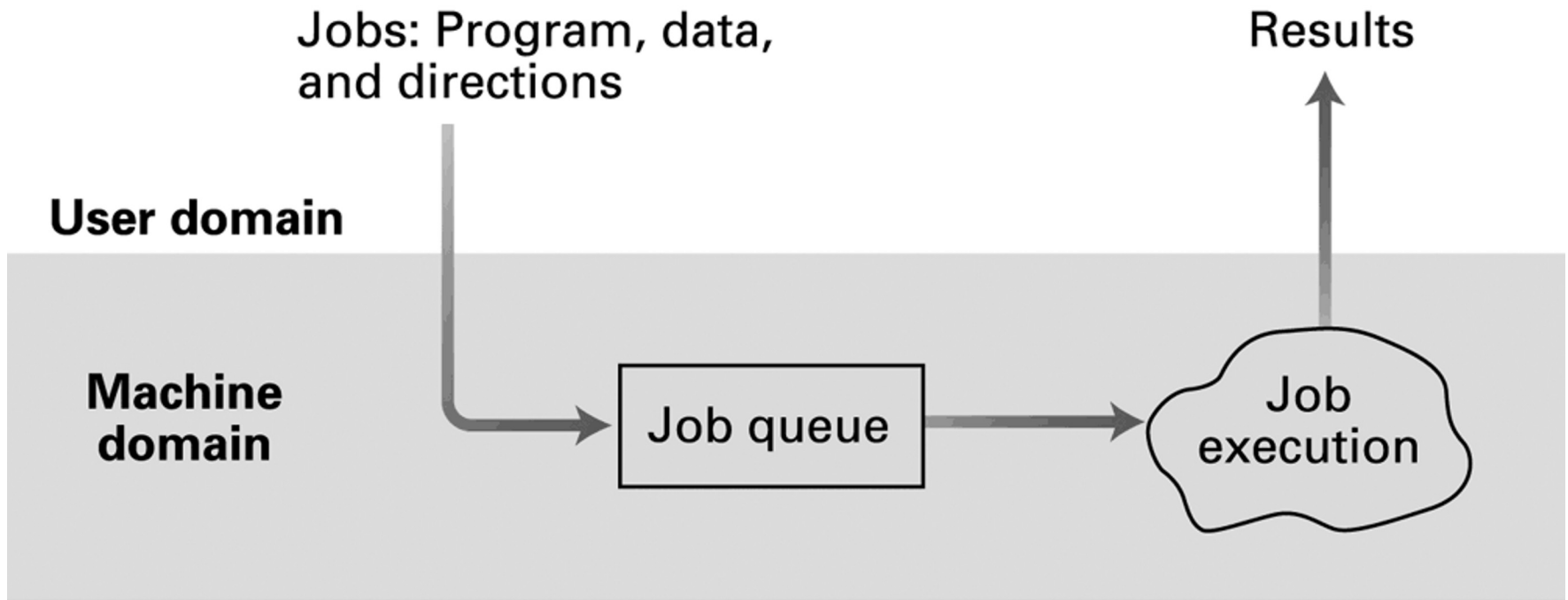# Functions of Operating Systems

- Oversee operation of computer
- Store and retrieve files
- Schedule programs for execution
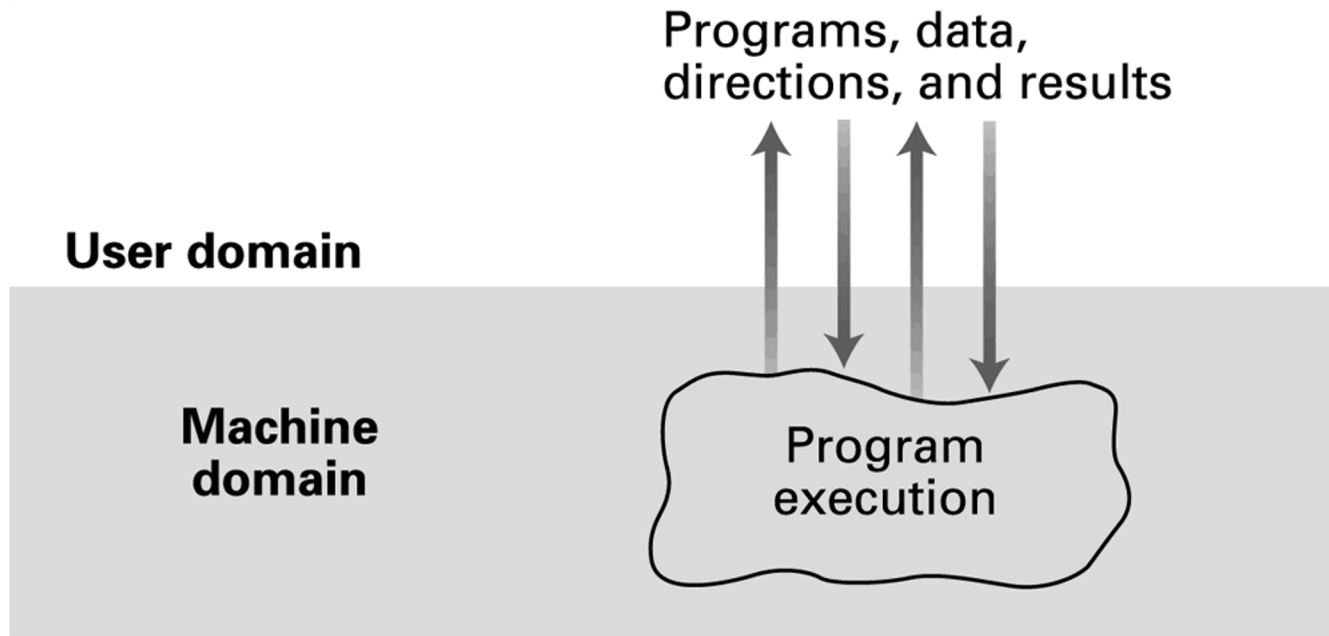- Coordinate the execution of programs

