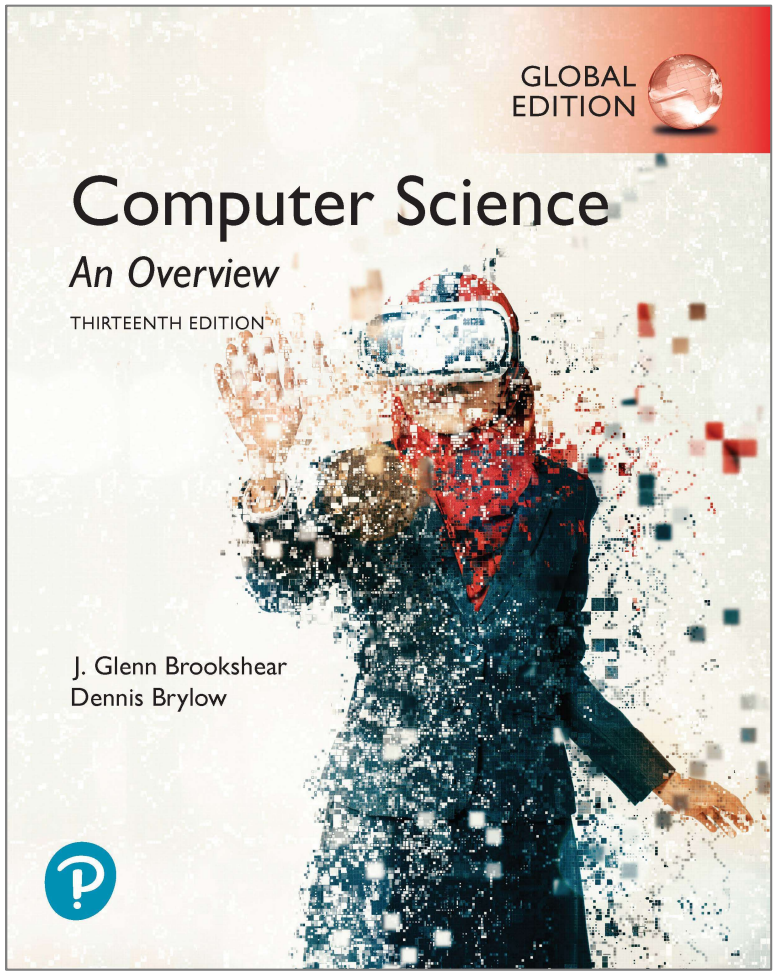
# Computer Science An Overview

13th Edition, Global Edition




## Chapter 4

Networking and the Internet

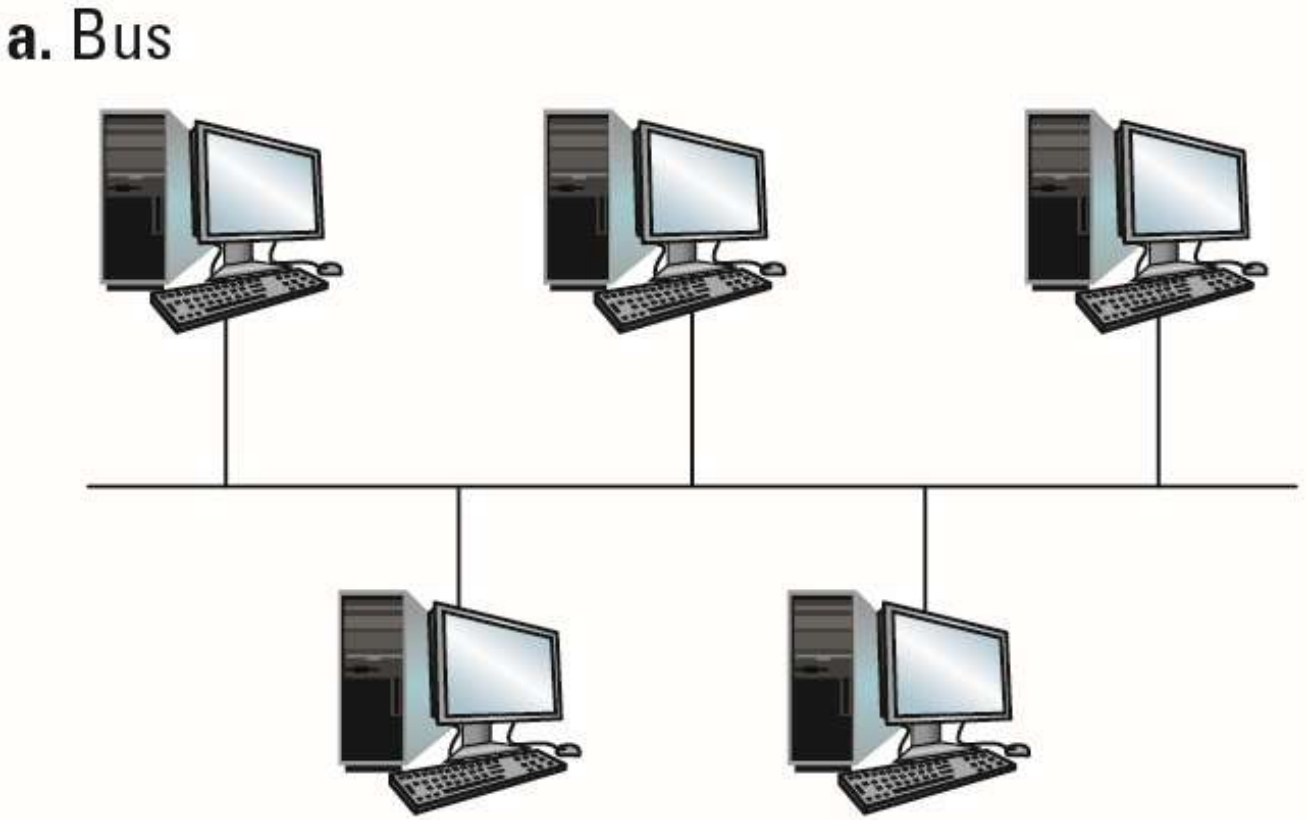
# 4.1 Network Fundamentals

- The need to share information and resources among different computers has led to linked computer systems, called **networks,** in which computers are connected so that data can be transferred from machine to machine.
- Network Software allows users to exchange information and share resources
  - Content
  - Software
  - Data storage facilities

