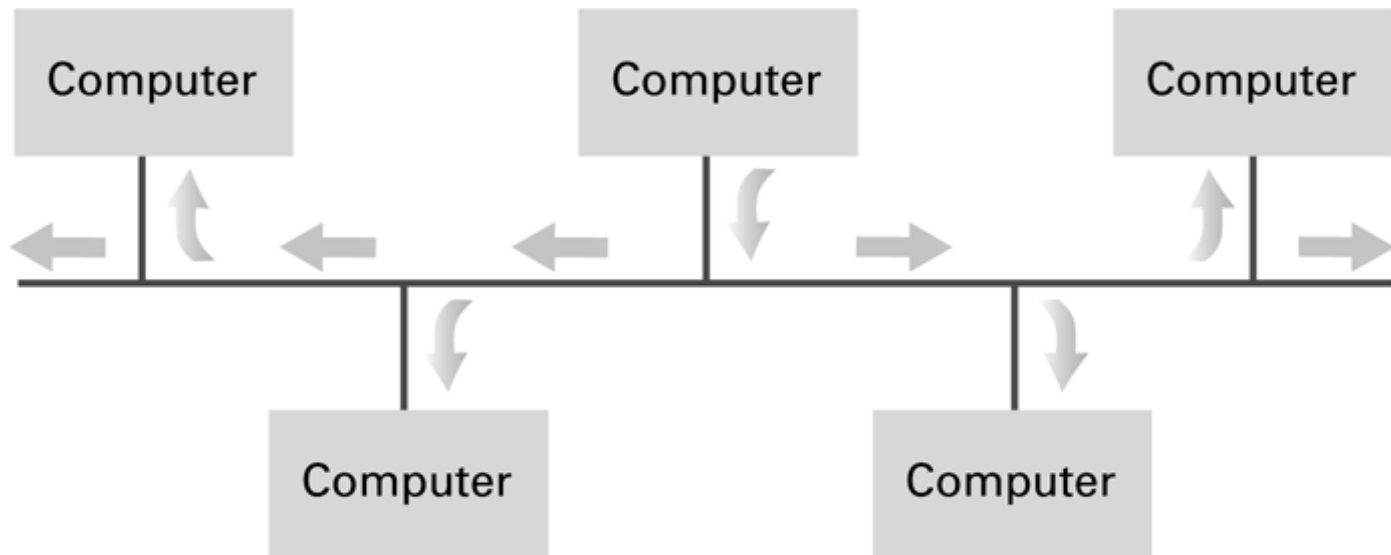
# Protocols

- CSMA/CD (Carrier Sense Multiple Access With Collision Detection)
  - Used in Ethernet
  - Silent bus provides right to introduce new message
- CSMA/CA (Carrier sense multiple access with collision avoidance)
  - Used in Wi-Fi
  - Hidden terminal problem

