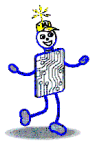


CHAPTER 2:
An Introduction to Systems Concepts and Systems Architecture

The Architecture of Computer Hardware, Systems Software & Networking:
An Information Technology Approach

5th Edition, Irv Englander

John Wiley and Sons ©2013

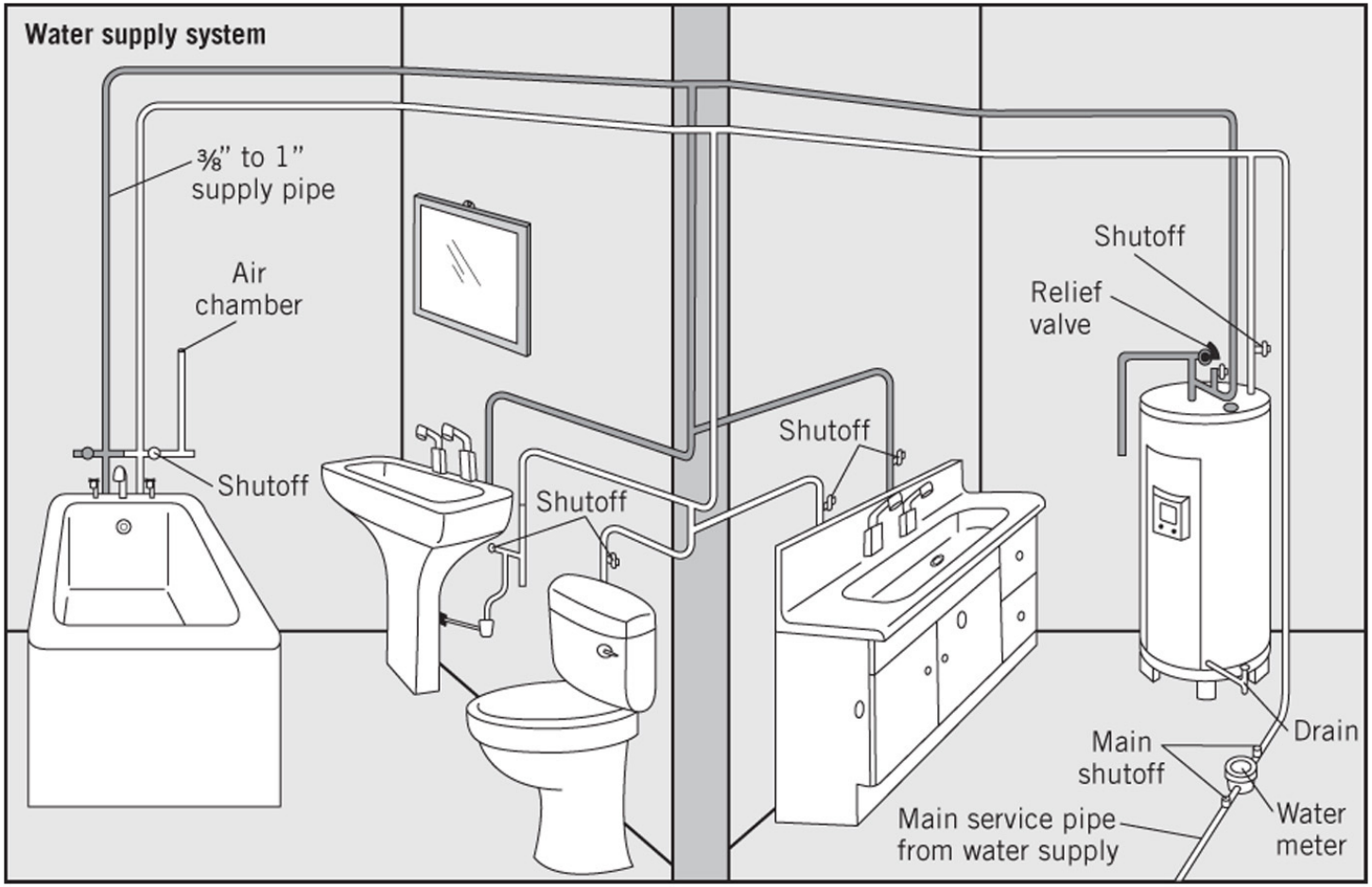
PowerPoint slides authored by Angela Clark, University of South Alabama

PowerPoint slides for the 4th edition were authored by Wilson Wong, Bentley University

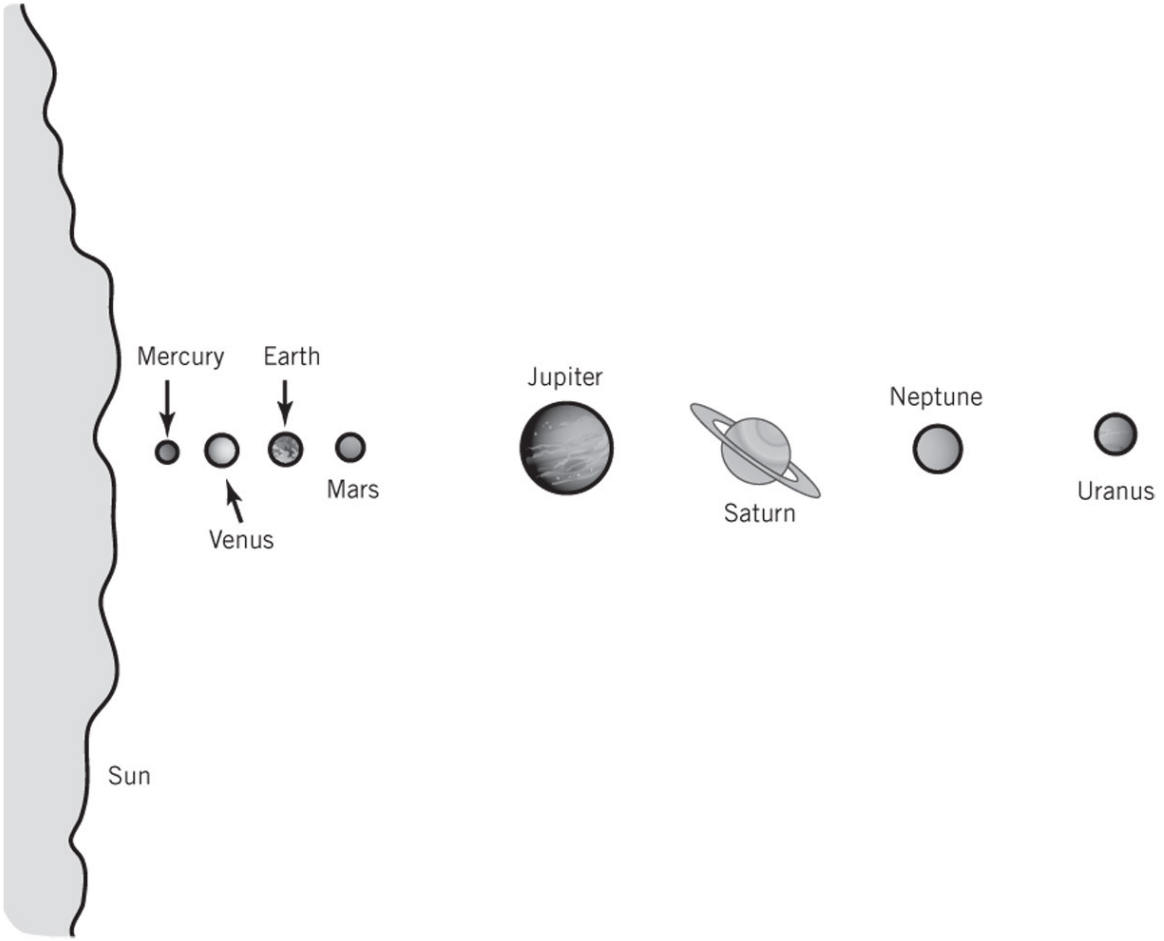
What is a system?