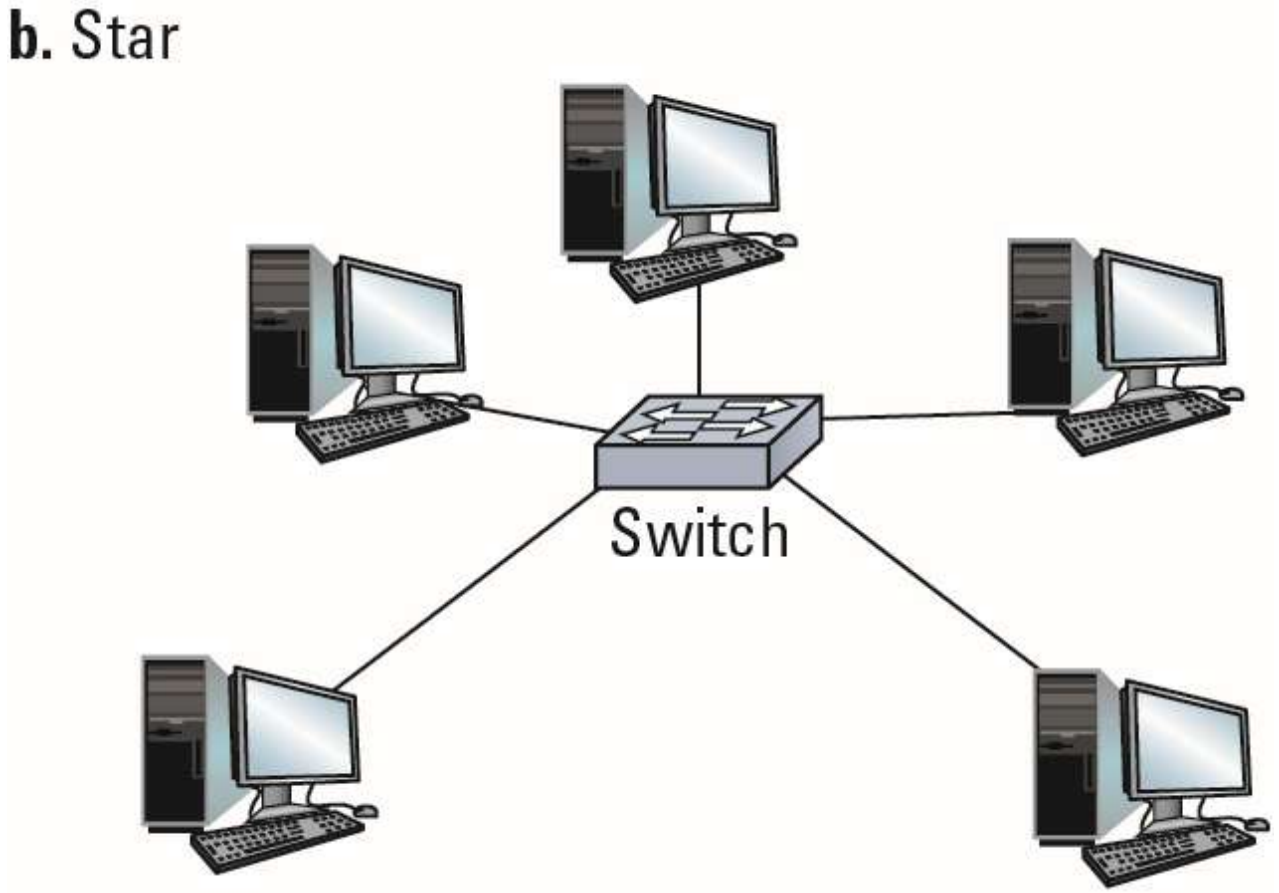
# Network Classifications

- Scope
  - Personal Area Network (short-range)
  - Local Area Network (building/campus)
  - Metropolitan Area Network (community)
  - Wide Area Network (greater distances)