# The hidden terminal problem



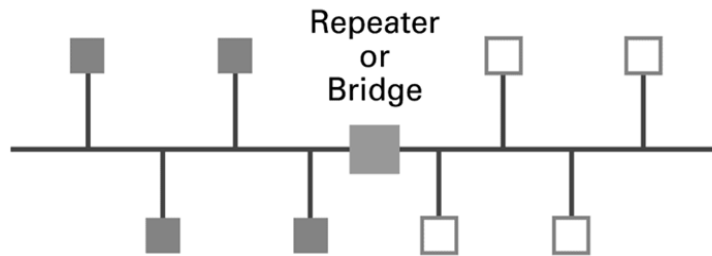
# Communication over a bus network



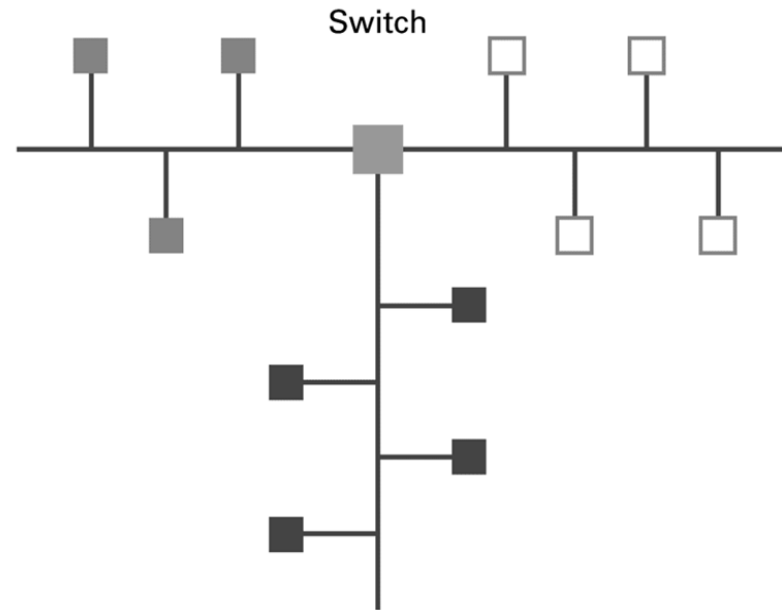
# Connecting Networks

- **Repeater:** Extends a network
- **Bridge:** Connects two compatible networks
- **Switch:** Connects several compatible networks
- **Router:** Connects two incompatible networks resulting in a network of networks called an **internet**

# Figure 4.4 Building a large bus network from smaller ones



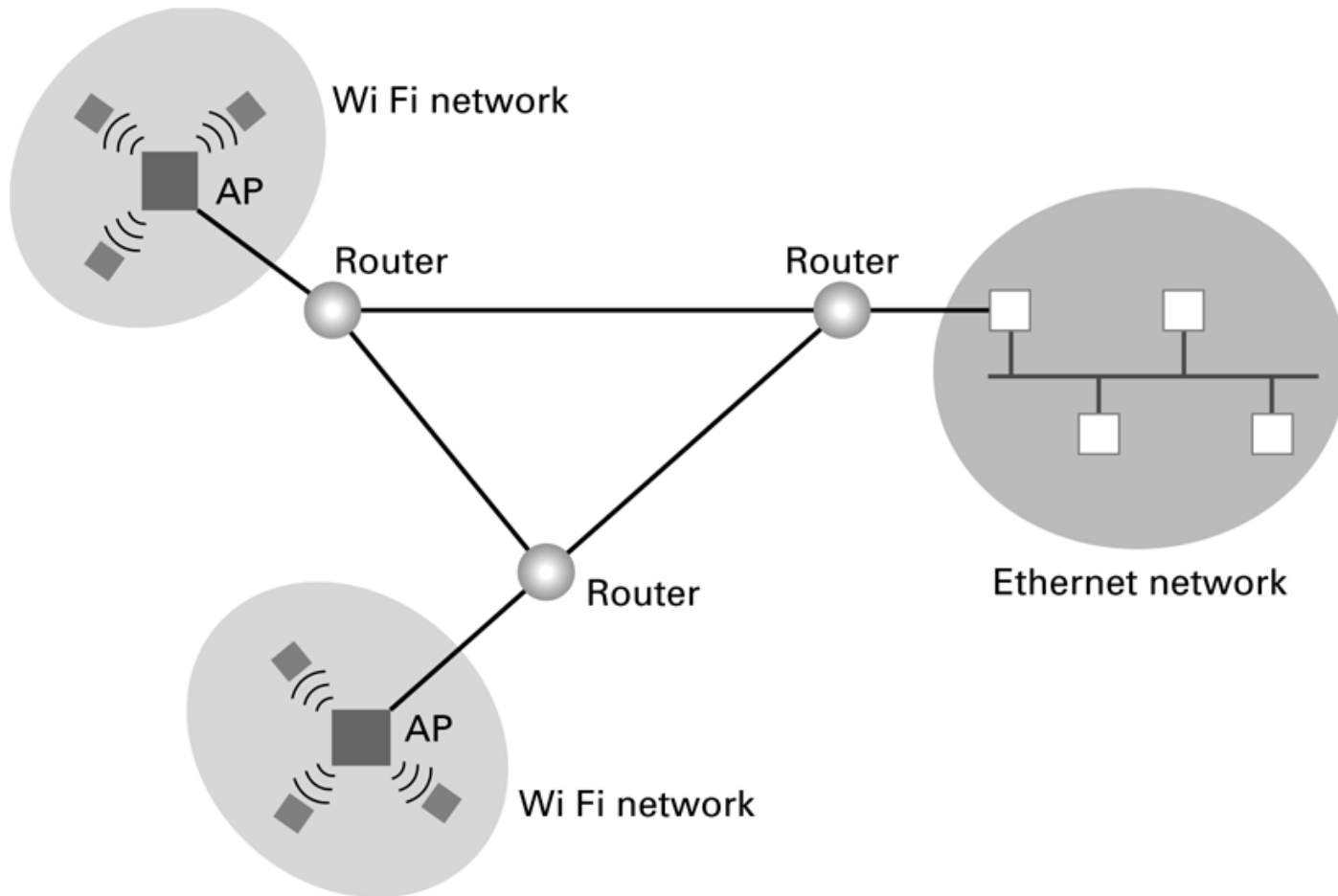
a. A repeater or bridge connecting two buses



