INTRODUCTION TO COMPUTER SCIENCE

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Fall 2013

Ch.4: Networking and the Internet

- Network Fundamentals
- The Internet
- The World Wide Web
- Internet Protocols
- Security

Networks Overview

- What?
- Why?

Network Fundamentals

The Internet
The World Wide Web
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- Network Classifications
  - local area network (LAN)
  - metropolitan area network (MAN)
  - wide area network (WAN)

  -- open vs. closed networks

Network Fundamentals

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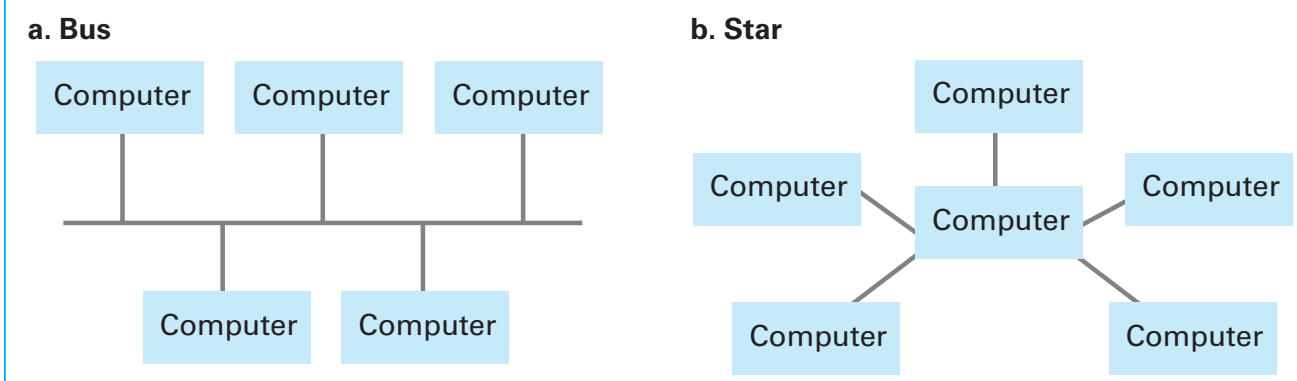
• Networks Topologies

Figure 4.1 Two popular network topologies



The distinction is whether the machines in the network envision themselves as communicating directly with each other over a common bus **or** indirectly through an intermediary central machine.

- Protocols
- For a network to function reliably, it is important to establish rules by which activities are conducted. Such rules are called **protocols.**
- Without rules, all the computers might insist on transmitting messages at the same time or fail to assist other machines when that assistance is required.

