

Prof. Dr. Nizamettin AYDIN

[naydin@yildiz.edu.tr](mailto:naydin@yildiz.edu.tr)

[naydin@ieee.org](mailto:naydin@ieee.org)

<http://www.yildiz.edu.tr/~naydin>

# Information Systems: Software

## Learning Objectives

- When you finish this chapter, you will:
  - Understand why managers must keep abreast of software developments.
  - Recognize the different generations of programming languages and how they differ.
  - Understand the difference between application software and system software.

## Learning Objectives

- Know the strengths and weaknesses of tailored software vs. off-the-shelf software.
- Be able to cite the latest major developments in application and system software.
- Recognize characteristics that are important in evaluating packaged software application for business use.

## Software

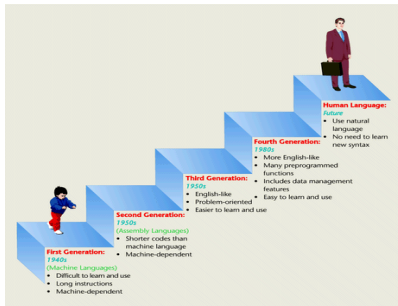
- Instructions to the Computer
- Computer program
  - a series of instructions to a computer to execute any and all processes.
- Computers only “understand” instructions consisting of electrical signals alternating between two states.

## Programming Languages

- Programming languages
  - Abbreviated forms of instructions that translate into machine language
  - New programming languages make programming easier for people who are not necessarily hardware experts

## Programming Languages

### The evolution of programming languages



## Programming Languages

- Machine Languages (ML)
  - Only languages computers can directly interpret to carry out instructions
  - String of ‘0s’ and ‘1s’ for a machine language instruction
  - ML coding: time-consuming and error-prone
  - ML programmers: concerned with hardware details
  - Every computer or family of computers has its own ML; each is machine-dependent.

## Programming Languages

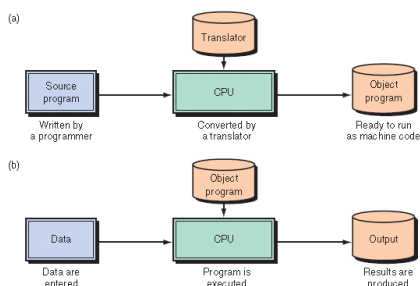
- Assembly Languages
  - More English-like; codes shorter than machine languages
  - Assembler translates into machine language
  - Advantages of machine or assembly languages
    - Programmer in control of hardware
    - Programs written in low-level languages run more efficiently.

## Programming Languages

The instruction “ADD 2 and 5 and assign the result to variable y” written in different programming languages

PROGRAMMING LANGUAGE	CODE
IBM System 370 machine language	0000101 0000100 0000010 0000000 0001100 0001000 0001000 0000000 0000101 0000100 0000010 0000000 0001100 0001000 0001000 0000000 0000101 0000000 0000010 0000000 0001100 0000001 0000000 0000000
IBM System 370 assembler language	L R2, = F2' A R2, = F5' ST R2,Y
Third-generation languages	
FORTRAN	y = 2+5
COBOL	add 2,5 giving y
BASIC	let y = 2+5;
C, C++	y = 2+5;
Fourth-generation languages:	y = 2+5

## The language translation process



## Programming Languages

- Procedural Languages
  - Third-generation (procedural) languages are more English-like than assembly languages.
  - Programmers focus on the procedure of the application problem at hand.
  - Some languages are standardized or portable.
  - Relatively easy to learn, write, and debug.
  - FORTRAN, COBOL, BASIC
  - Requires compiling and linking to test

## Programming Languages

- Fourth Generation Languages (4GL)
  - 4GLs are more English-like than procedural languages.
  - Programmer only has to select an action without having to specify the action's formula or procedure.
  - Easy to learn and use; shorter application development time.
  - PowerBuilder, FOCUS, NOMAD, and RAMIS

## Programming Languages

- Visual Programming
  - Languages that let programmers create field windows, scroll-down menus, click buttons, etc., by choosing from a palette
  - Appropriate code written automatically
  - Integrated programming environment
  - Accelerates work
  - Microsoft's Visual Basic

## Programming Languages

- Object-Oriented Programming (OOP)
  - Emphasis on the objects involved in the task, not on the procedure.
  - An object encapsulates a data set with the code that is used to operate on it.
  - Standardized programming modules can be reused.
  - Applications can be rapidly developed with appropriate objects from an object library.