b. A switch connecting multiple buses



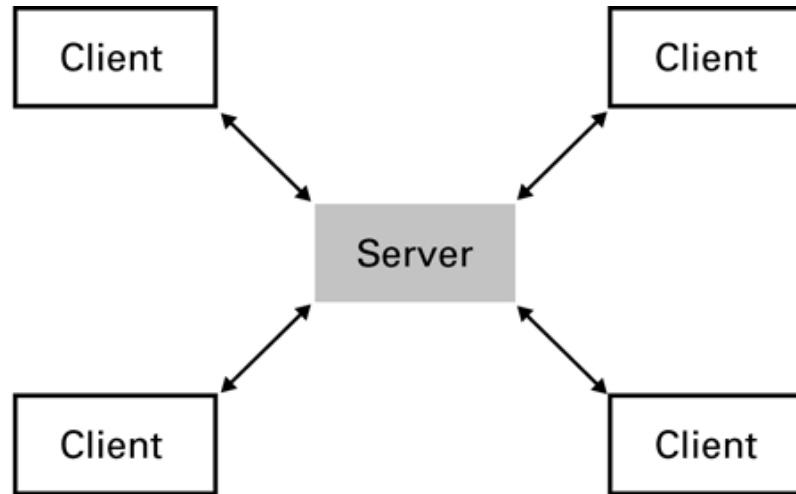
# Routers connecting two Wi-Fi networks and an Ethernet network to form an internet



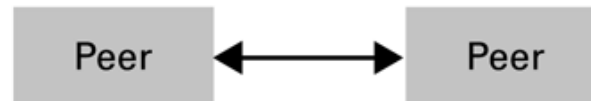
# Inter-process Communication

- Client-server
  - One server, many clients
  - Server must execute continuously
  - Client initiates communication
- Peer-to-peer (P2P)
  - Two processes communicating as equals
  - Peer processes can be short-lived