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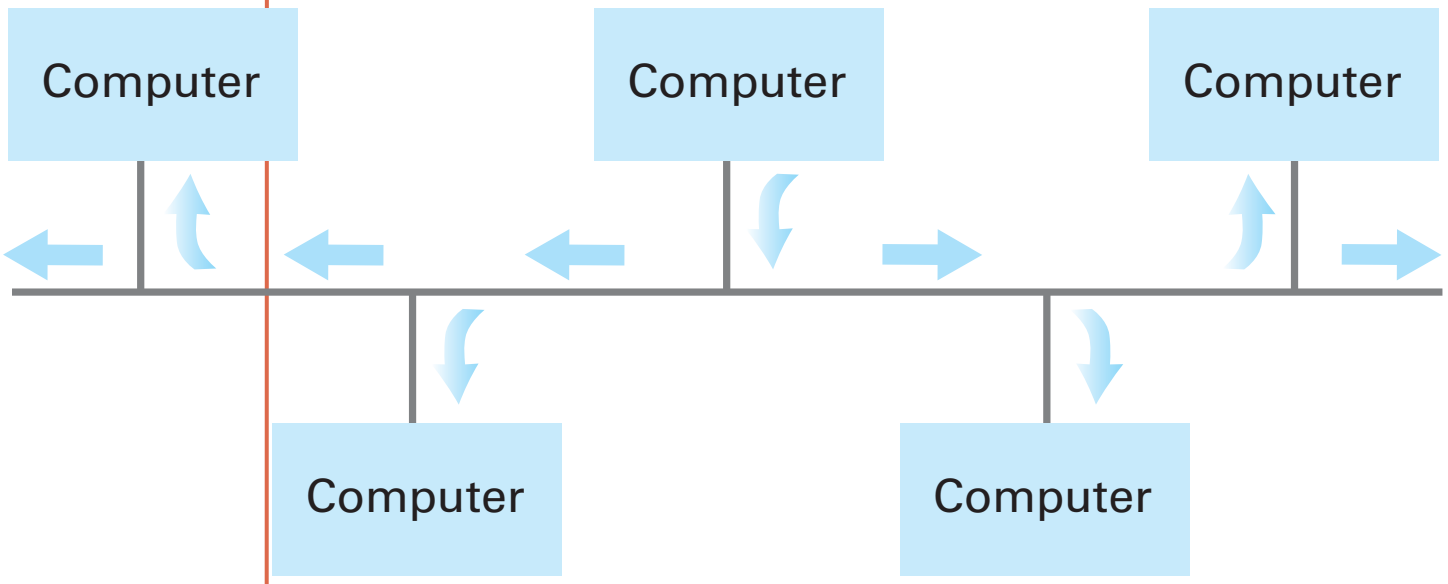
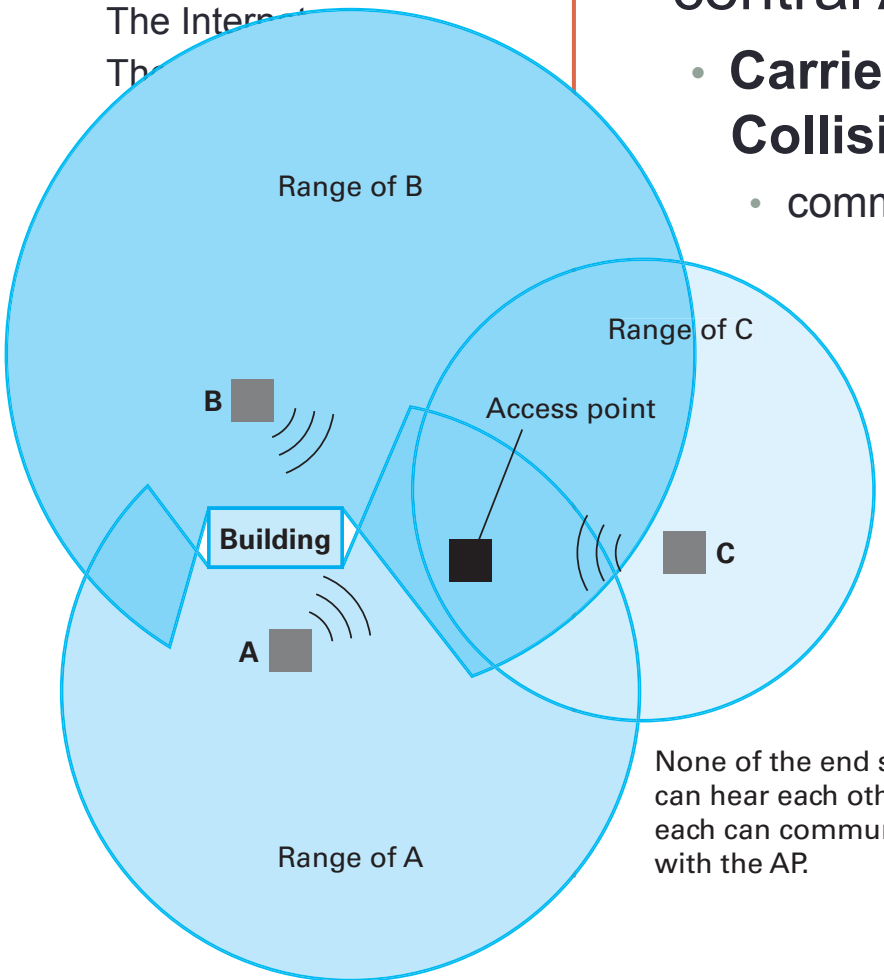
- **Carrier Sense, Multiple Access with Collision Detection (CSMA/CD) protocol**
  - Broadcast messages



Network Fundamentals

The Inter
Th

- CSMA/CD is not compatible with wireless star networks in which all machines communicate through a central Access Point (AP).
  - **Carrier Sense, Multiple Access with Collision Avoidance (CSMA/CA),**
    - commonly referred to as **WiFi**.