Evolution of Shared Computing

- Batch processing
- Interactive processing
  - Requires real-time processing
- Time-sharing/Multitasking
  - Implemented by Multiprogramming
- Multiprocessor machines

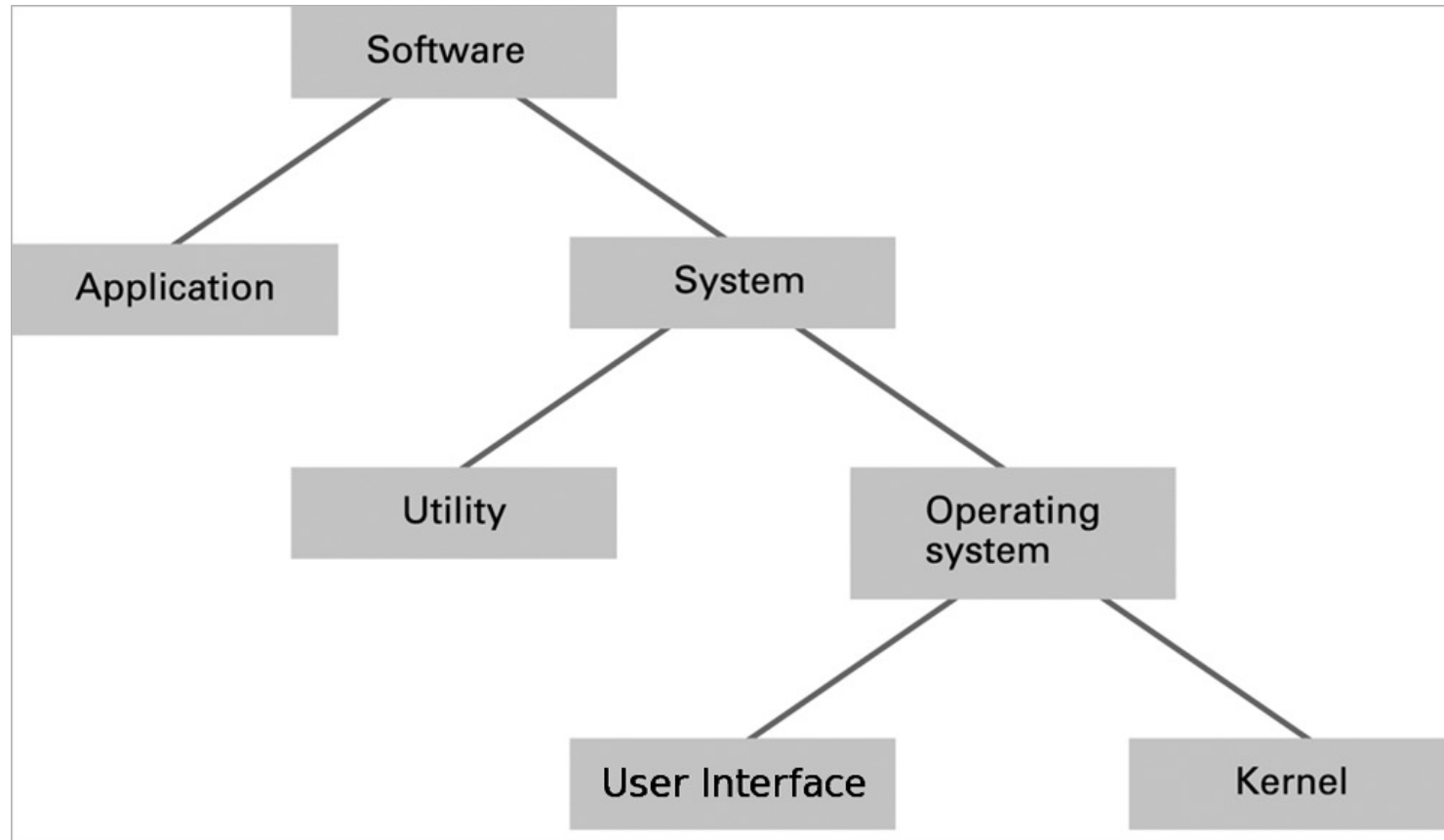# Figure 3.1 Batch processing

Figure 3.2 Interactive processing

Types of Software

- Application software
  - Performs specific tasks for users
- System software
  - Provides infrastructure for application software
 - Consists of operating system and utility software

Figure 3.3 **Software classification**

Operating System Components

- **User Interface:** Communicates with users
  - Text based (Shell)
  - Graphical user interface (GUI)
- **Kernel:** Performs basic required functions
  - File manager
  - Device drivers
  - Memory manager
  - Scheduler and dispatcher

