Lecture-02

Chapter-04
Computer Software

Software

Is the general term for a myriad of programs **used to operate and manipulate** computers and their peripheral devices or to perform a specific task using a computer as the vehicle.

- Can be thought as the variable part of a computer and hardware as the invariable part.
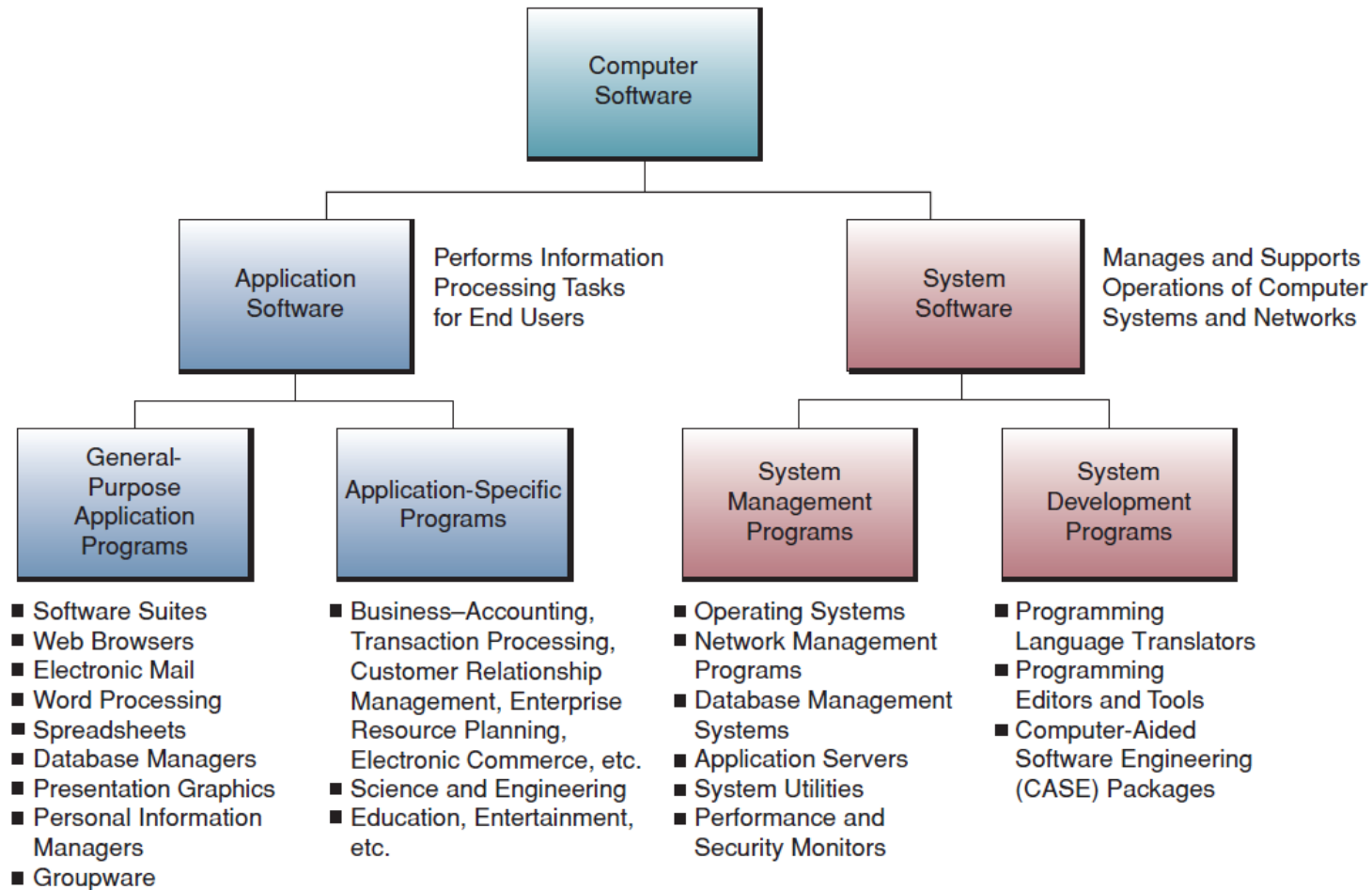
Some examples of hardware (iPod, CD player, Computing devices)

Some examples of software (any application to play songs, movies, or games)

Section-1

Application Software: End-user Application

Types of Software

Computer Software

Application Software — Performs Information Processing Tasks for End Users

System Software — Manages and Supports Operations of Computer Systems and Networks

General-Purpose Application Programs
- Software Suites
- Web Browsers
- Electronic Mail
- Word Processing
- Spreadsheets
- Database Managers
- Presentation Graphics
- Personal Information Managers
- Groupware

Application-Specific Programs
- Business–Accounting, Transaction Processing, Customer Relationship Management, Enterprise Resource Planning, Electronic Commerce, etc.
- Science and Engineering
- Education, Entertainment, etc.

System Management Programs
- Operating Systems
- Network Management Programs
- Database Management Systems
- Application Servers
- System Utilities
- Performance and Security Monitors

System Development Programs
- Programming Language Translators
- Programming Editors and Tools
- Computer-Aided Software Engineering (CASE) Packages

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Application Software

Includes variety of programs.

Can be subdivided into **two** main categories (General Purpose and Application Specific).

General-purpose: perform common information processing jobs for end users. (word processing, spreadsheet, database management, graphics program, web browsers, e-mail, and groupware)

- Popular with users for home, education, business, scientific, and many other purposes.
- Significantly increase the productivity of end users.
- Sometimes known as productivity packages.
- Support communication and collaboration among workgroups and teams.