# The client/server model compared to the peer-to-peer model



**a.** Server must be prepared to serve multiple clients at any time.



**b.** Peers communicate as equals on a one-to-one basis.

# Distributed Systems

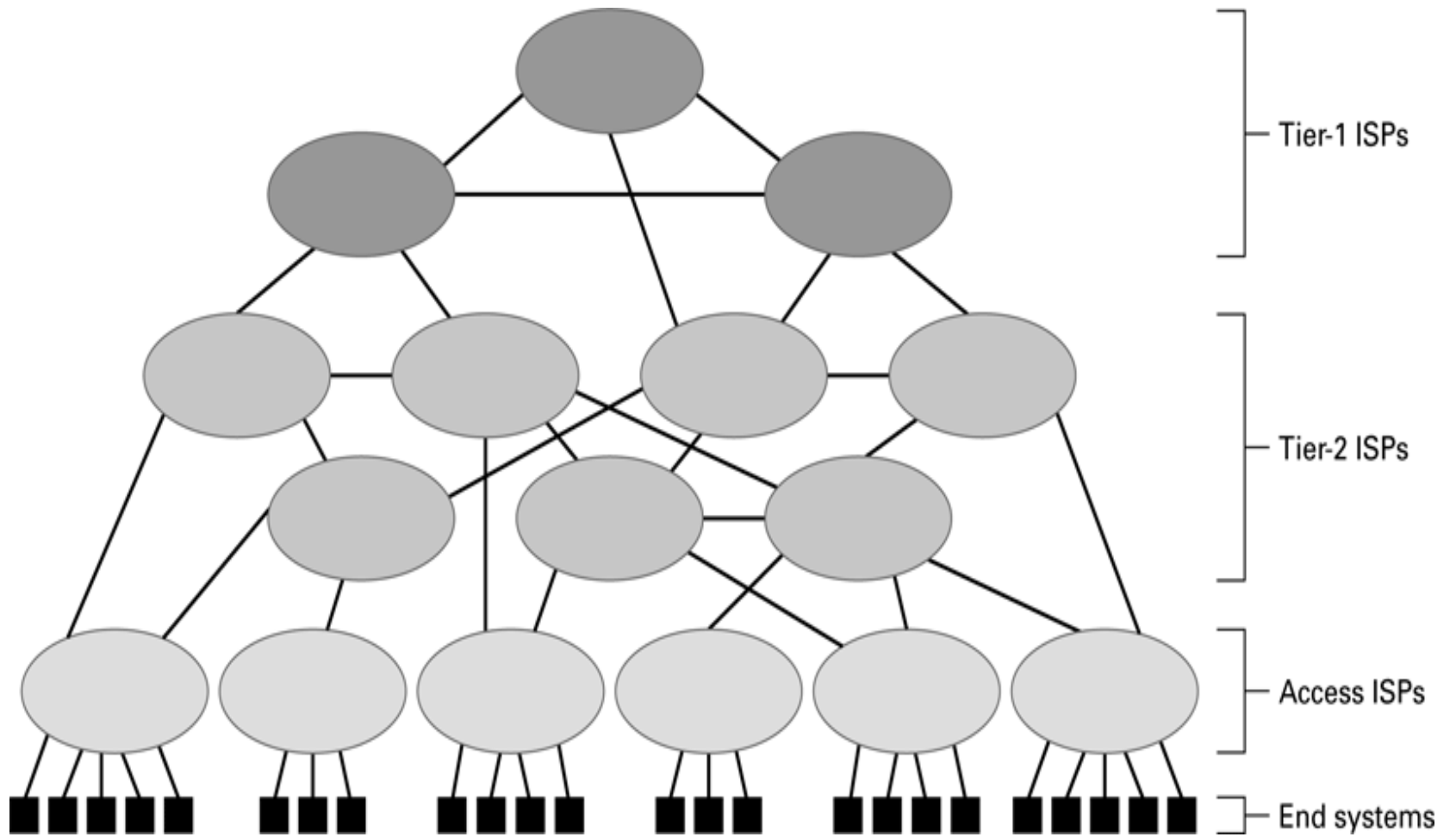
- Systems with parts that run on different computers
  - Infrastructure can be provided by standardized toolkits
    - Example: Enterprise Java Beans from Oracle
    - Example: .NET framework from Microsoft

# The Internet

- The Internet: An internet that spans the **world**
  - Original goal was to develop a means of connecting networks that would not be disrupted by local disasters.
  - Today it has shifted from an academic research project to a commercial undertaking.

# Internet Architecture

- Internet Service Provider (ISP)
  - Tier-1
  - Tier-2
- Access ISP: Provides connectivity to the Internet
  - Traditional telephone (dial up connection)
  - Cable connections
  - DSL
  - Wireless



# Internet Addressing

- IP address:
  - pattern of 32 or 128 bits often represented in dotted decimal notation
- Mnemonic address:
  - Domain names
  - Top-Level Domains
- Domain name system (DNS)
  - Name servers
  - DNS lookup



# Internet Corporation for Assigned Names & Numbers (ICANN)

- Allocates IP addresses to ISPs who then assign those addresses within their regions.
- Oversees the registration of domains and domain names.