Figure 3.4 The user interface act as an intermediary between users and the operating system kernel
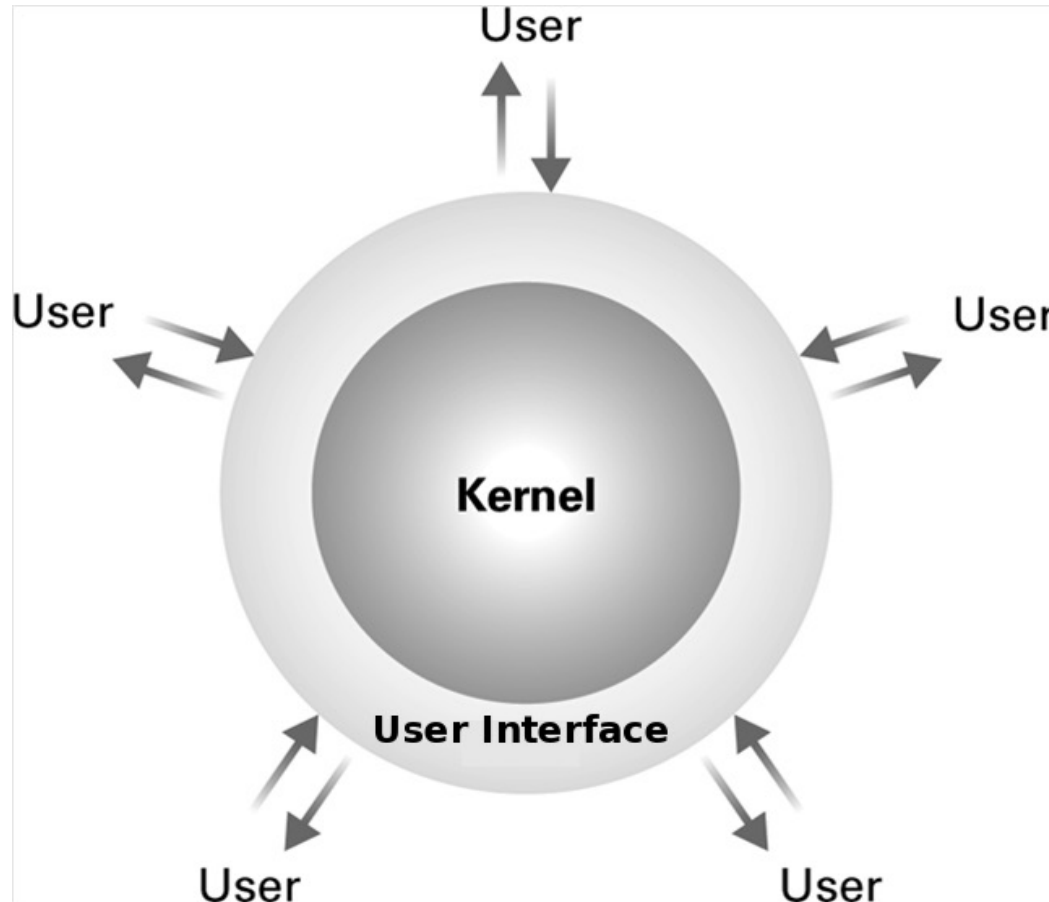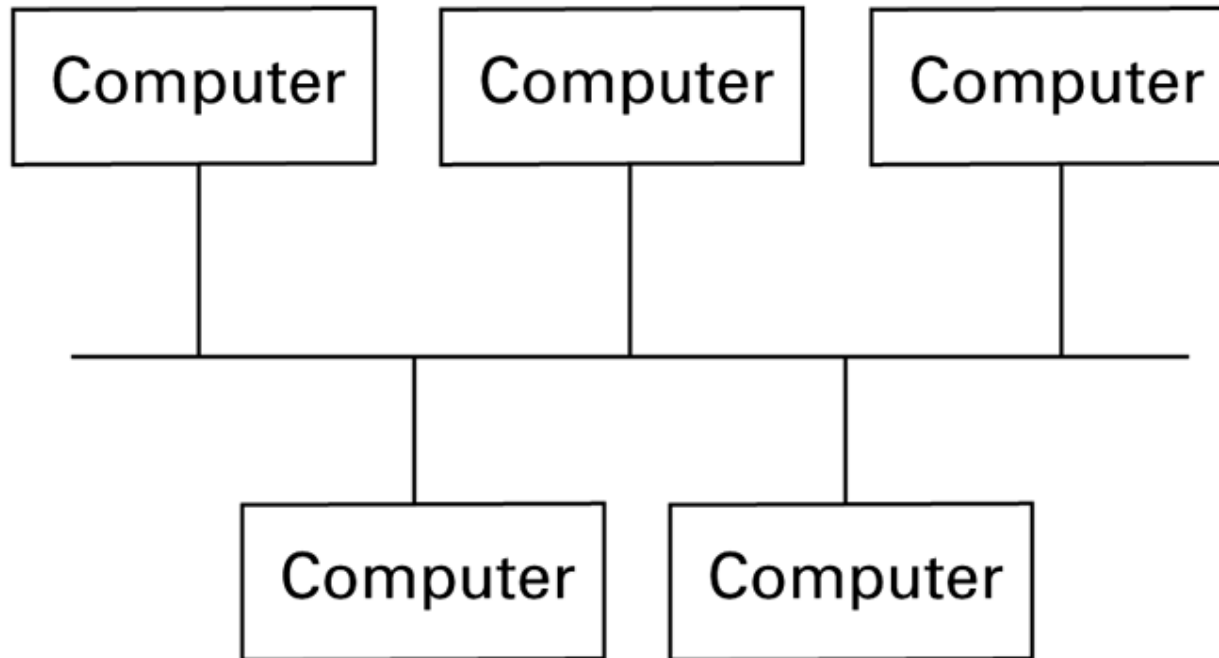
Networking and the Internet