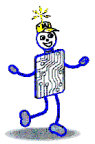
- What do the following systems have in common?
  1. Plumbing system
  2. Solar system
  3. Home network system
  4. Inventory control system

Plumbing System

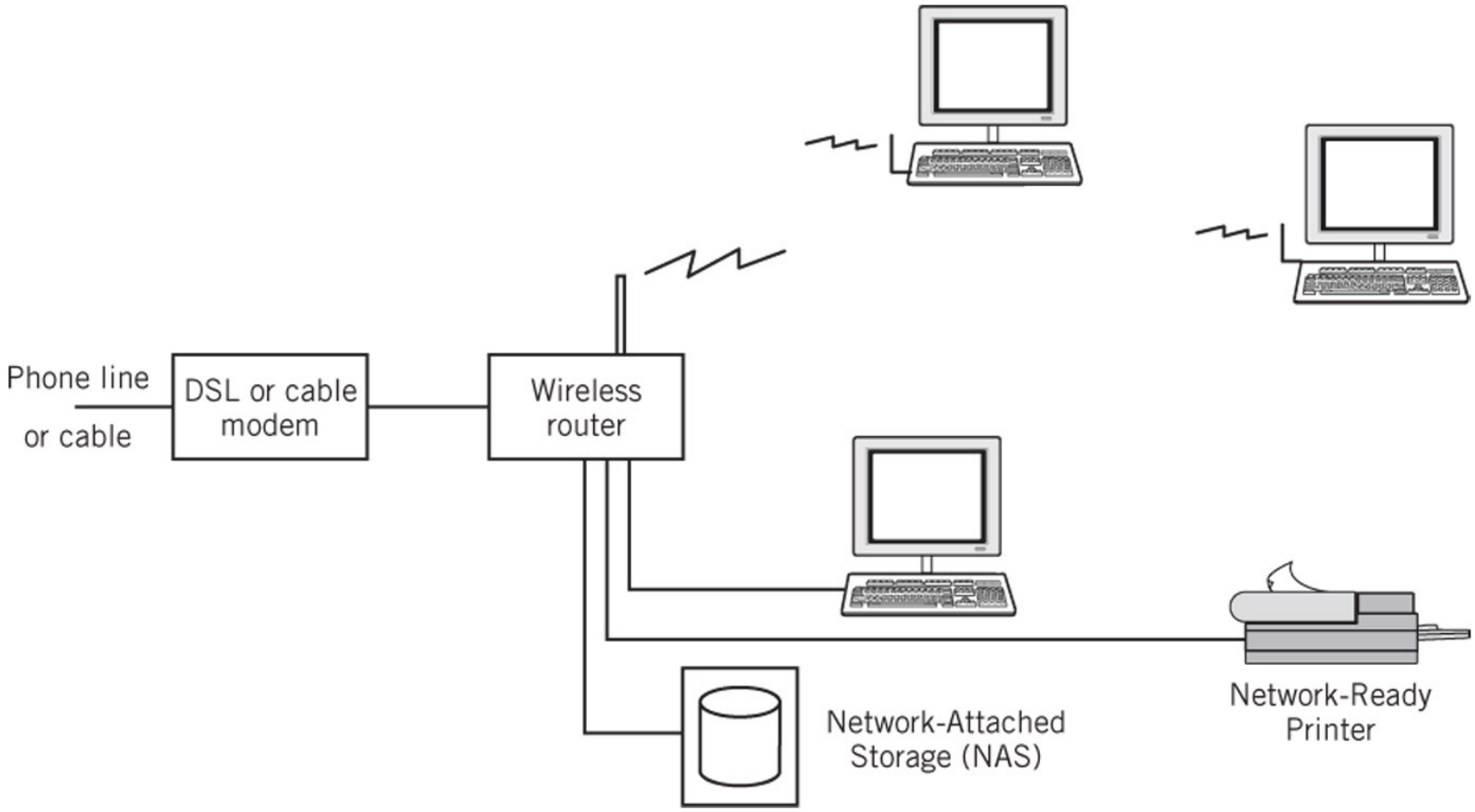


Solar System

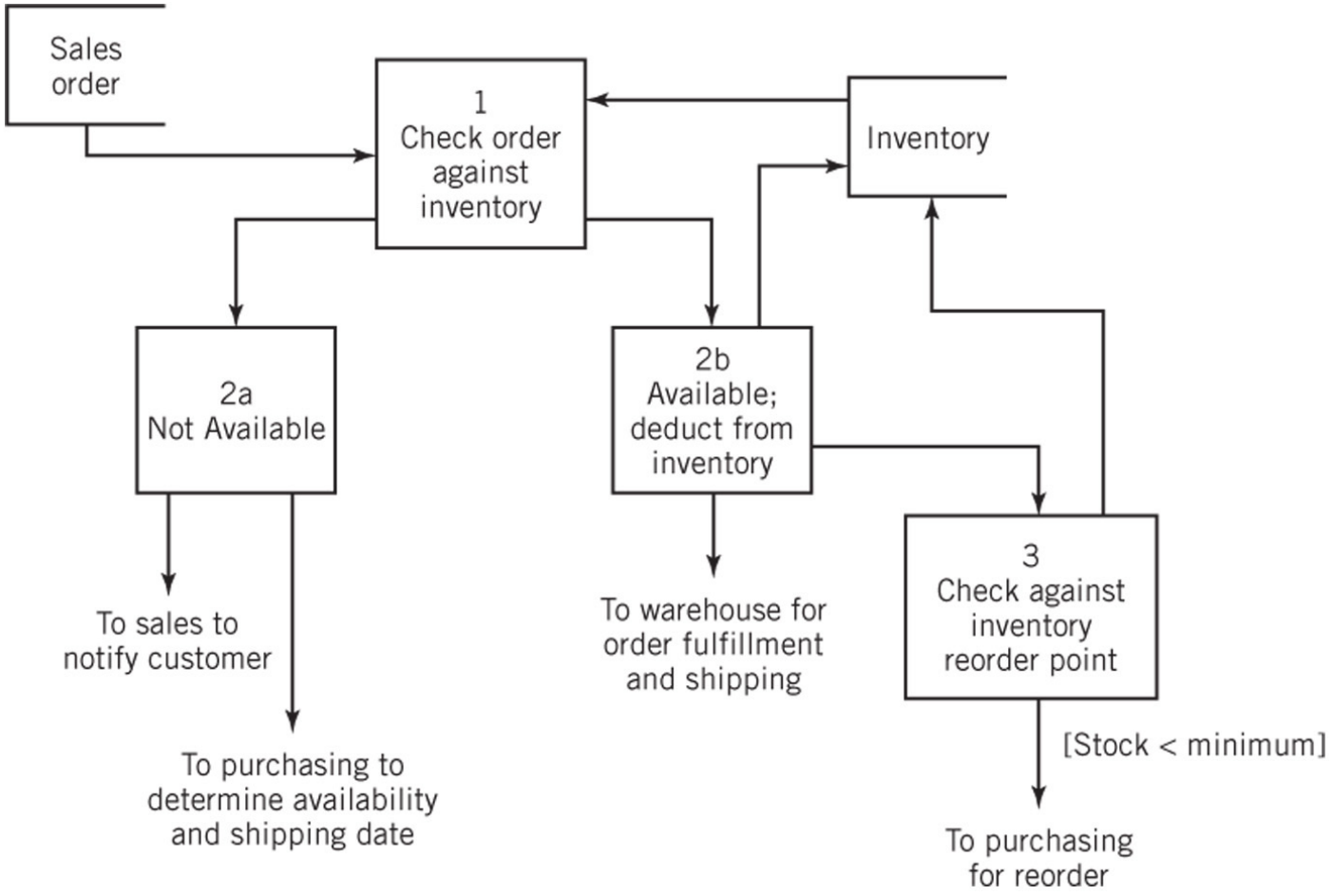


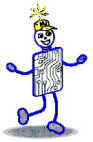


Home Network System



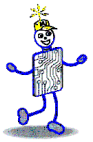
Inventory Control System



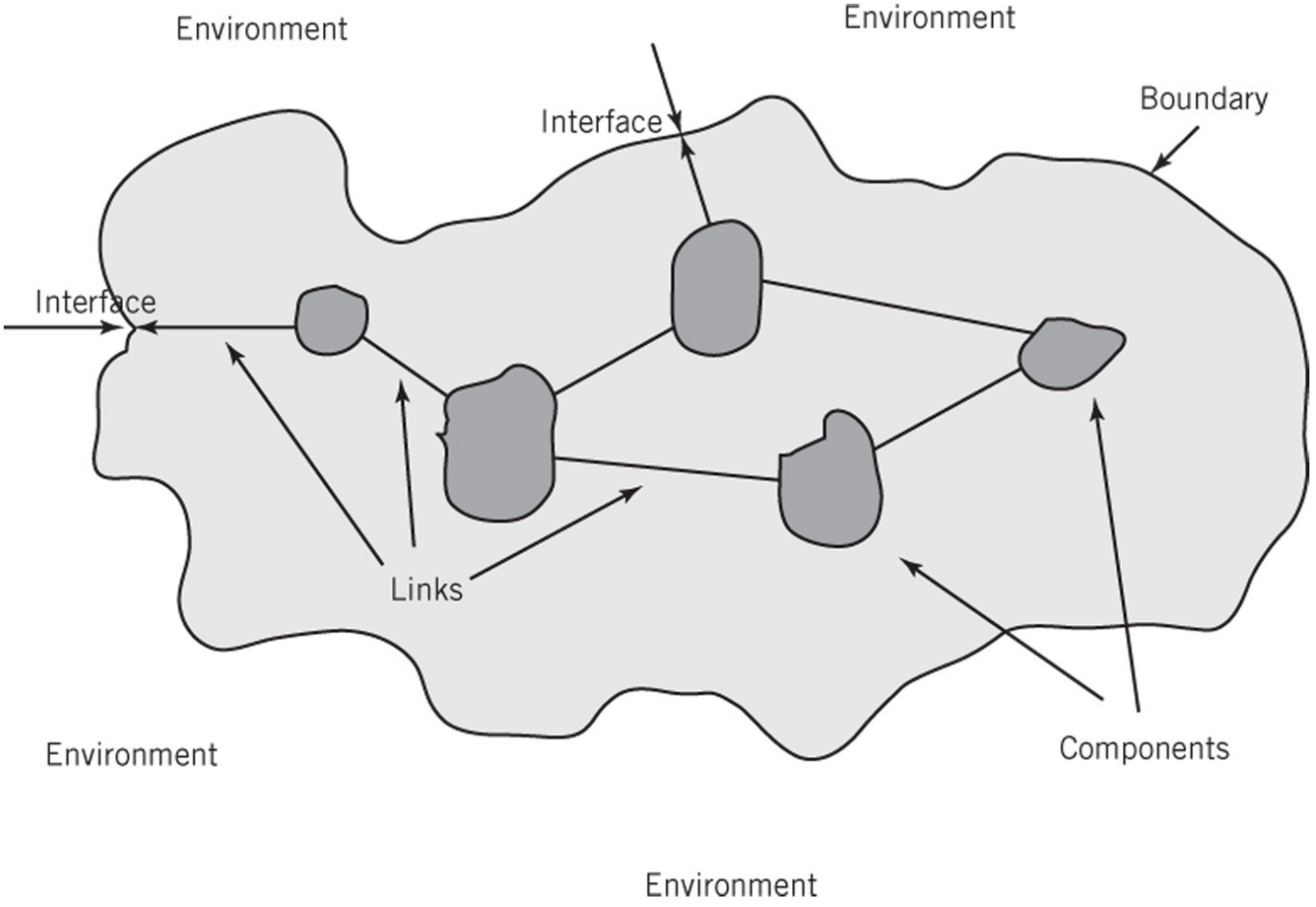


Definition of a System

- “A system is a collection of components linked together and organized in such a way as to be recognizable as a single unit.”
- Linked components of a system also define a boundary for the system
- The environment is anything outside of the system

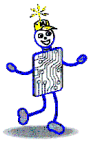


General Representation of a System



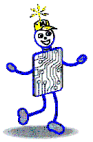
System Decomposition

- Components
  - May be irreducible or
  - May be subsystems
- Decomposition
  - The division of a system into its components and linkages
  - Hierarchical



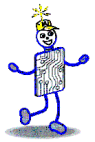
System Architecture

"The fundamental properties, and the patterns of relationships, connections, constraints, and linkages among the components and between the system and its environment are known collectively as the *architecture* of the system"