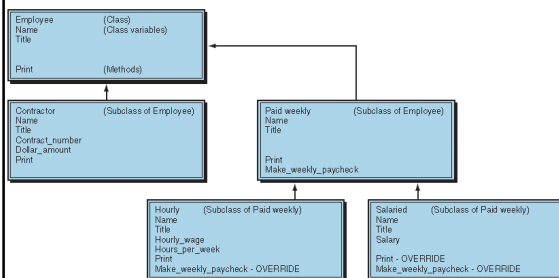
## Advantages of object-oriented programming (OOP) over procedural languages

### OOP Advantages

- ◆ requires less code than other languages
- ◆ requires less time than programming in other languages
- ◆ enhances program modularity and reusability
- ◆ makes code maintenance easier
- ◆ enhances ability to create user-friendly interface
- ◆ is appropriate for graphic- and sound-enhanced applications

## Programming Languages

### Object classes, subclasses, inheritance, and overriding



## Advantages and disadvantages of higher-level programming languages

### Advantages of Higher-level Programming

- ◆ Ease of learning the language
- ◆ Ease of programming
- ◆ Significantly shorter code
- ◆ Ease of debugging
- ◆ Ease of maintenance (for example, modification of a procedure)

### Disadvantages of Higher-level Programming

- ◆ Less control over hardware
- ◆ Less efficient memory use
- ◆ Program runs more slowly

## Application Software vs. System Software

- **Application:**
  - a program developed to address a specific business need;
    - software for development of such programs.
- **System:**
  - programs designed to carry out general routine operations,
    - such as loading, copying, or deleting a file.

## Application Software

- **Application-specific programs**
  - Programs designed to perform specific jobs
- **General-purpose programs**
  - Usable for different purposes

## Application Software

- **Custom-Designed Applications**
  - **Advantages:**
    - Meeting the organization's needs exactly
    - In-house developers are sensitive to the organizational culture
  - **Disadvantages:**
    - High cost
    - Production schedule subject to long delays
    - Incompatible with other organizations' systems

## Advantages and disadvantages of custom applications

### Advantages

- ◆ Good fit of features to business needs
- ◆ Good fit of features to organizational culture
- ◆ Personnel available for maintenance
- ◆ Smooth interfaces with other information systems
- ◆ Availability of special security measures

### Disadvantages

- ◆ High cost
- ◆ Long wait for development if IS personnel are busy with other projects
- ◆ Application may be too organization-specific to interface with systems of other organizations

## Application Software

- **Packaged Software**
  - **Advantages:**
    - Low cost
    - High quality
    - Vendor support
    - Immediate availability
  - Often tested at user sites (alpha sites and beta sites) before the final version is released.

## Advantages and disadvantages of packaged software

### Advantages of Packaged Software

- ◆ Low cost
- ◆ High quality
- ◆ Good vendor support
- ◆ Vendor upgrade for low cost
- ◆ Immediate availability
- ◆ Good documentation
- ◆ Conducive to sharing applications and data

### Disadvantages of Packaged Software

- ◆ Features cater to the lowest common denominator of users' needs
- ◆ Software often addresses only a narrow spectrum of business needs
- ◆ Purchasers may pay for features they don't need
- ◆ Impossible to alter to meet specific needs
- ◆ Vendor may go out of business, leaving users without support

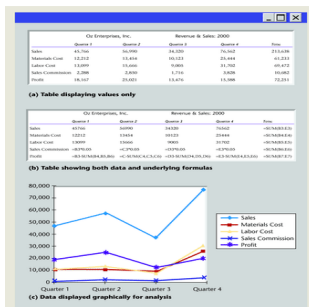
## Types of applications

- Spreadsheet applications
  - for creating documents to manage and organize numerical data
- Word processing applications
  - for creating documents that are formatted and organized for readability
- Database applications
  - for developing databases that can organize and retrieve large amounts of information
- Accounting applications
  - for managing personal checkbooks, or the accounting functions of businesses.

## Types of applications

- Activity management applications
  - such as calendars and address books
- Presentation applications
  - for making slide shows
- Graphics applications
  - for creating pictures
- Communications programs
  - such as e-mail, text messaging, and fax software for sending and receiving messages
- Multimedia applications
  - for creating video and music
- Utilities or utility programs
  - for performing a variety of tasks that maintain or enhance the computer's operating system

## Packaged Software



Electronic spreadsheets are powerful tools for

- (a) tabulation,
- (b) manipulation, and
- (c) data analysis.