Chapter 4

Network Classifications

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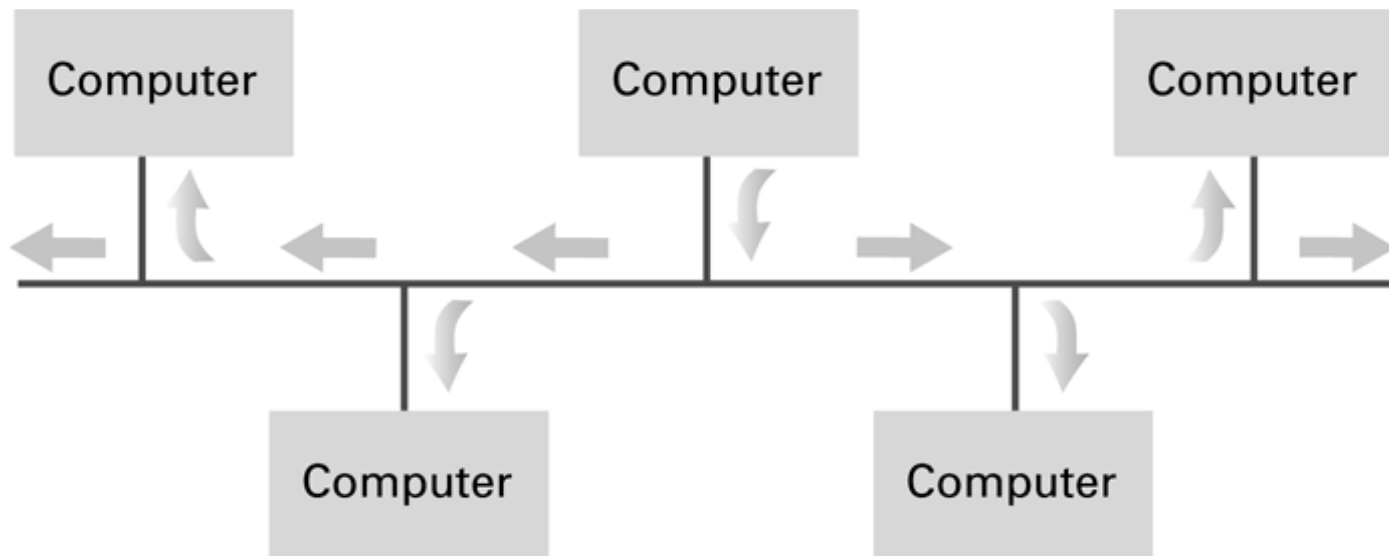 - Personal area network (PAN)
  - Local area network (LAN)
  - Metropolitan area (MAN)
  - Wide area network (WAN)
- Ownership
  - Closed versus open
- Topology (configuration)
  - Bus (Ethernet)
  - Star (Wireless networks with central Access Point)

Figure 4.1 **Network topologies**
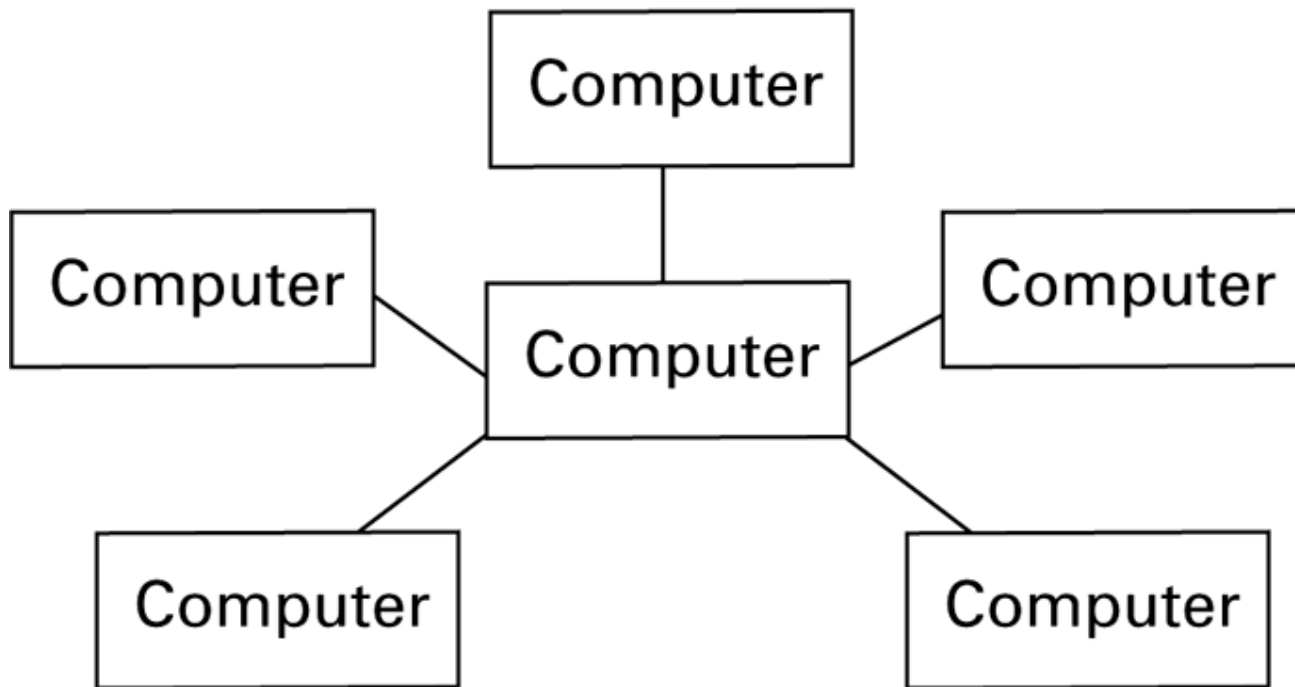
a. Bus