None of the end systems can hear each other although each can communicate with the AP.

Network Fundamentals

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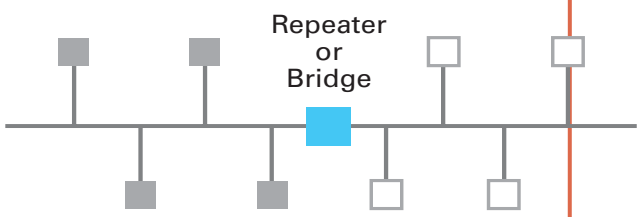
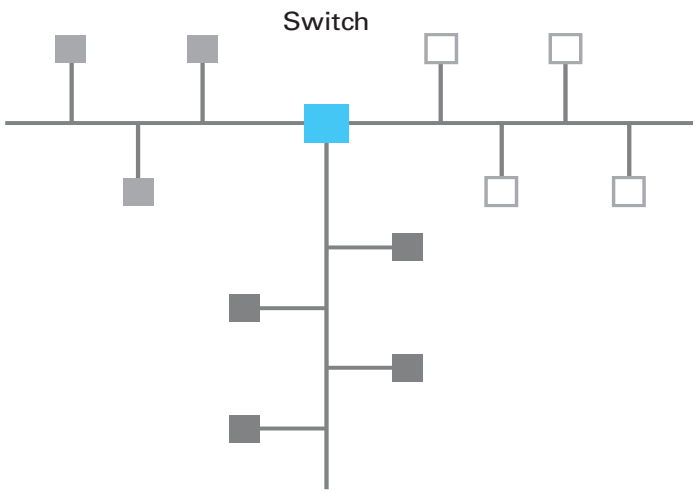
- Combining Networks
  - Repeaters
    - passes signals with amplification
  - Bridges
    - looks at the destination address that accompanies each message and forwards a message across the connection only when that message is destined for a computer on the other side
  - Switches
    - a bridge with multiple connections