## Packaged Software

- Multimedia
  - Can handle many different types of data such as text, voice, and image.
  - Powerful means of communicating.
  - Uses include education, training, research, and business.

## Packaged Software

- Virtual Reality (VR)
  - Mimics sensory reality.
  - Some sophisticated VR software includes use of goggles, gloves, earphones, and a moving base.
  - Business use of VR is expected to grow dramatically for design and testing of new products, and for marketing.

## Other Application Software

- There exist hundreds of other application software products.
- Of special interest to business managers are the following:
  - Middleware
  - Enterprise Applications
  - Presence Software

## Middleware

- Software designed to link application modules developed in different computer languages and running on heterogeneous platforms, whether on a single machine or over a network.
- Middleware keeps track of the locations of the software modules that need to link to each other across a distributed system and manages the actual exchange of information.

## Enterprise Applications

- Enterprise software
  - consists of programs that manage the vital operations of an organization, such as
    - supply-chain management (movement of raw materials from suppliers through shipment of finished goods to customers),
    - inventory replenishment,
    - ordering,
    - logistics coordination,
    - human resources management,
    - manufacturing,
    - operations, accounting, and financial management.

## Enterprise Applications

- Some common modules of enterprise applications software
  - payroll,
  - sales order processing,
  - accounts payable/receivable, and
  - tax accounting.
- The largest vendors
  - SAP, Oracle, PeopleSoft, and Computer Associates
    - offer software programs that make the jobs of business users and IT personnel easier.

## Presence Software

- Presence technology can detect when you're online and what kind of device you're using.
- It has its roots in instant messaging (IM).
- When you log on to an IM service, your arrival is immediately announced to a list of other users you've selected to be alerted to your online presence.

## System Software

- Controls and supports the computer hardware and its information processing activities.
- Also facilitates the programming, testing, and debugging of computer programs.
- More general than applications software and is usually independent of any specific type of application.
- Systems software programs support application software by directing the basic functions of the computer.
  - For example, when the computer is turned on, the initialization program (a systems program) prepares and readies all devices for processing.

## System Software

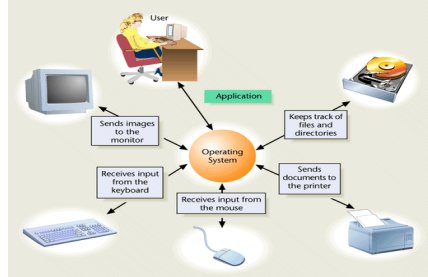
- Other common operating systems tasks are the following:
  - Monitoring performance
  - Correcting errors
  - Providing and maintaining the user interface
  - Starting ("booting") the computer
  - Reading programs into memory
  - Managing memory allocation to those programs
  - Placing files and programs in secondary storage
  - Creating and maintaining directories
  - Formatting diskettes
  - Controlling the computer monitor
  - Sending jobs to the printer
  - Maintaining security and limiting access
  - Locating files
  - Detecting viruses
  - Compressing data

## System Software

- Operating Systems (O/S)
  - Most important system software
    - Developed for a certain microprocessor or microprocessors
    - Addresses technical details such as registers and RAM addresses.
    - Plays the role of “traffic cop” or the “boss” of computer resources.

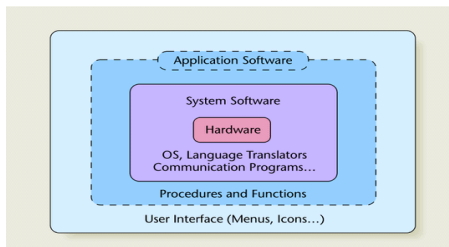
## System Software

The operating system mediates between applications and the computer, and controls peripheral devices.



## System Software

Computers operate on a number of layers, starting from the user interface and moving inward to the hardware.