Figure 4.2 Communication over a bus network

Figure 4.1 **Network topologies (continued)**

b. Star

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
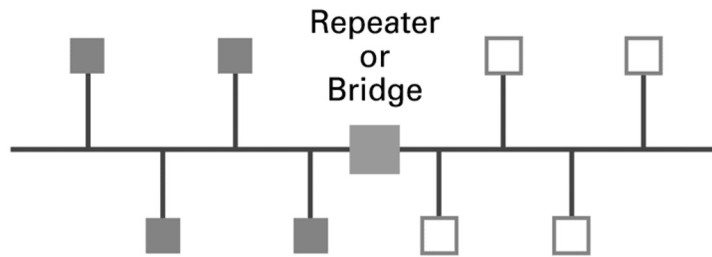
a. A repeater or bridge connecting two buses
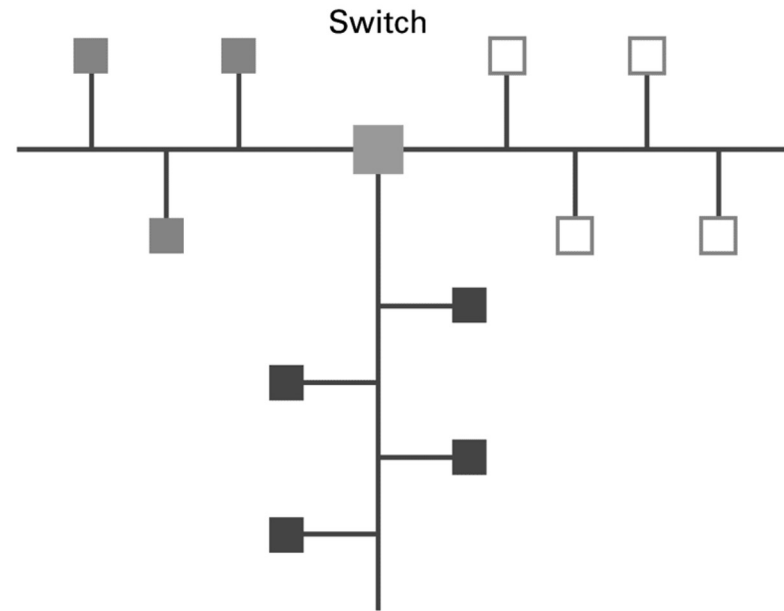
b. A switch connecting multiple buses

Figure 4.5 **Routers connecting two WiFi networks and an Ethernet network to form an internet**
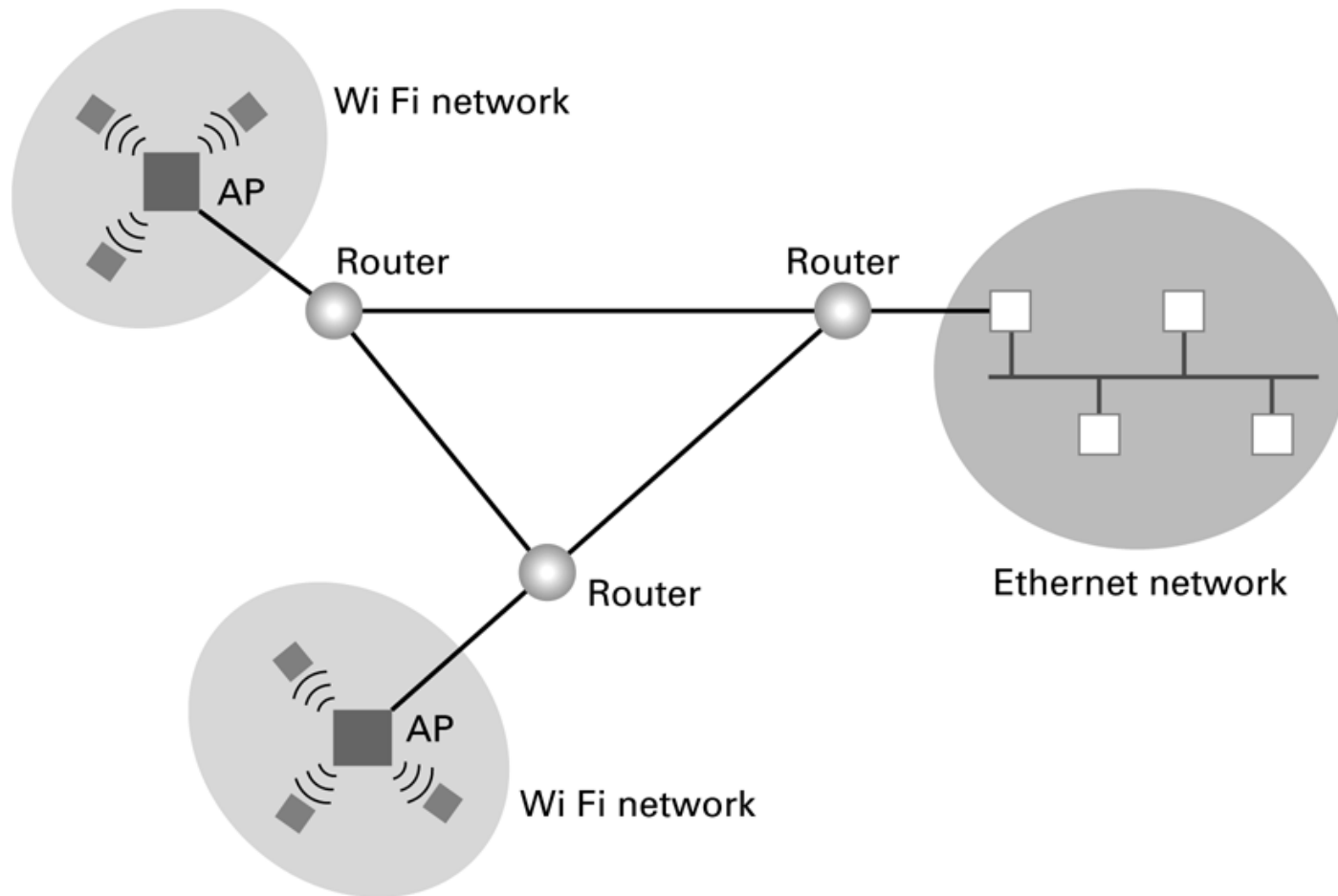
Internet Addressing