- Topology (configuration)
  - Bus (Ethernet)
  - Star (Wireless networks with central Access Point)

# Figure 4.1 Two popular network topologies (1 of 2)



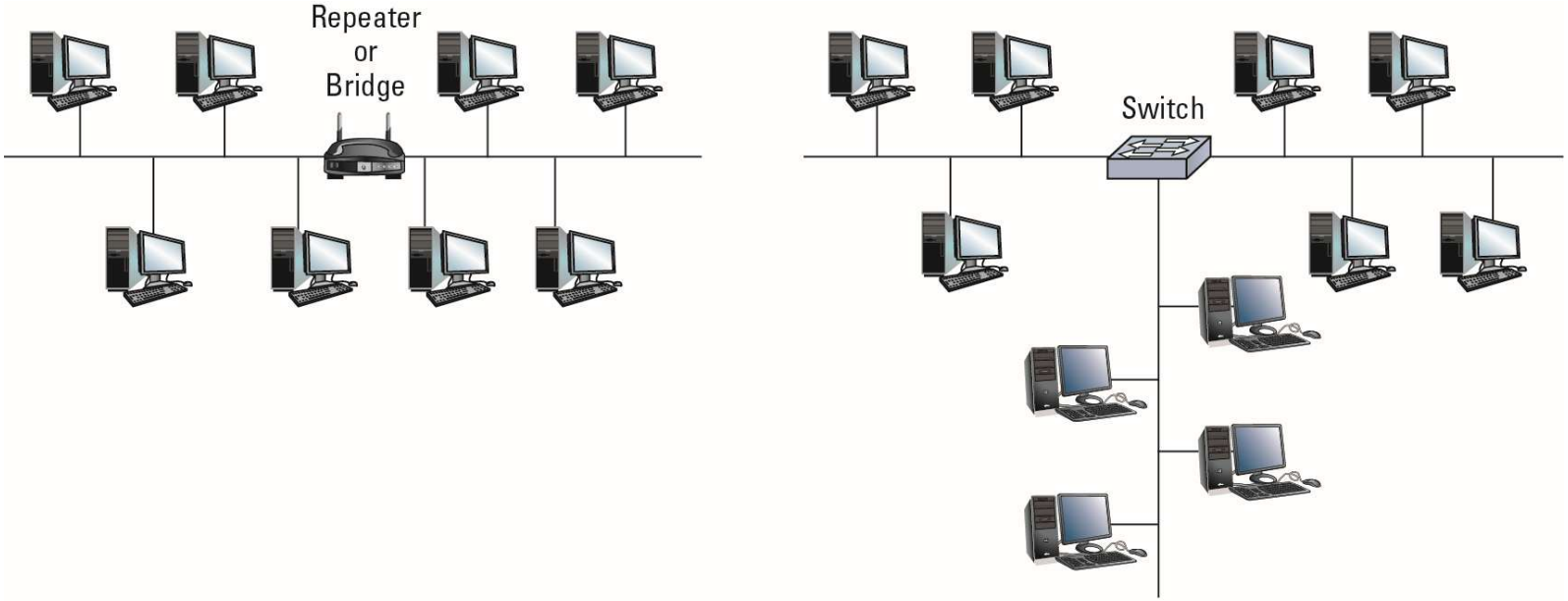
# Figure 4.1 Two popular network topologies (2 of 2)