## System Software

Popular operating systems

NAME	OS AUTHOR	RUNS ON
MVS	IBM	IBM mainframes
VMS	DEC (Compaq)	DEC minicomputers
OS/400	IBM	IBM AS/100 computers
MS-DOS	Microsoft	IBM and compatible PCs
Windows 3.x	Microsoft	IBM and compatible PCs
Windows NT	Microsoft	IBM and compatible PCs
Windows 95	Microsoft	IBM and compatible PCs
Windows 98	Microsoft	IBM and compatible PCs
Windows 2000	Microsoft	IBM and compatible PCs
MacOS 8.X (and other versions)	Apple Computer	Macintosh computers
Solaris	SunSoft, Inc.	Sun workstations
Unix	ATT (originally) and other software companies	There are different versions for IBM, Macintosh, Sun, and other manufacturers' computers
Linux	Linus Torvald and Others	IBM and compatible PCs

## Operating System Functions

- OS performs four major functions in the operation of a computer system:
  - job management,
  - resource management,
  - server consolidation, and
  - data management.

## Job management

- Preparing, scheduling, and monitoring of jobs for continuous processing by the computer system.
- A job control language (JCL) is a special computer language found in the mainframe-computing environment
  - JCL allows a programmer to communicate with the operating system.

## Resource management

- controlling the use of computer system resources employed by the other systems software and application software programs being executed on the computer.
- These resources include
  - primary storage,
  - secondary storage,
  - CPU processing time, and
  - input/output devices.

## Server consolidation

- is about creating a simpler, more rational, and manageable infrastructure.
- There are four possible consolidation strategies:
  - logical consolidation,
  - physical consolidation,
  - workload consolidation, and
  - application consolidation.
- Consolidation also leads to much more flexible, consistent, and efficient use of resources than distributed servers by allowing customers to strike the right balance within each server.

## Data management

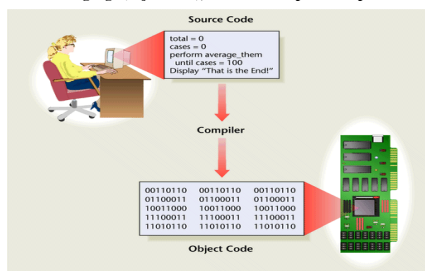
- controlling of the input and output of data as well as their location, storage, and retrieval.
- Data management programs control
  - the allocation of secondary storage devices,
  - the physical format, and
  - cataloguing of data storage.

## Compilers and Interpreters

- **Compiler**
  - Scans source code and translates into object code
  - Generates error message and does not compile when an error is found
  - Allows users to save programs in object code
- **Interpreter**
  - Checks one statement at a times
  - Converts into object code and executes

## System Software

A compiler converts higher-level language code (source code) into machine language (object code), which the computer can process.



## System Software

- Data Communication Programs
  - Controls and supports data communication activities in a network
    - Setting up rules that govern transmission and reception of data
    - Connecting and disconnecting communication links
    - Assigning priorities among terminals in a network
    - Detecting and correcting transmission errors



## System Software

- Proprietary vs. Open Source
  - Proprietary O/S: limited to using applications compatible with it
  - Open O/S: compatible with virtually all applications.
    - Completely open O/S does not exist
  - Some O/Ss (e.g., Unix) are said to be nonproprietary, but it is still impossible to run many applications on different versions of such O/Ss.

## Considerations in Purchasing Software

### Sample software evaluation form

Factor	What To Look For	Score
Fitness for purpose	◆ Try to maximize the number of needs satisfied.	_____
Ease of learning to use	◆ The shorter the training time, the better.	_____
Ease of use	◆ The easier a program is to use, the better. ◆ Try to minimize the number of commands that need to be memorized.	_____
Compatibility with other software	◆ Try to maximize compatibility with related software and with other operating systems. ◆ Try to maximize portability of data and output to other programs.	_____
Reputation of vendor	◆ Use professional contacts and references to gather background information on vendor. ◆ Be sure vendor can deliver what it promises. ◆ Be sure vendor stands by his pricing.	_____
Availability and quality of telephone and on-line support	◆ Ask references about their experience. ◆ Look for knowledgeable staff on phone support.	_____
Networking	◆ Try to maximize ability of many computers to share the software.	_____
Cost	◆ Seek detailed pricing information. ◆ Seek the best price, while maintaining quality and performance.	_____

## Considerations in Purchasing Software

Reliability	4.0	Tools & utilities	4.1
Technical support	4.2	Spreadsheet editing	4.4
Ease of use	4.2	Programming	4.2
Performance	3.5	Formulas & analysis	4.4
Installation	3.5	Charting & graphics	4.2
Networking	3.0	Compatibility	4.1
		Overall rating	4.5