İnternet Tahsisli  
Sayılar ve İsimler  
Kurumu

İnternet Tahsisli Sayılar ve İsimler Kurumu, internetin iş dünyası, teknik, akademik ve kullanıcı gruplarının geniş katılımıyla oluşturulmuş kâr amacı gütmeyen bir özel sektör kuruluşudur. [Vikipedi](#)

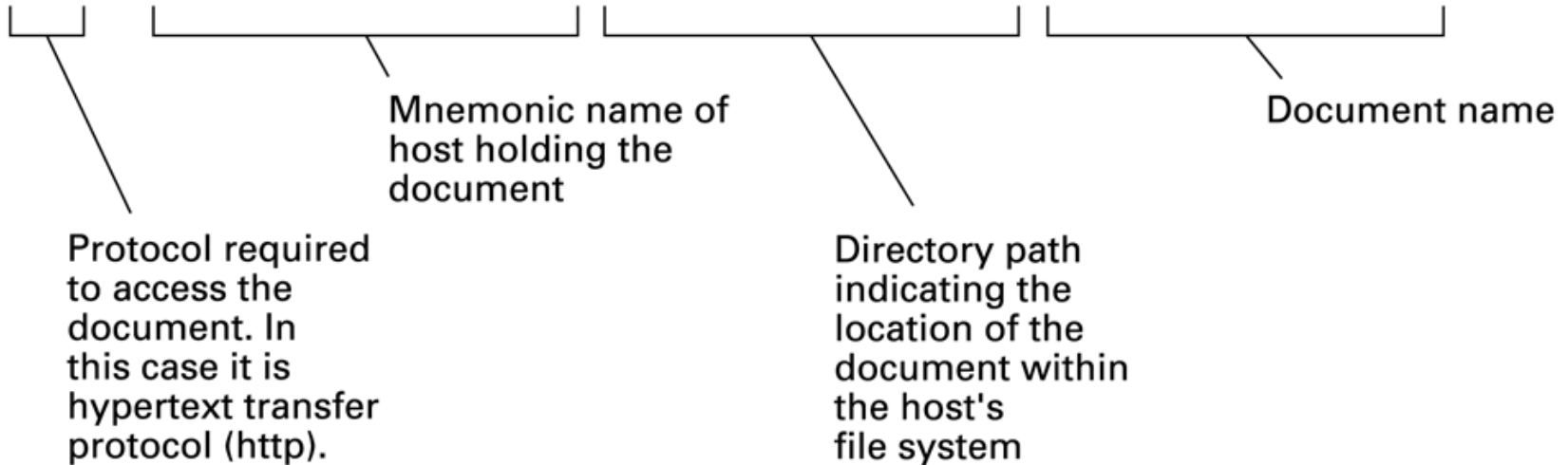


# Traditional Internet Applications

- Electronic Mail (email)
  - Domain mail server collects incoming mail and transmits outgoing mail
  - Mail server delivers collected incoming mail to clients via POP3 or IMAP
- File Transfer Protocol (FTP)
- Telnet
- SSH