a. A repeater or bridge connecting two buses



b. A switch connecting multiple buses

Network Fundamentals

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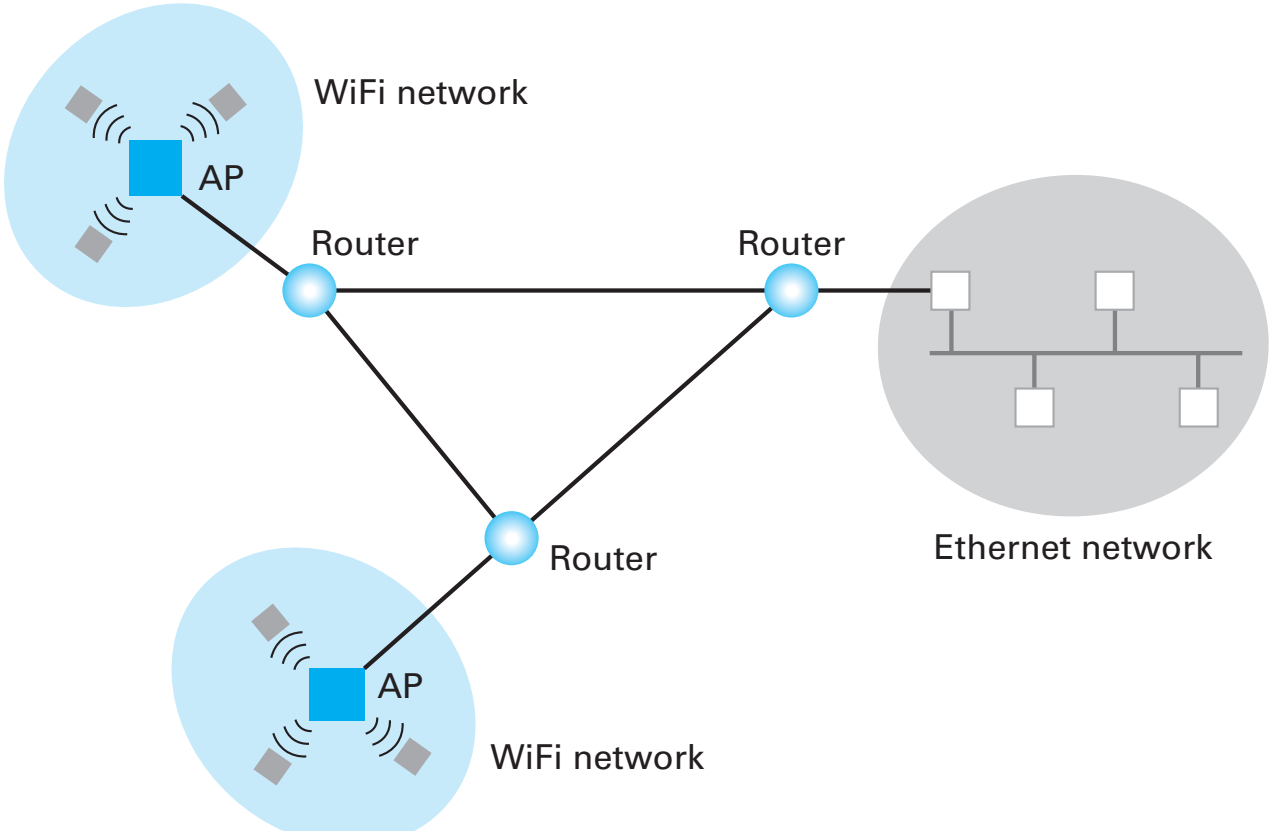
- **internet:** a network of networks
  - The Internet is a particular worldwide internet
  - Handled by *Routers*



Network Fundamentals

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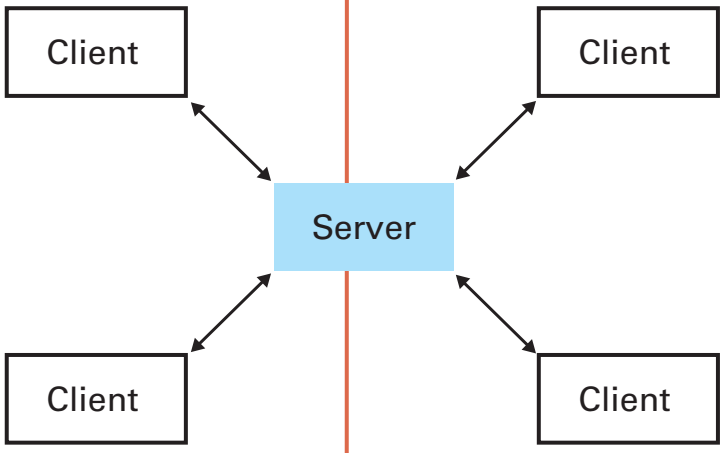
- Methods of Process Communication
  - **client/ server** model: e.g. print server, file server (shared magnetic disk)
  - **peer-to-peer (P2P)** model: e.g. instant messaging



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

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

Network Fundamentals

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- Cloud Computing
  - huge pools of shared computers on the network can be allocated for use by clients as needed,
  - Google Docs allow users to collaborate on information without needing to know how many computers are working on the problem or where the relevant data are stored.
  - provide reasonable guarantees of reliability and scalability,
  - but also raise concerns about privacy and security in a world where we may no longer know who owns and operates the computers that we use.