- IP address: pattern of 32 or 128 bits often represented in dotted decimal notation
- 130.255.39.201
  - 10000010 11111111 00100111 11001000
- Mnemonic address:
  - Domain names
  - Top-Level Domains
- Domain name system (DNS)
  - Name servers
  - DNS lookup

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

Figure 4.6 The client/server model compared to the peer-to-peer model
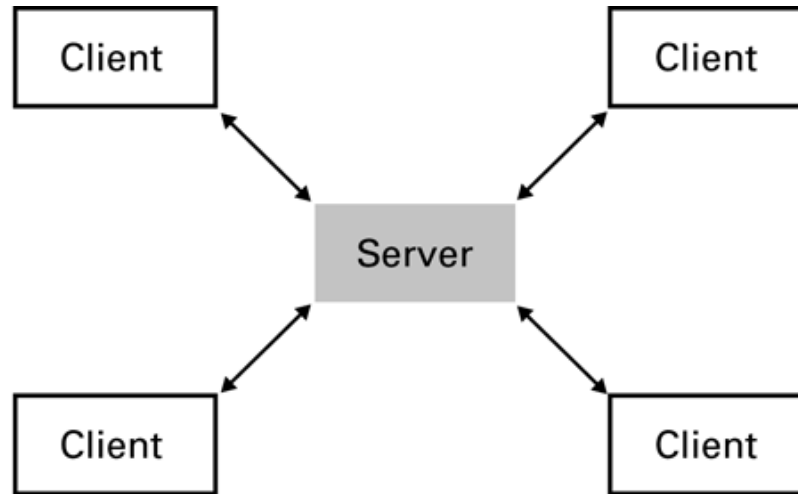
a. Server must be prepared to serve multiple clients at any time.
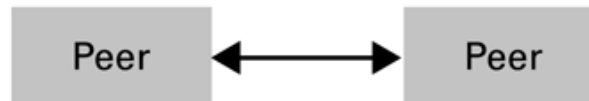
b. Peers communicate as equals on a one-to-one basis.

File Manager

- **Directory** (or **Folder**): A user-created bundle of files and other directories (subdirectories)
- **Directory Path:** A sequence of directories within directories

Memory Manager

- Allocates space in main memory

- May create the illusion that the machine has more memory than it actually does (**virtual memory**) by playing a "shell game" in which blocks of data (**pages**) are shifted back and forth between main memory and mass storage

Getting it Started (Bootstrapping)

- **Boot loader:** Program in ROM (example of firmware)
  - Run by the CPU when power is turned on
  - Transfers operating system from mass storage to main memory
  - Executes jump to operating system

Figure 3.5 The booting process

Step 1: Machine starts by executing the bootstrap program already in memory. Operating system is stored in mass storage.

Step 2: Boot loader program directs transfer of the operating system into main memory and then tranfers control to it.
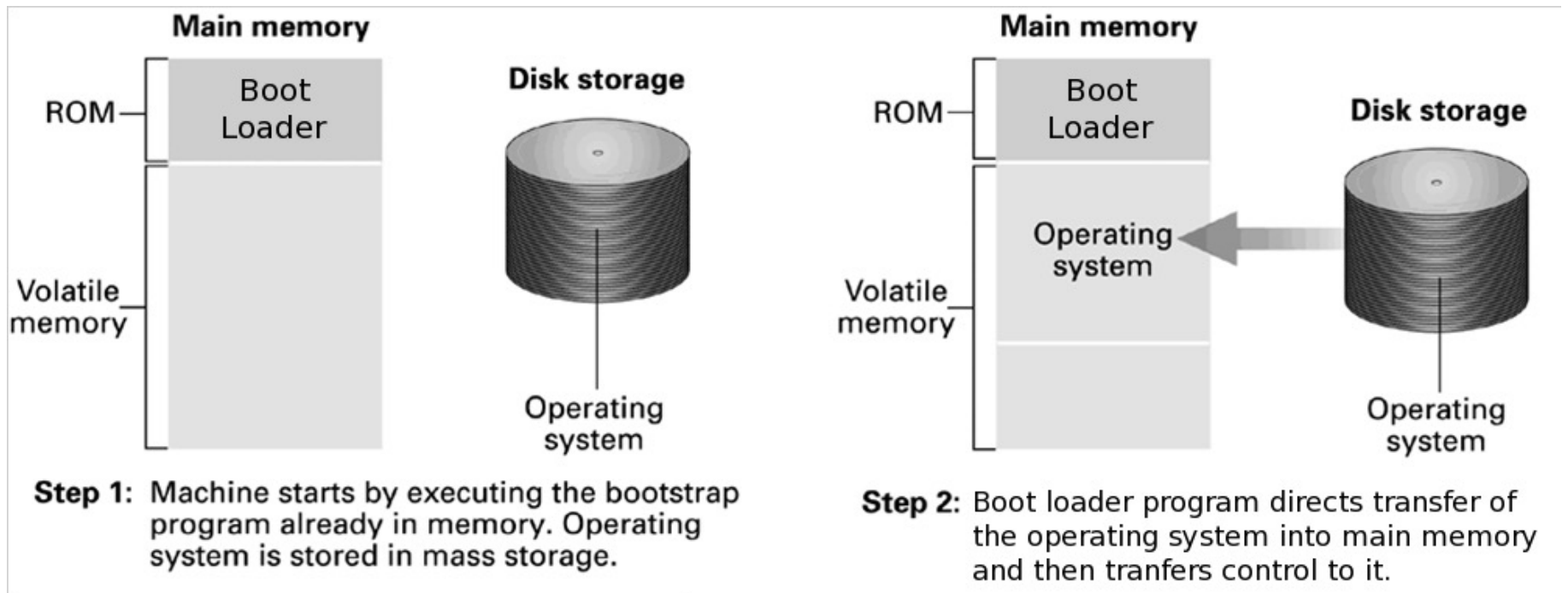
Processes