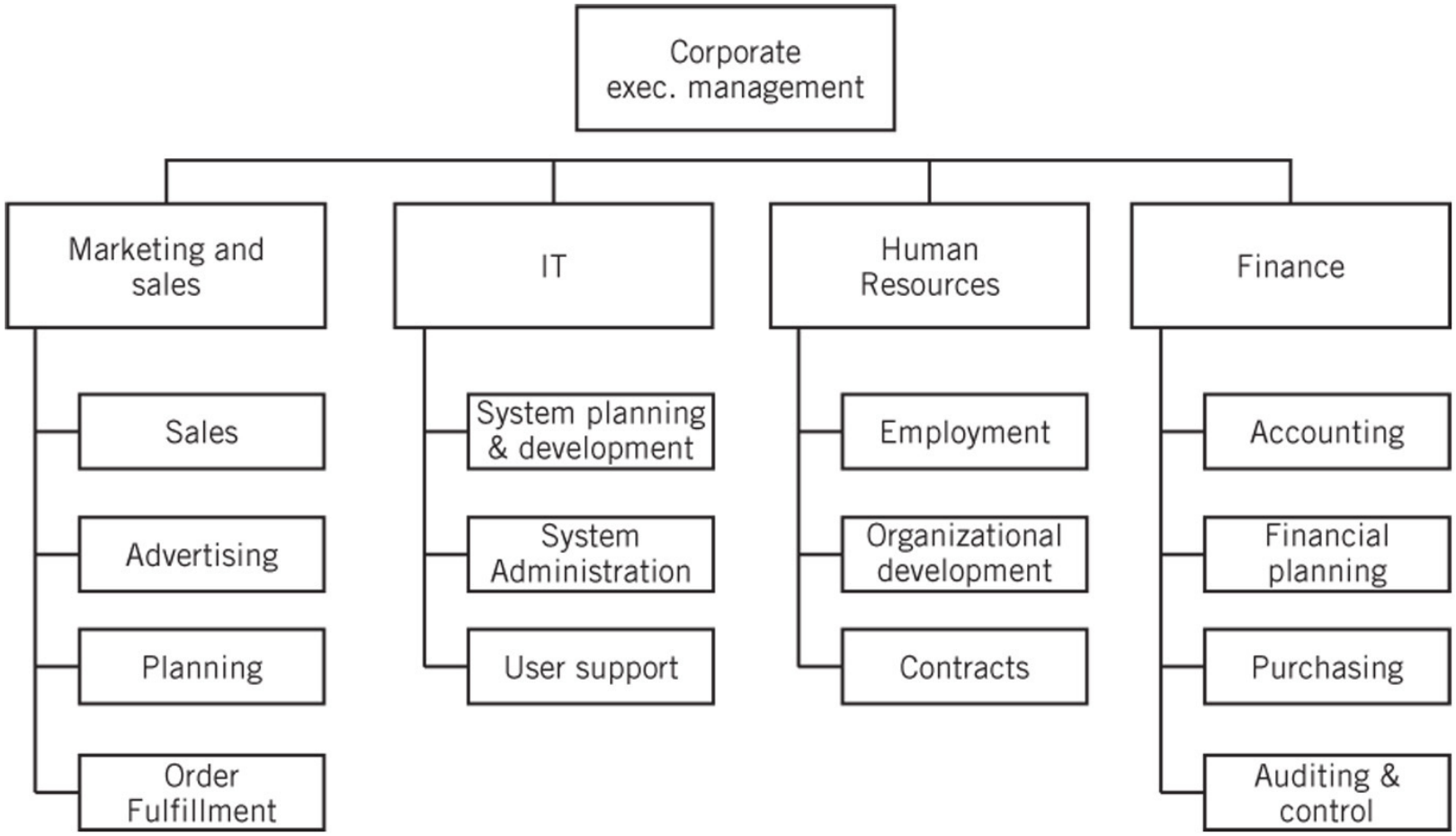


Abstractions of Systems

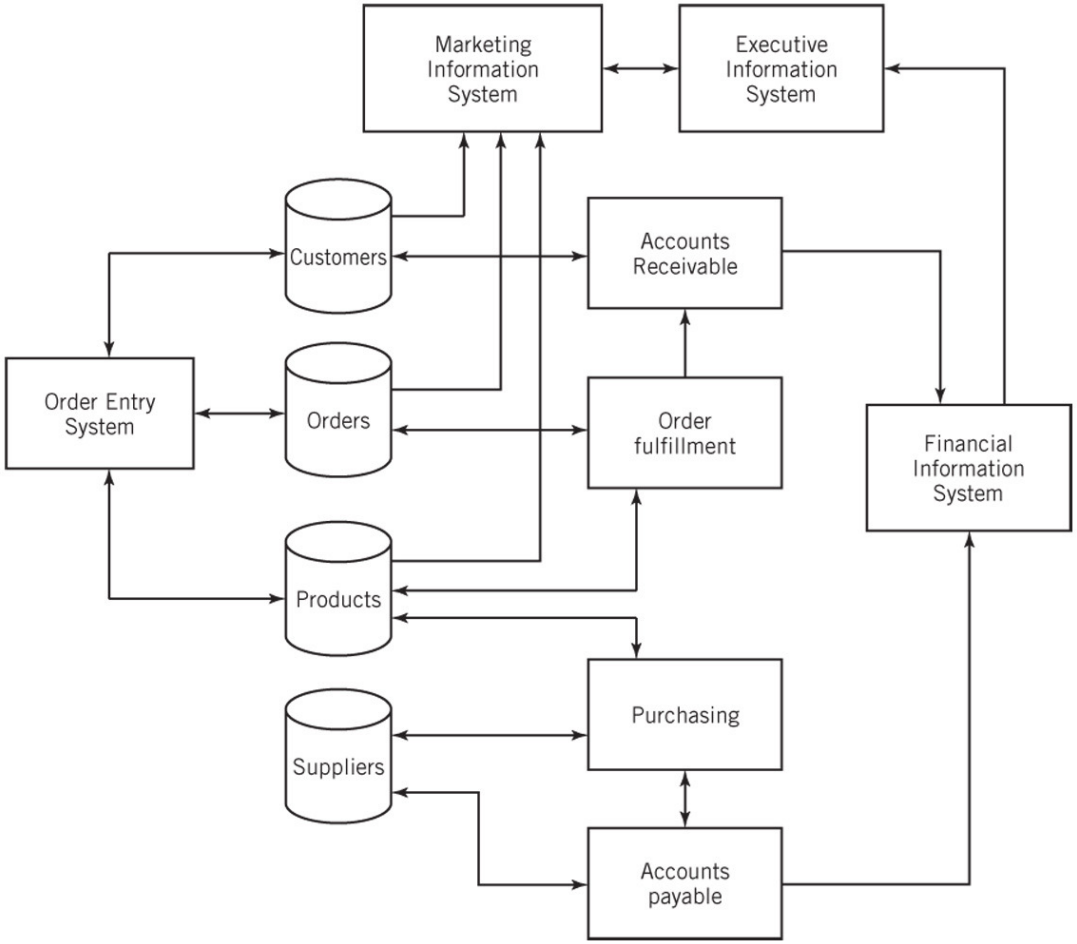
- How are the following two abstractions of a business system different from one another?
- How are these abstractions different from the real business system?

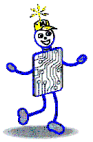


Business Organization Chart