The Internet

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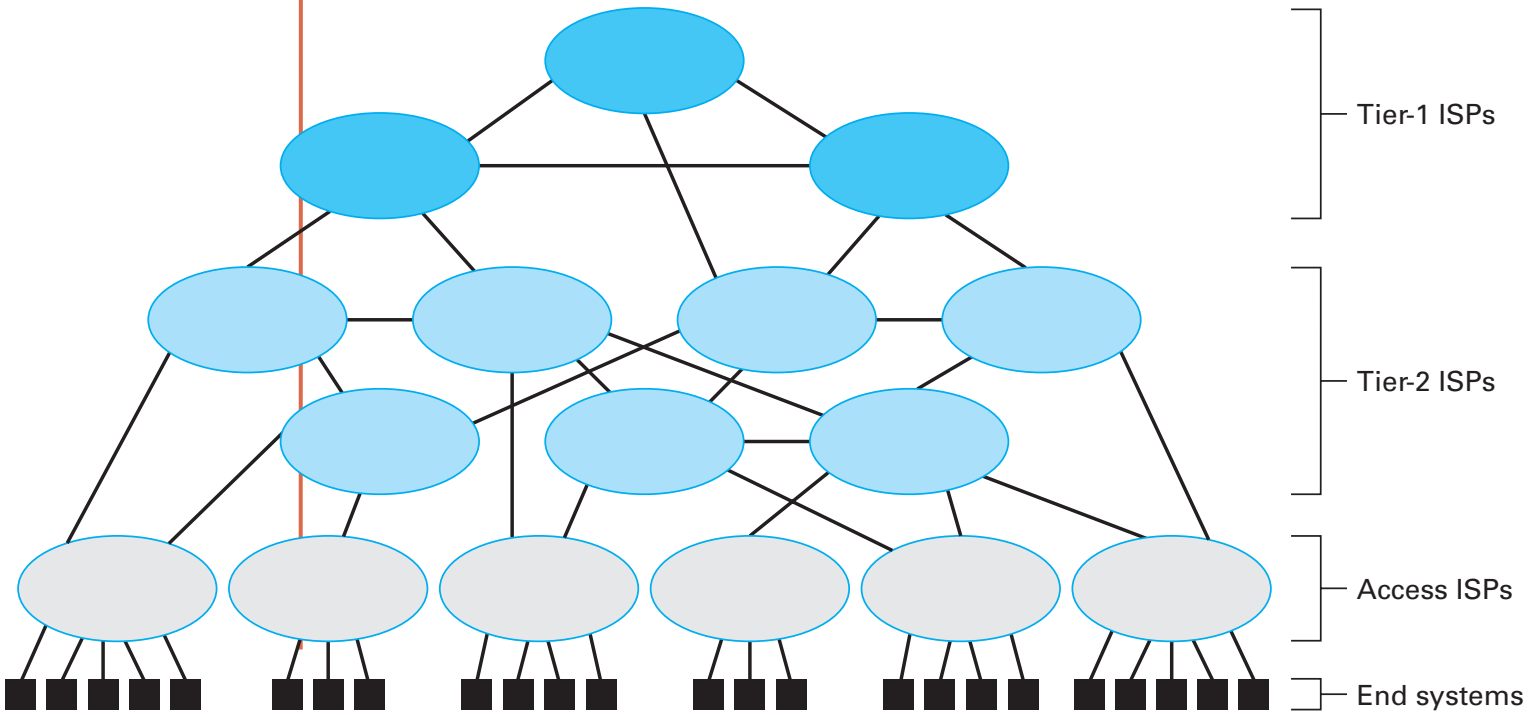
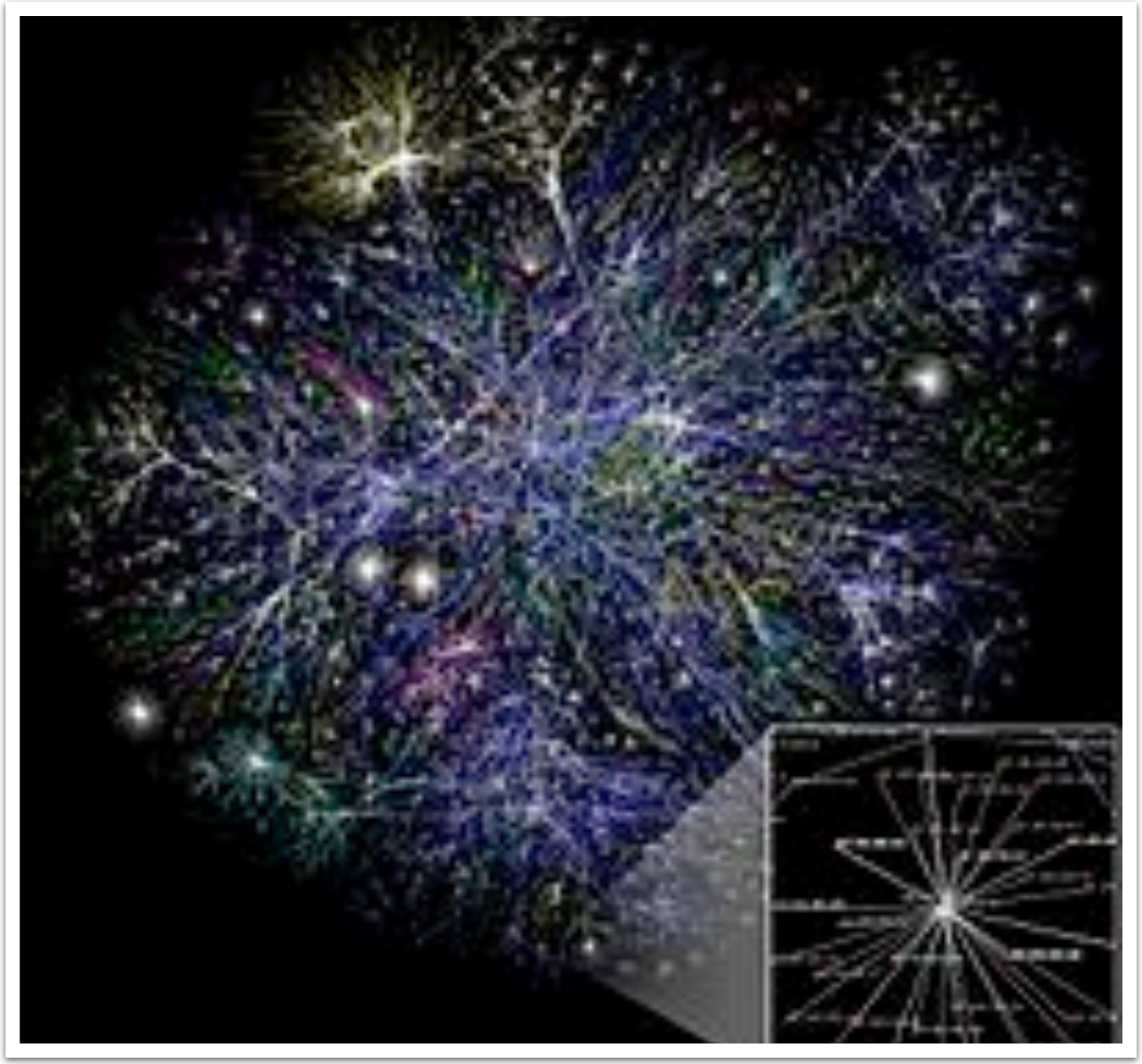
- The most notable example of an internet is the **Internet**
- a worldwide combination of LANs, MANs, and WANs involving millions of computers.
- these networks are constructed and maintained by organizations called **Internet Service Providers (ISPs)**



Each line is drawn between two nodes, representing two IP addresses. This is a small look at the backbone of the Internet.



Internet Addressing

- an internet needs an internet-wide addressing system that assigns a unique identifying address to each computer in the system.
- In the Internet these addresses are known as **IP addresses.**
- **Internet Corporation for Assigned Names and Numbers (ICANN):** a nonprofit corporation established to coordinate the Internet's operation

IP addresses

- each IP address was a pattern of 32 bits
- written in **dotted decimal notation** e.g. 192.207.177.133
- This addressing system is based on the concept of a **domain**
- Each domain must be registered with ICANN
- The domain is assigned a **domain name**
  - Suffixes: com, edu, gov, eg

Internet Applications

- Electronic Mail
  - SMTP — sending e-mail between machines
  - Accessing e-mail
    - POP3 — mail transferred to your own computer
    - IMAP — mail stays on mail server — can access mail from other computers
- The File Transfer Protocol
- VoIP, e.g. Skype

Assignment

- Read chapter 4 to end of 4.3 (page 166)
- Report a summary of your reading
- Study Hard for the Midterm