

# Chapter 6

IM/IT Architecture and  
Infrastructure

# Learning Objectives

- Define and use in context technical terms related to information technology architecture.
- Distinguish between the hardware and software elements of an information system and provide illustrative examples.
- Identify the elements of a computer network and give examples of various network structures.
- Distinguish among operating systems, utility programs, and application software.
- Introduce basic telecommunication concepts.

# Computer

- An electronic, digital device (hardware) that stores a set of instructions (program or software) and the data on which the instructions will operate

# Generations of Technology

- The Electronic Numerical Integrator and Calculator (ENIAC) (developed in 1946 at U. Penn) launched the first generation of computer hardware – devices that used vacuum tubes.
- Current technology has evolved to the fourth generation, which employs microprocessor technology.
- Fifth generation, parallel processing and artificial intelligence, is in development.

# Thanks to the Microprocessor...

A user can now hold in one hand a device that has more computing power than first-generation computers that required a large controlled-environment room.



# Computing System Components

- Central processing unit
- Primary storage
- Secondary storage
- Input devices
- Output devices
- Communications devices

# Computer Software

- Applications, either general purpose or function specific
- Operating systems
- Utilities
- Programming languages
- Software development tools
- Language translators

# Software Selection Factors

- Number of existing and potential users
- Required hardware configurations
- Security considerations
- Anticipated future growth in computer applications
- Functional requirements for individual applications

# General Purpose Applications

- Word processors
- Desktop-publishing software
- Spreadsheet software
- Statistical packages
- Database-management software
- Presentation graphics software
- Web browsers
  
- Often purchased as a “suite” of integrated menu-driven module programs

# Application Specific Software

- A computer program designed to solve a single, somewhat specifically defined problem.
- A good example is a payroll program developed to
  - Accumulate labor hours
  - Compute deductions
  - Write payroll checks
  - Post summaries to the general ledger
  - Complete forms required by federal and state governments

# Application Service Providers

- The high cost of specialized software has led some organizations to contract with application service providers (ASP) that provide needed computing services via a network connection.
- Key issues to include in contract negotiations are data ownership and return of data should the relationship be terminated.

# Integrated vs. Interfaced

- An integrated system ensures compatibility among the modules and requires a single source for system support and maintenance.
- Interfaced systems allow users to choose the leading system for a given module, can sometimes result in lower costs by leveraging one vendor against another, and obviate the need to replace all existing modules when updates are considered.

# Utility Programs

- Perform generalized data processing or computational functions not specific to any particular computer application
- Examples include virus scan programs and encryption programs

# Programming Language

- The evolutionary goal – not yet achieved – is to achieve *natural language* input, whereby the user is able to give commands to a computer as easily as communication with another person.
- A translator program would convert natural language statements into the binary number commands intelligible to the computer.

# Network Configurations

- Four configurations are in common use, ranging from a *centralized* computing environment (where the processing functions are concentrated in a single device) to a *decentralized* environment (where these functions are split or *distributed* among all of the users on the network).
- Decentralized networks typically create greater managerial challenges, a fact that is particularly relevant for the healthcare manager.

# Network Topologies

- Available network options
  - Bus
  - Ring
  - Star topologies
- These topologies can be used singly or in combination with one another to form a *hybrid network*.

# Mobile Computing

- *Mobile computing* refers to the use of a portable computing device such as
  - Laptop computer
  - Notebook computer
  - Palmtop computer
- Mobile computing and wireless communication make data retrieval and data entry at the point of care possible.

# Wireless Communication

- The combination of mobile computing and *wireless communication* enables portable computers to be connected to an established information systems network.
- Computing activities performed on the portable devices occur in real time, and the central database, as well as the mobile device, always stays current.

# Wireless Communication

- Despite the obvious benefits of data accessibility, mobile devices are not without drawbacks.
- Portability, the feature that is a prime benefit, makes the devices physically insecure.
- Devices may be lost or stolen, creating problems of data security.
- Due to their size, devices may be easily damaged or need frequent replacement.
- Special attention must be paid to removing or destroying data on devices that are taken out of service or re-issued to new users.

# The Internet

- Largest interconnection of networks in the world.
- Began in 1969 as a Defense Department project designed to connect various government laboratories and contractors.
- Soon recognized as an indispensable data link between researchers.
- By the 1990s, the Internet had entered the domain of the general public.

# World Wide Web

- The World Wide Web (www), developed in 1991, is a collection of electronic resources distributed over the Internet that combine text, graphics, sound, and video.
- Not only have individuals found the Internet and the www to be valuable tools, but a wide spectrum of businesses has also developed numerous applications utilizing these resources.

# Thin Clients and the Internet

- Thin client computers are minimally configured PCs that are suitable client machines in a client/server network.
- These machines can also serve as user workstations on the Internet.
- The healthcare manager will encounter a variety of terminology associated with this type of installation, including network computer (NC), net PC, and proprietary names like Windows Terminal or Winterm.

# Advantages

- **Cost**

- Thin clients carry a lower purchase price that can become significant as the number of computers connected to the Internet in typical healthcare settings continues to increase.

- **Ease of update**

- In an environment where thin clients are used, the software resides on the Web server and can be updated quite easily.

# Disadvantages

- Culture
  - Users are accustomed to the power of a fully configured PC.
- Downtime
  - When the server is “down,” the user of a thin client is also “down.”

# Thin Clients and the Internet

- In this area, as in all decisions concerning information systems acquisition and installation, the healthcare manager is well advised to be aware of all alternatives and select the one best suited for his or her organization.