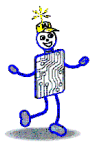
Business Application Architecture





IT System Architectures

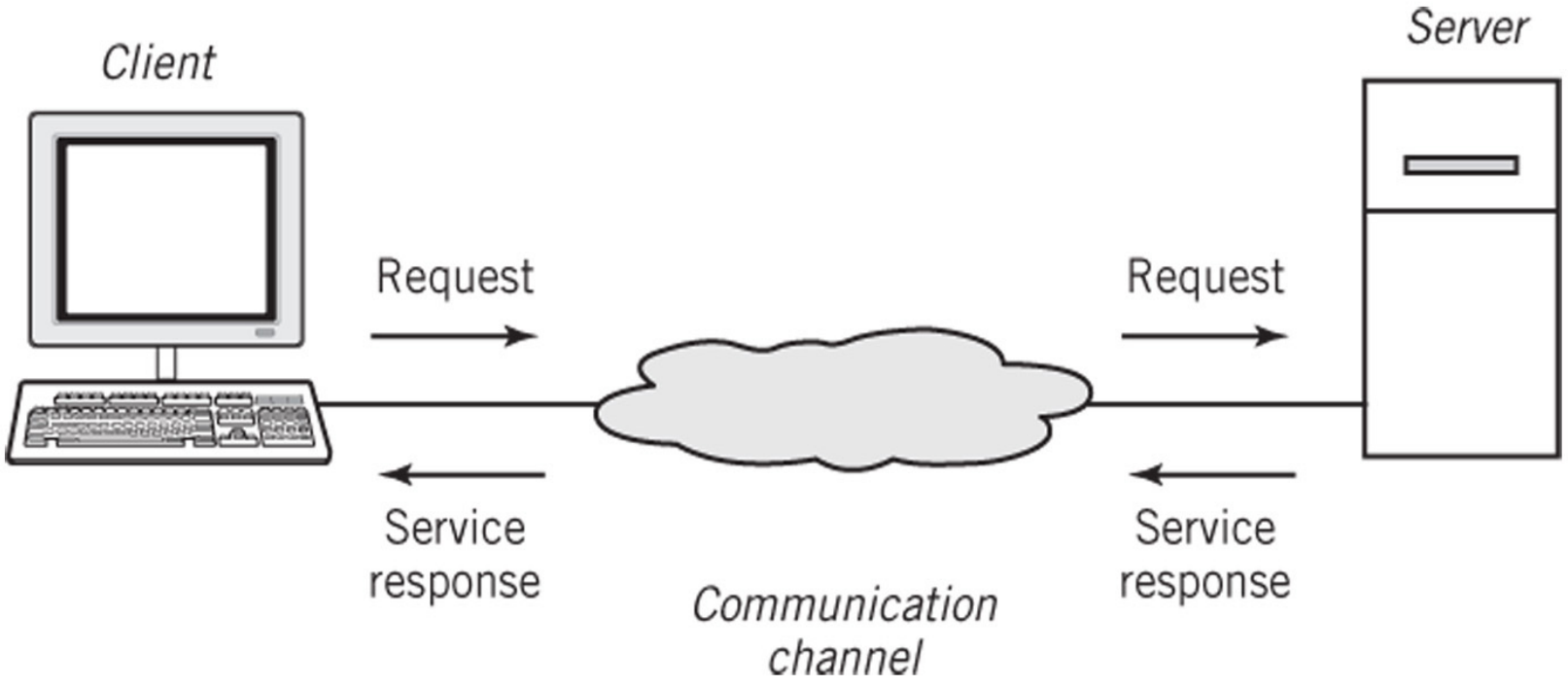
- Distributed processing systems
  - Client-Server Computing
    - Two-tier architecture
    - Three-tier architecture
    - N-tier architecture
  - Web-Based Computing
  - Cloud Computing
  - Peer-to-Peer Computing