# Combining Networks

- **Repeater:** passes all messages across two busses
- **Bridge:** passes only messages that are destined for computers on the other bus
- **Switch:** acts like a bridge, but with connections to multiple busses
- **Router:** Connects two incompatible networks resulting in a network of networks called an **internet**

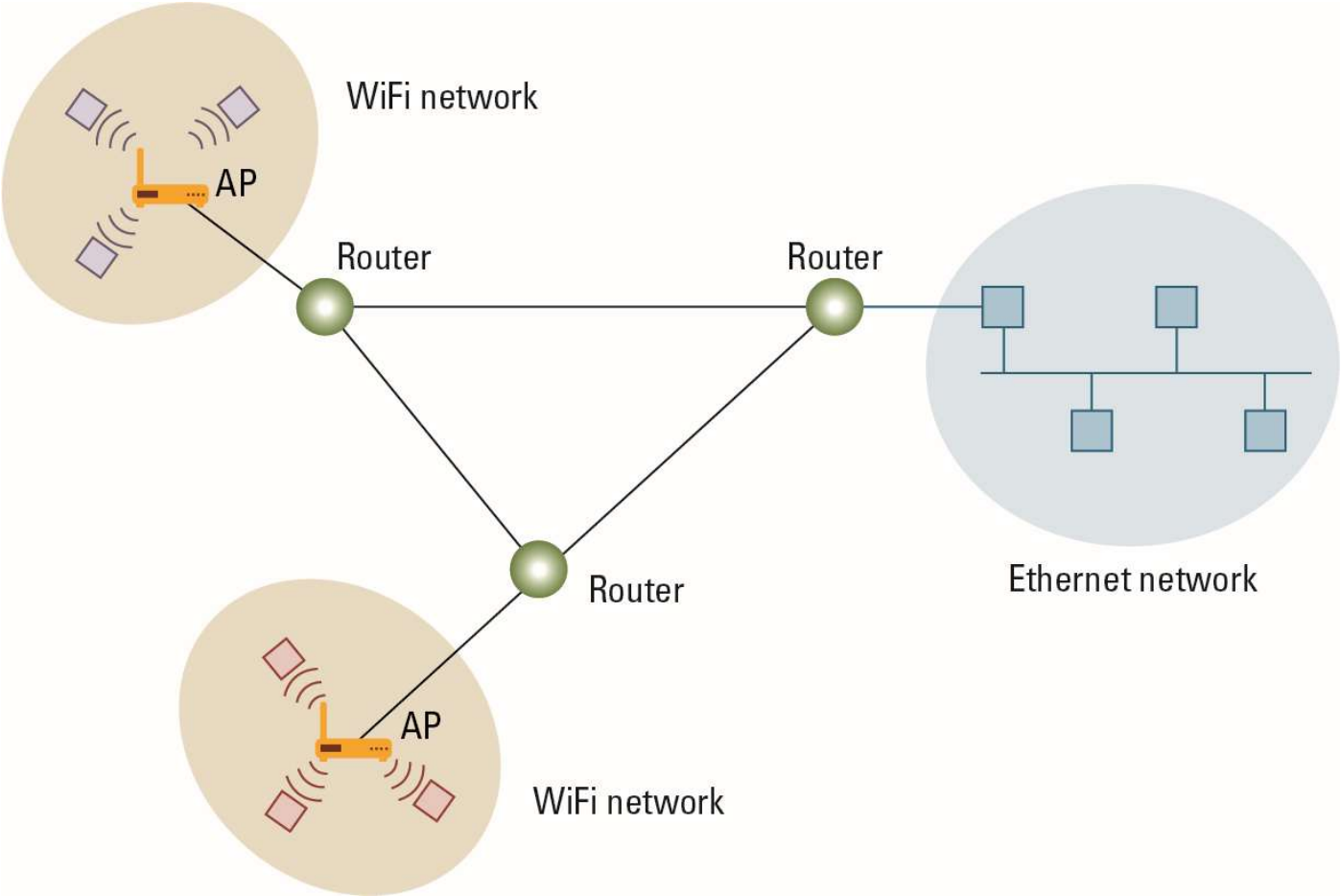
# Figure 4.4 Building a large bus network from smaller ones