- **Process:** The activity of executing a program

- **Process State:** Current status of the activity
  - Program counter
  - General purpose registers
  - Related portion of main memory

Process Administration

- **Scheduler:** Adds new processes to the process table and removes completed processes from the process table

- **Dispatcher:** Controls the allocation of time slices to the processes in the process table

  - The end of a time slice is signaled by an interrupt.

Figure 3.6 Time-sharing between process A and process B
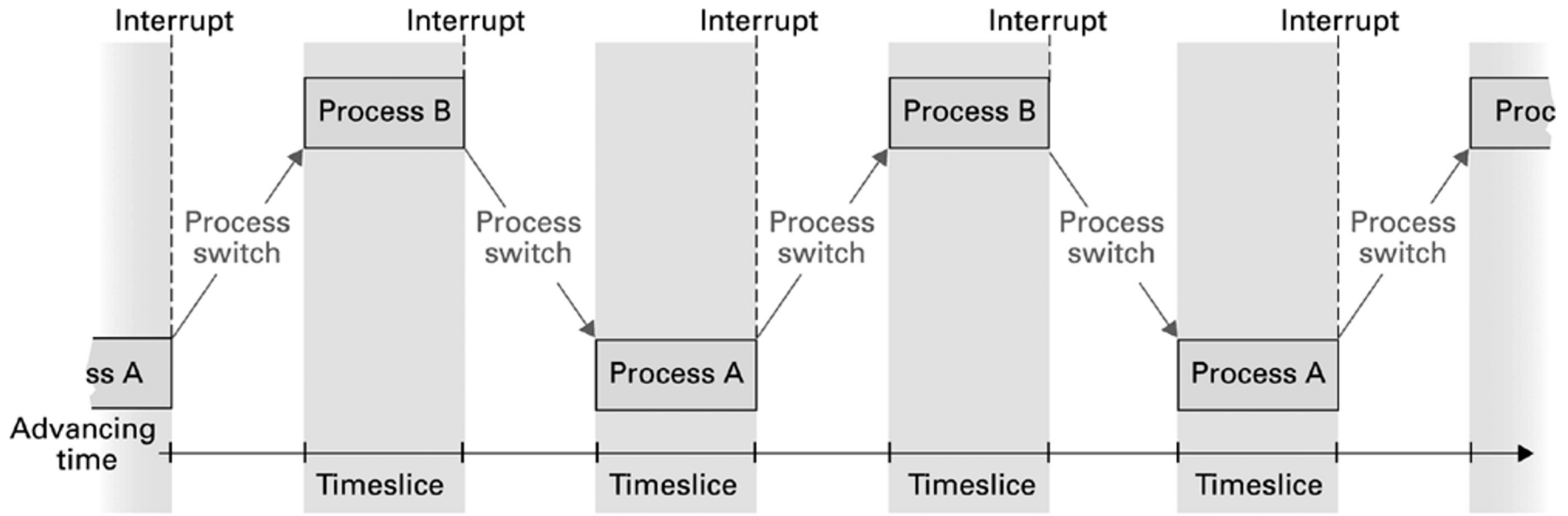
The Internet

- 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 a commercial undertaking that links a worldwide combination of PANs, LANs, MANs, and WANs involving millions of computers

World Wide Web

- **Hypertext** combines internet technology with concept of linked-documents
  - Embeds **hyperlinks** to other documents
- **Browsers** present materials to the user
- **Webservers** provide access to documents
- Documents are identified by **URL**s and transferred using **HTTP**

Figure 4.8 **A typical URL**


```
http://eagle.mu.edu/authors/Shakespeare/Julius_Caesar.html
```

Mnemonic name of host holding the document

Document name

Protocol required to access the document. In this case it is hypertext transfer protocol (http).