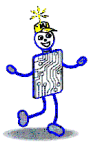


Client-Server Computing

- A program on a client computer requests services from a program on a server computer
- Examples:
  - Email services, file services, print services, directory services, Web services, database services, application services, remote access services

Basic Client-Server Architecture

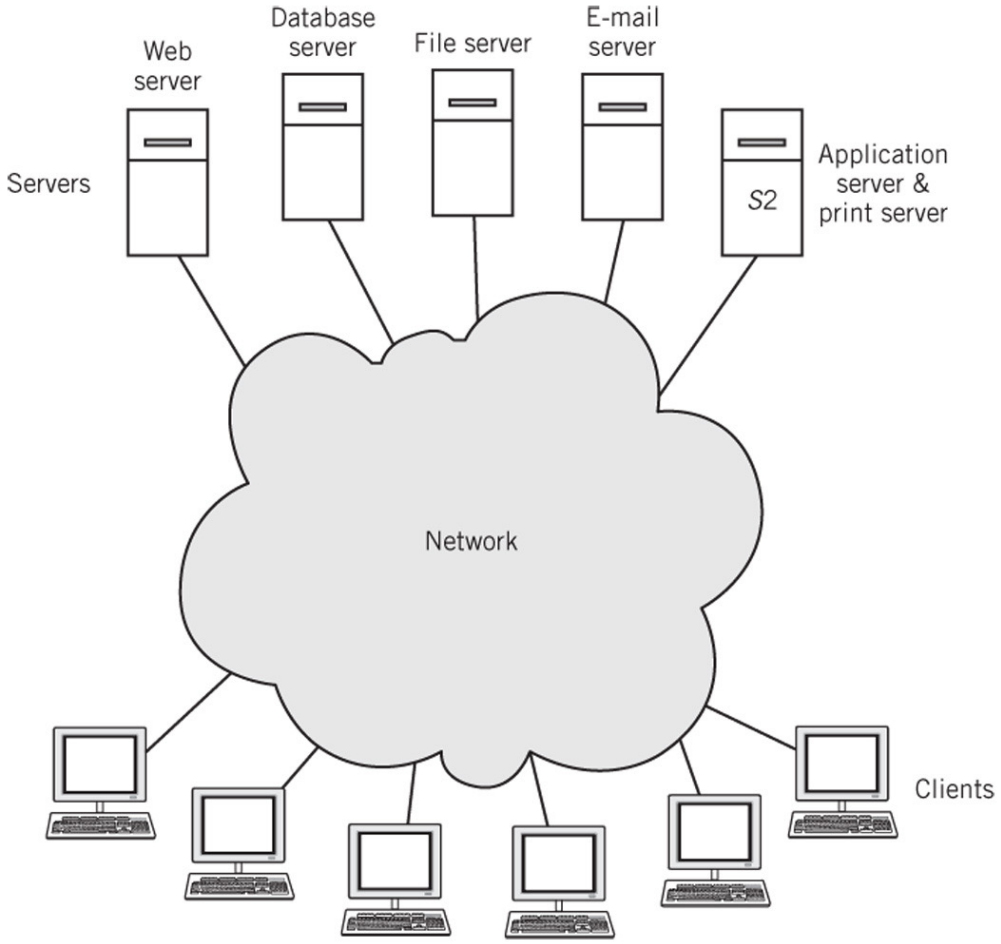


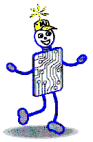


Advantages of Client-Server Architecture

- Centralization of services permits
  - easier administration of services by IT professionals
  - easier availability and location by users
  - consistency of resources, such as files and data, can be managed and assured
  - more efficient and cost-effective hardware procurement through purchasing a small number of very powerful computers