**a.** A repeater or bridge connecting two buses

**b.** A switch connecting multiple buses

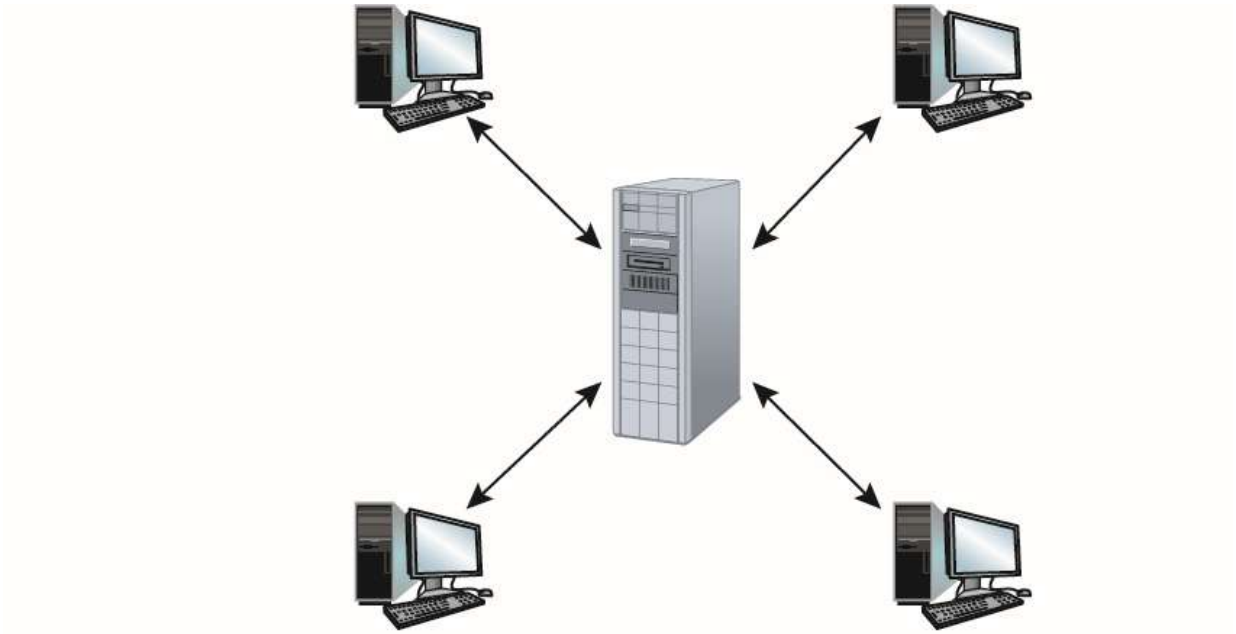
# Figure 4.5 Routers connecting two WiFi networks and an Ethernet network to form an internet



# Methods of Process Communication

- Client-server
  - Many clients, one server (executing continuously)
  - Clients make requests of other processes
  - Server satisfies requests made by clients
- Peer-to-peer (P2P)
  - Two processes communicating as equals
  - Processes execute on a temporary basis

# 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.

# Distributed Systems

- Systems units that execute as processes on different computers
  - Cluster computing
    - Independent computers work closely together instead of a single, much larger machine
  - Grid computing
    - Millions of home PCs (not connected to each other) work on a complex problem
  - Cloud computing
    - Provide services, hide the details

# 4.2 The Internet

- The Internet is an internet that spans the world
  - Original goal was to link a variety of networks into a connected system unaffected by local disasters
  - Today, it is a commercial undertaking that links a worldwide combination of PANs, LANs, MANs, and WANs involving millions of computers

# Internet Addressing

- IP address: pattern of 32 or 128 bits often represented in dotted decimal notation
- Mnemonic address:
  - Domain names (mu.edu)
  - Top-Level Domains
    - .org, .gov, .com, .mil, .net, .au, .ca, .biz, ….
- Domain name system (DNS)
  - Name servers
  - DNS lookup

# Early Internet Applications

- Network News Transfer Protocol (NNTP)
- File Transfer Protocol (FTP)
- Telnet and Secure Shell (SSH)
- Hypertext Transfer Protocol (HTTP)
- Electronic Mail (email)
  - Domain mail server collects incoming mail and transmits outing mail
  - Mail server delivers collected incoming mail to clients via POP3 or IMAP

# More Recent Applications

- Voice Over IP (VoIP)
- Internet Multimedia Streaming
  - N-unicast
  - Multicast
  - On-demand streaming
  - Content delivery networks (CDNs)