# A typical URL

```
http://ssenterprise.aw.com/authors/Shakespeare/Julius_Caesar.html
```



# World Wide Web

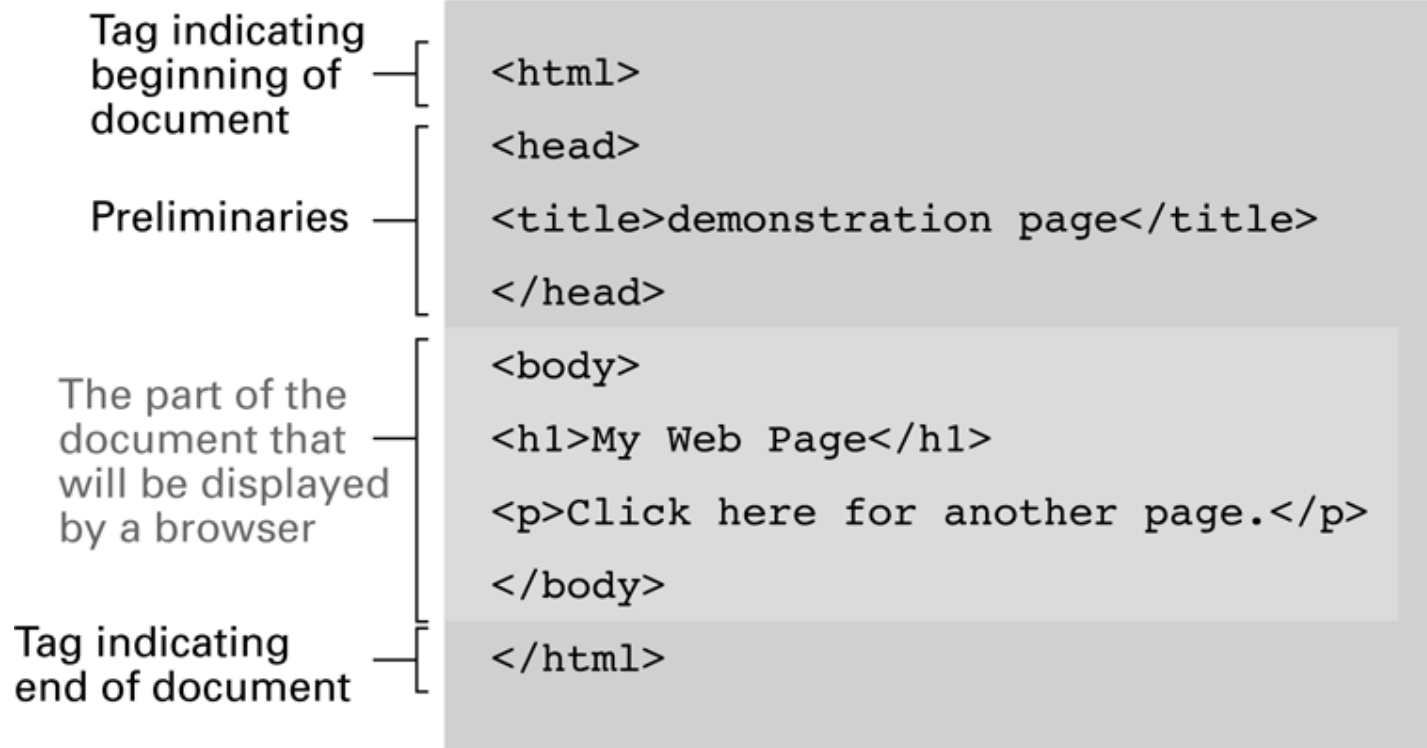
- Hypertext and HTTP
- Browser gets documents from Web server
- Documents identified by URLs

# Hypertext Document Format

- Contains **tags** to communicate with browser
  - Appearance
    - `<h1>` to start a level one heading
    - `<p>` to start a new paragraph
  - Links to other documents and content
    - `<a href = . . . >`
  - Insert images
    - `<img src = . . . >`

# A simple Web page

a. The page encoded using HTML.



# A simple Web page (continued)

b. The page as it would appear on a computer screen.



# An enhanced simple Web page

a. The page encoded using HTML.

Anchor tag  
containing  
parameter

Closing  
anchor tag

```
<html>
<head>
<title>demonstration page</title>
</head>
<body>
<h1>My Web Page</h1>
<p>Click
  <a href="http://crafty.com/demo.html">
    here
  </a>
  for another page.</p>
</body>
</html>
```