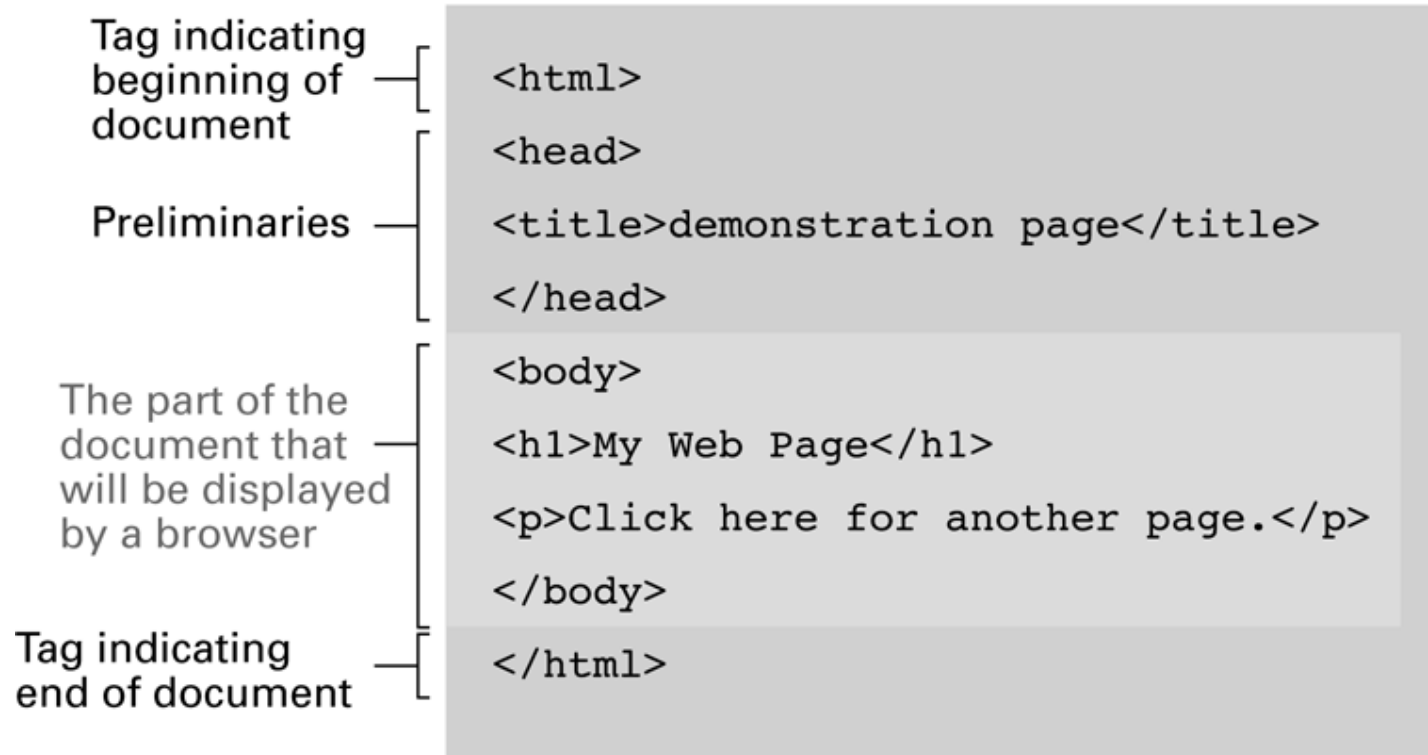Directory path indicating the location of the document within the host's file system
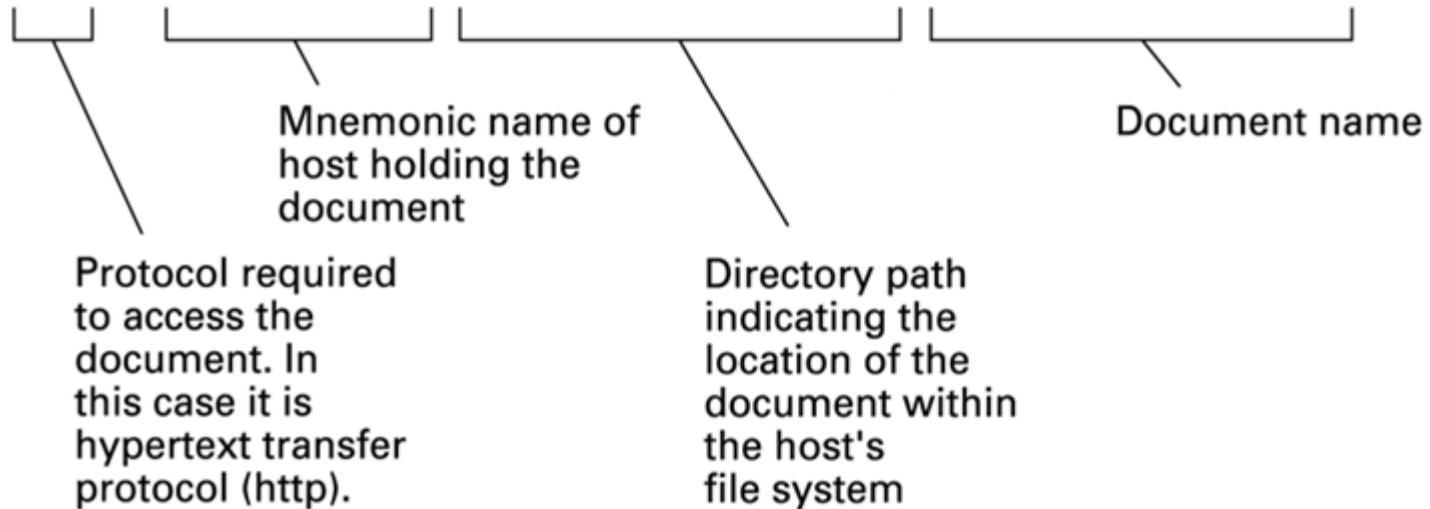
Hypertext Markup Language (HTML)

- Encoded as text file

- 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 = . . . >

Figure 4.9 **A simple webpage**

a. The page encoded using HTML.

Tag indicating beginning of document
```
<html>
```

Preliminaries
```
<head>
<title>demonstration page</title>
</head>
```

The part of the document that will be displayed by a browser
```
<body>
<h1>My Web Page</h1>
<p>Click here for another page.</p>
</body>
```

Tag indicating end of document
```
</html>
```

Figure 4.9 **A simple webpage (continued)**

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

My Web Page

Click here for another page.

Figure 4.10 An enhanced simple webpage

a. The page encoded using HTML.

```
<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>
```

Anchor tag containing parameter ⎯ `<a href="http://crafty.com/demo.html">`

Closing anchor tag ⎯ `</a>`

Figure 4.10 An enhanced simple Web page (continued)

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

My Web Page

Click here for another page.