Clients and Servers on a Network

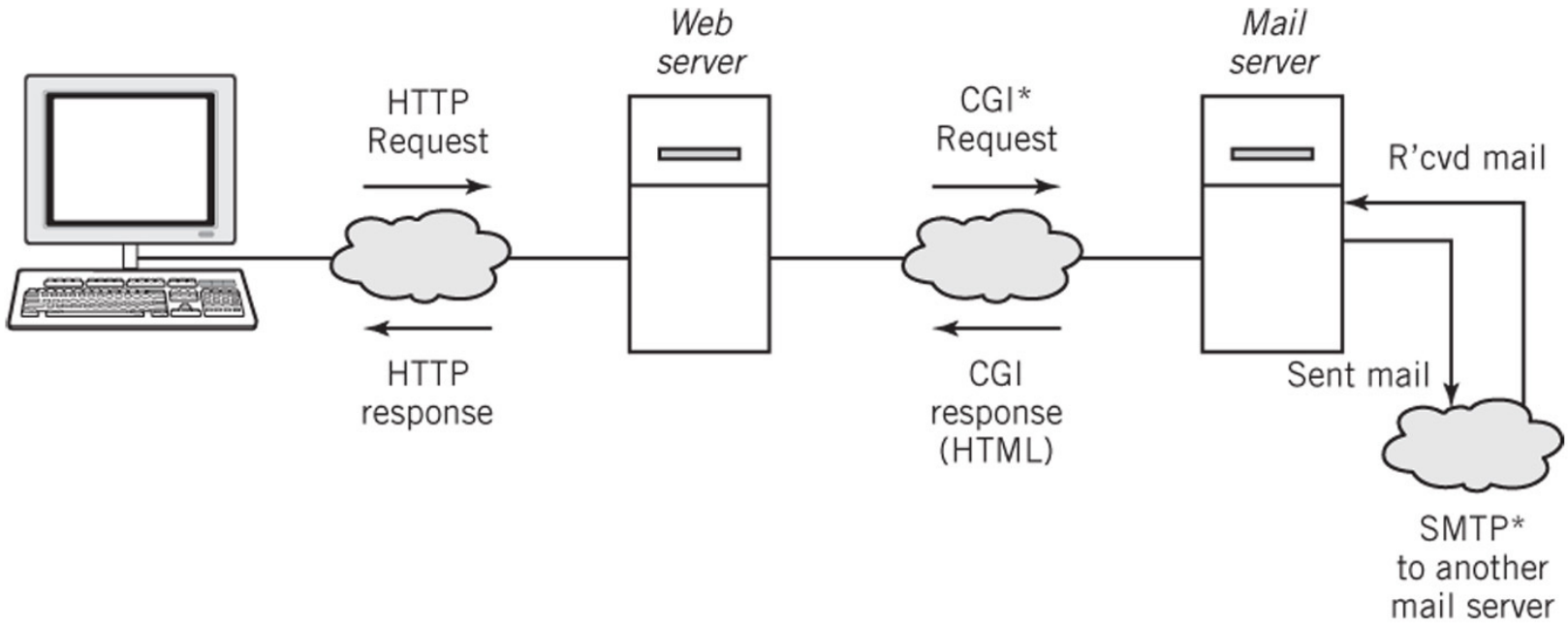




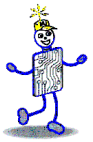
Multi-tier Architectures

- Two-tier architecture
  - Two computers are involved in a service
  - Example: Web browser and Web server model used in intranets and on the Internet
- Three-tier architecture
  - Three computers are involved in a service
  - Example: client computer, Web server, database server
- N-tier architecture

Three-tier Web-based Email Architecture

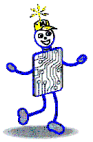


*SMTP: Simple Mail Transfer Protocol
*CGI: Common Gateway Interface



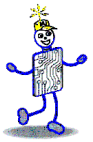
Cloud Computing

- Off-site storage facilities for an organization
- Software as a service (SaaS): applications run on a server or processing may be divided on server and client
- Platform as a service (PaaS): tools for a developer to create and run applications on a cloud platform
- Infrastructure as a service (IaaS) – cloud-based hardware emulation of virtual machines and networking



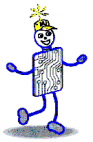
Cloud Computing Advantages/Risks

- Advantages
  - Client's datacenter needs are simplified; reduced costs
  - Supports collaboration
  - Scalable to a variety of host platforms
  - Reduced maintenance downtime
  - Lower investment for short-term projects
- Risks
  - Quality of security is critical
  - Outages or loss of connectivity may prevent users from working
  - Requires long-term commitment and viability of cloud service
  - Changes in operating procedures can result in data loss



Peer-to-Peer Computing

- Computers on a network are treated as equals
- Each computer can share resources with the other computers on the network
- Disadvantages
  - Difficult to establish centralized control of services
  - Difficult to locate services
  - Difficult to synchronize versions of files or software
  - Difficult to secure network from unauthorized access and from viruses
- Advantages
  - Sharing files between personal computers
  - Internet file sharing

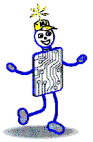


Hybrid Model of Computing

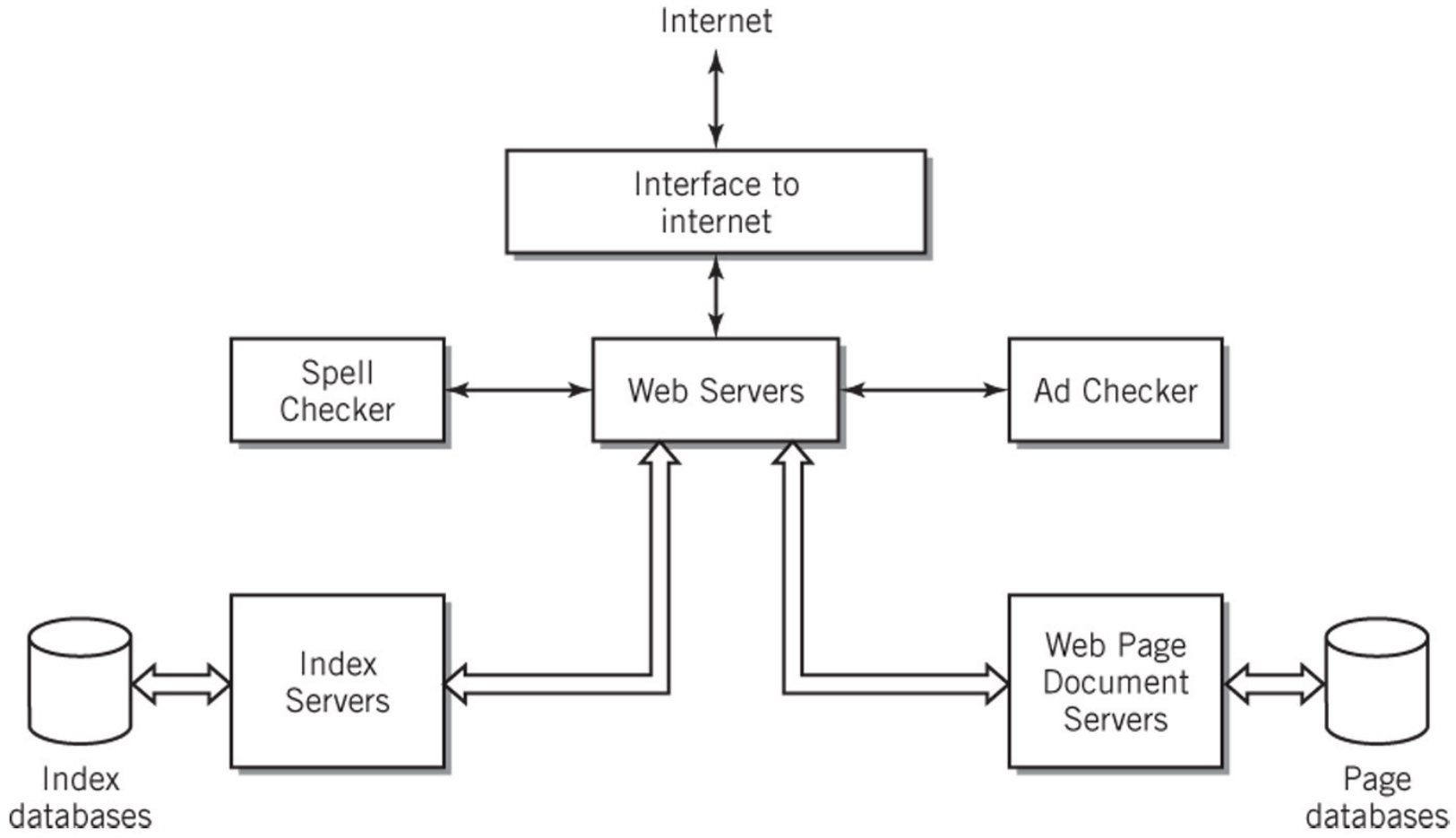
- Client-server technology used to locate systems and files
- Then systems can participate in peer-to-peer transactions
- Examples
  - Instant messaging
  - Skype
  - Napster