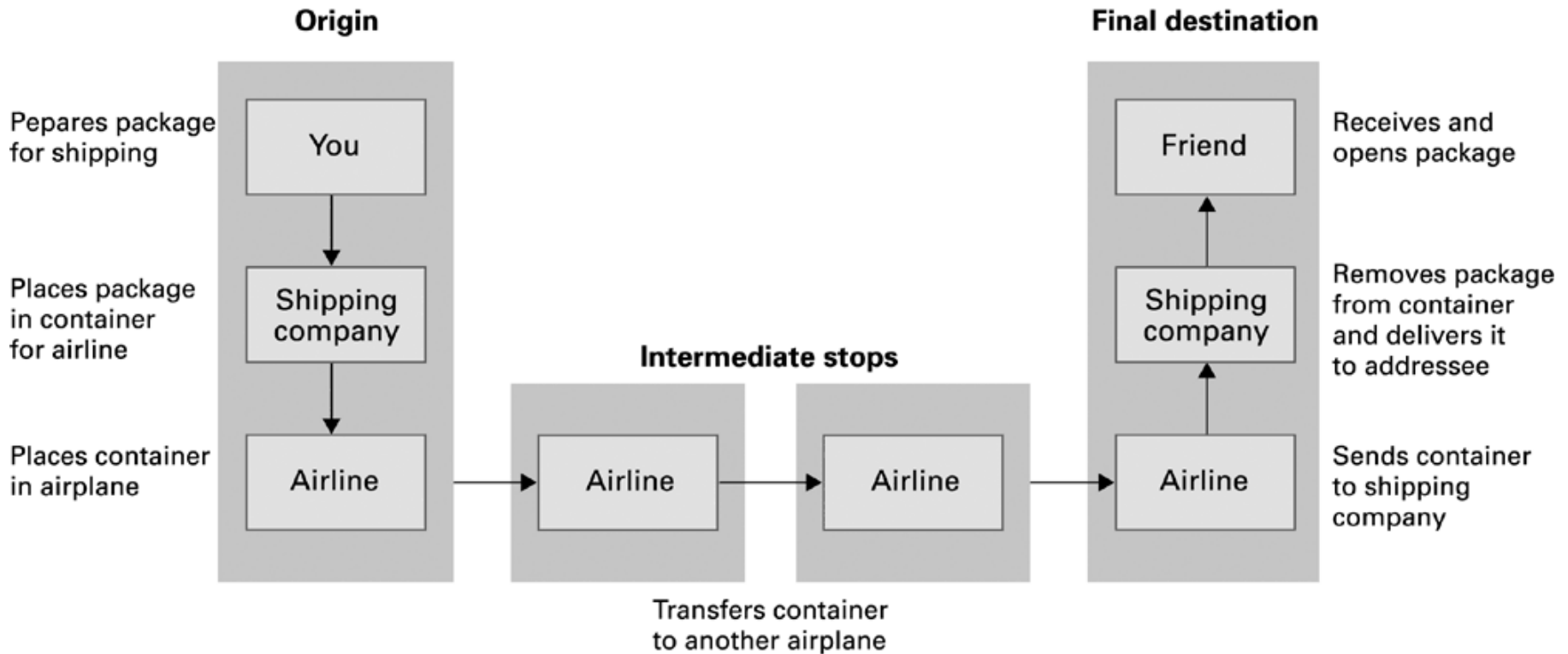
# An enhanced simple Web page (continued)

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b. The page as it would appear on a computer screen.