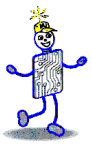
Google: System Architecture

- Provide powerful, fast search capability for material on the Internet
- Derive income from advertising that is targeted to each user based on their searches
- Basic requirements
  - Capable of responding to millions of simultaneous requests from all over the world
  - Perform a web crawl of the Internet to retrieve and organize data
  - Establish ranking of results with appropriately targeted advertising
  - High reliability of the system
  - System is easily scalable and cost effective

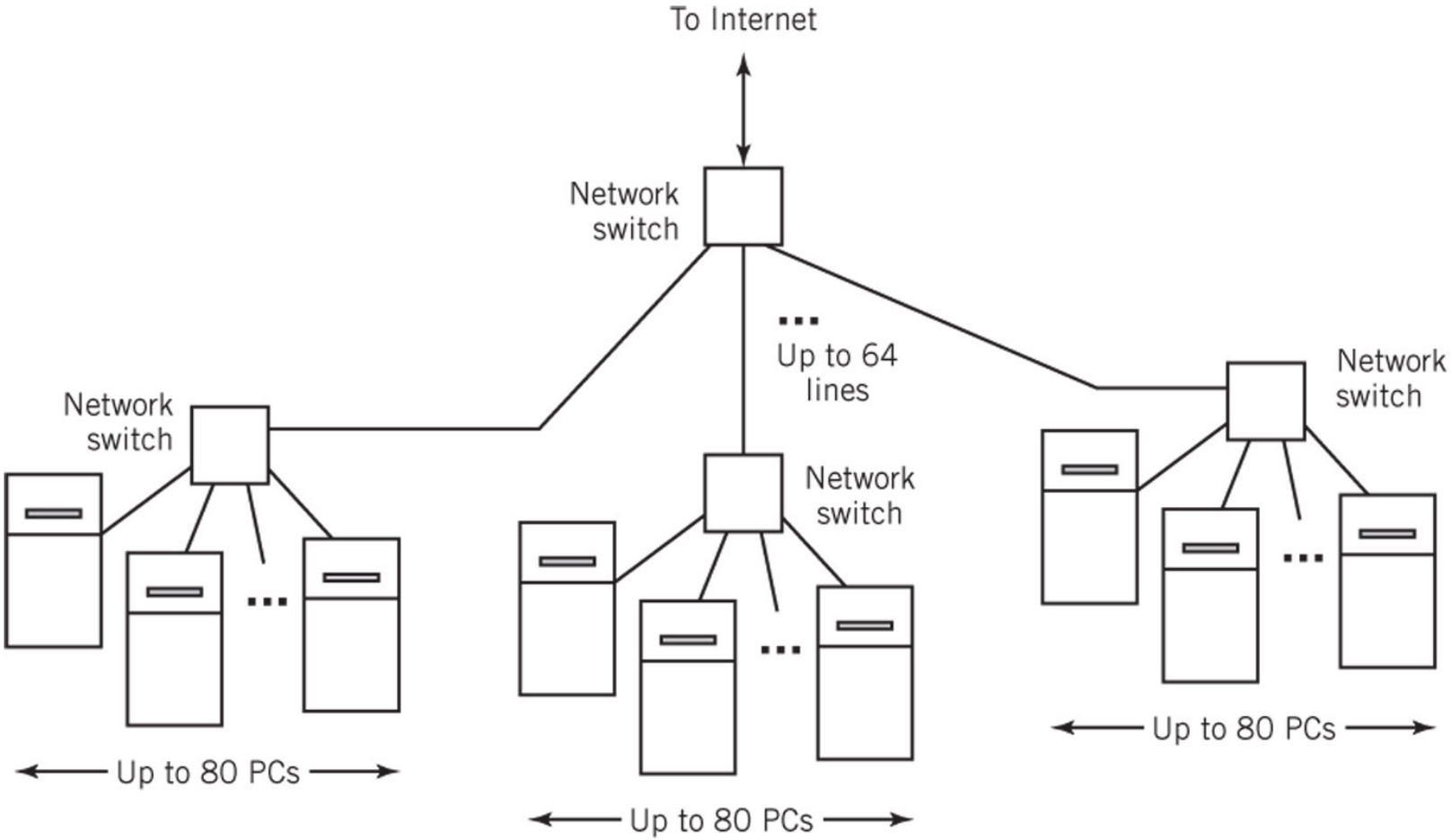


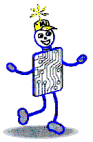
Google Data Center Search Application Architecture





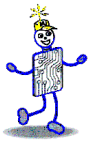
Simplified Google System Hardware Architecture





Facebook's Application Architecture

- N-tier architecture
- Based entirely on open source software
- Serves as an intermediary between web browser and an application provider's Web service
- API and protocols allow information exchange between Facebook servers and the application server



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