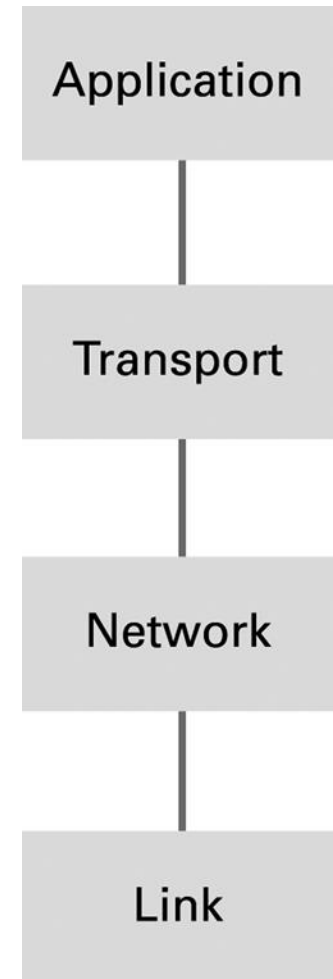


# Package-shipping example

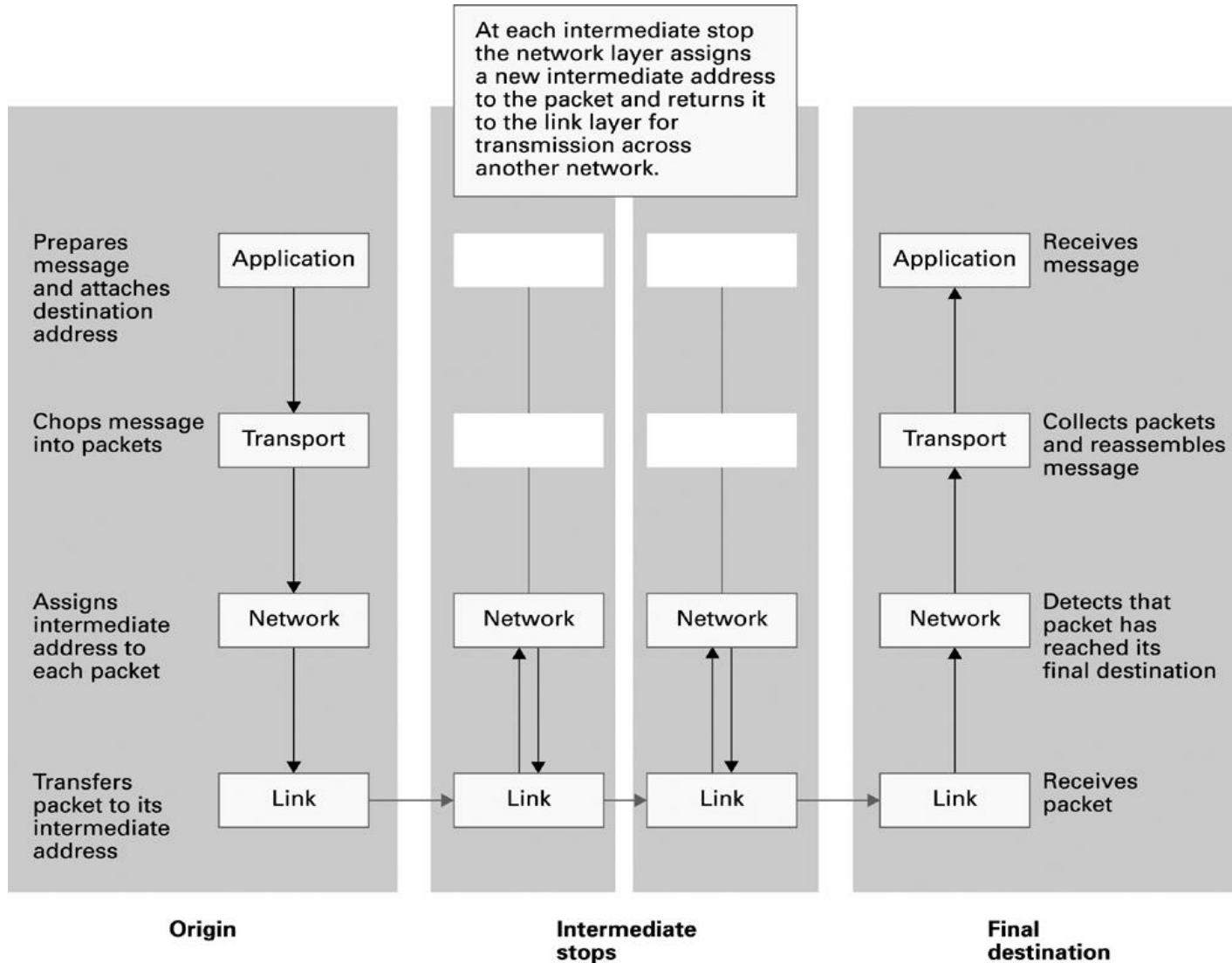


# Internet Software Layers

- **Application:** Constructs message with address
- **Transport:** Divides message into packets
- **Network:** Handles routing through the Internet
- **Link:** Handles actual transmission (bits, signals, etc.) of packets



# Following a message via Internet



# Security

- Attacks
  - Malware (viruses, worms, Trojan horses, spyware, phishing software)
  - Denial of service
  - Spam
- Protection
  - Firewalls
  - Spam filters
  - Proxy Servers
  - Antivirus software

# Encryption

- FTPS, HTTPS, SSL
- Public-key Encryption
  - Public key: Used to encrypt messages
  - Private key: Used to decrypt messages
- Certificates and Digital Signatures

# Public-key encryption