Custom Software

Additional common way of classifying software is based on how the software was developed.

Custom software is the term used to identify software applications that are developed within an organization for use by that organization.

- So, custom application can be designed to do exactly what the organization wants or need.
- Software will work only for that organization and for the intended purpose.
- Is generally owned by the organization that developed it (or that paid to have it developed)

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COTS Software

COTS (Commercial off-the-shelf) **Software** is developed with the intention of selling the software in multiple copies (and **usually for a profit**).

- In this case, organizations that writes the software is not the intended target audience for its use
- Examples include MS Office, Adobe Acrobat.
- Purchasers of COTS software generally have no control over the specification, schedule, evolution, or access to either the source code or the internal documentation.
- A COTS product is sold, leased, or licensed to the general public
- The vendor of the product retains the intellectual property rights to the software.

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Open-source Software

The newest innovation in software development.

- Developers collaborate on the development of an application using programming standards that allow anyone to contribute to the software.

- As each developer completes his or her project, the code for the application becomes available and free to anyone else who wishes to use it.

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Function-specific Application Software

Can literally be designed to do whatever you want.

- Thousands of packages are available to support needs of end users in business, education, and day-to-day activities.

*For example, business application software supports the **reengineering and automation of business processes** with strategic e-business applications like customer relationship management, enterprise resource planning, and supply chain management .*

*Other examples are software packages that Web-enable online applications or apply to the **internal activities of organizations** like human resource management, accounting, and finance. Still other software empowers managers and business professionals with decision support tools like data mining, enterprise information portals, or knowledge management systems.*

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ORACLE E-BUSINESS SUITE

Advanced Planning	Business Intelligence	Contracts
e-Commerce	Enterprise Asset Management	Exchanges
Financials	Human Resources	Interaction Center
Manufacturing	Marketing	Order Fulfillment
Procurement	Product Development	Professional Services Automation
Projects	Sales	Service
Training	Treasury	

SOURCE: Oracle Corp., "Oracle Enterprise Performance Management and Business Intelligence," Oracle.com, 2011.

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Software Suites

- Are very likely the most widely used productivity software packages.

- Software suites bundle together a variety of general-purpose software applications.

Advantages of Software Suites

✓ Generally, costs a lot less than the cost of buying its individual packages separately

✓ All programs use a similar GUI (graphical user interface) of icon, tools, status bars, menus which gives them the same look and feel and makes them easier to learn and use.

✓ Also share common tools, such as spell checkers and help wizards, to increase their efficiency.

✓ Programs are designed to work together seamlessly and import each other's files easily no matter which program people are using at the time

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Disadvantages/ Drawbacks of Software Suites

- It is argued that many end users never use many software suite features.

- The suites take up a lot of disk space (often upward of 1+ gigabytes in size), depending on which version or function we install

- Because of the size, software suites are sometimes derisively called bloatware by their critics.

- Can be expensive. (cost of suites can vary from as low as $100 for a competitive upgrade to more than $700 for a full version of some editions of the suites.

Integrated Packages

Drawbacks of software suite features are one reason for the continued use of integrated packages like Microsoft Works, Apple Works, and Lotus eSuite Workplace.

- Integrated packages combine some, but not all, of the functions of several programs.

- Integrated packages leave out many features and functions that are in individual packages and software suites, they are considered less powerful.

- Limited functionality requires a lot less disk space (often less than 10 megabytes) and costs less than $100.

- Packages are preinstalled on many low-end-micro-computer systems.

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Programs	Microsoft Office	Lotus SmartSuite	Corel WordPerfect Office	Sun Open Office
Word Processor	Word	WordPro	WordPerfect	Writer
Spreadsheet	Excel	1-2-3	Quattro Pro	Calc
Presentation Graphics	PowerPoint	Freelance	Presentations	Impress
Database Manager	Access	Approach	Paradox	Base
Personal Information Manager	Outlook	Organizer	Corel Central	Schedule

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Web Browser

- Are software application designed to support navigation through point-and-click hyperlinked resources of the World Wide Web and the rest of the internet, as well as corporate intranets and extranets.

- Once was limited to surfing the Web.

- Have become the universal software platform from which end users launch information searches, e-mail, multimedia file transfers, discussion groups, and even productivity applications.

- Largest search engine- Google.com

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Electronic Mail

The first thing many people do most often is check their mail.

- Computer users depend on e-mail software/ apps to communicate with one another by sending and receiving electronic messages and file attachments via the internet or their organizations' intranets or extranets.

- E-mail is stored on networked mail servers and can be read whenever the users are ready by using e-mail apps or just a browser.

- A message can be composed, sent, and received with only a few minutes of effort (and a few microseconds of transmission time).

- Some e-mail packages are: Google gmail, Microsoft Hotmail, Microsoft Outlook, Yahoo! Mail.

And what **can be done** besides sending messages:

- Adding attachments (documents, files), filter and sorting incoming messages and route them to appropriate mail box …

Instant Messaging (IM)

E-mail/ computer conferencing hybrid technology which has become a standard method of electronic messaging for the internet users worldwide.

What people could do previously:

- Sending and receiving electronic messages instantly.
- Messages pop up instantly in an IM window on the computer screen.
- IM software can be downloaded.
- Many popular IM systems were Yahoo Messenger, Skype, AOL's Instant Messenger.

What people can do now:

- Some popular IM systems are: Facebook Messenger, WhatsApp, Instagram, IMO Messenger.
- Sending and receiving messages, weblinks, any multimedia files, attachments, reels instantly.
- Capturing images, videos.
- Creating polls for taking any opinions or voting.
- Individual calls or group calls …

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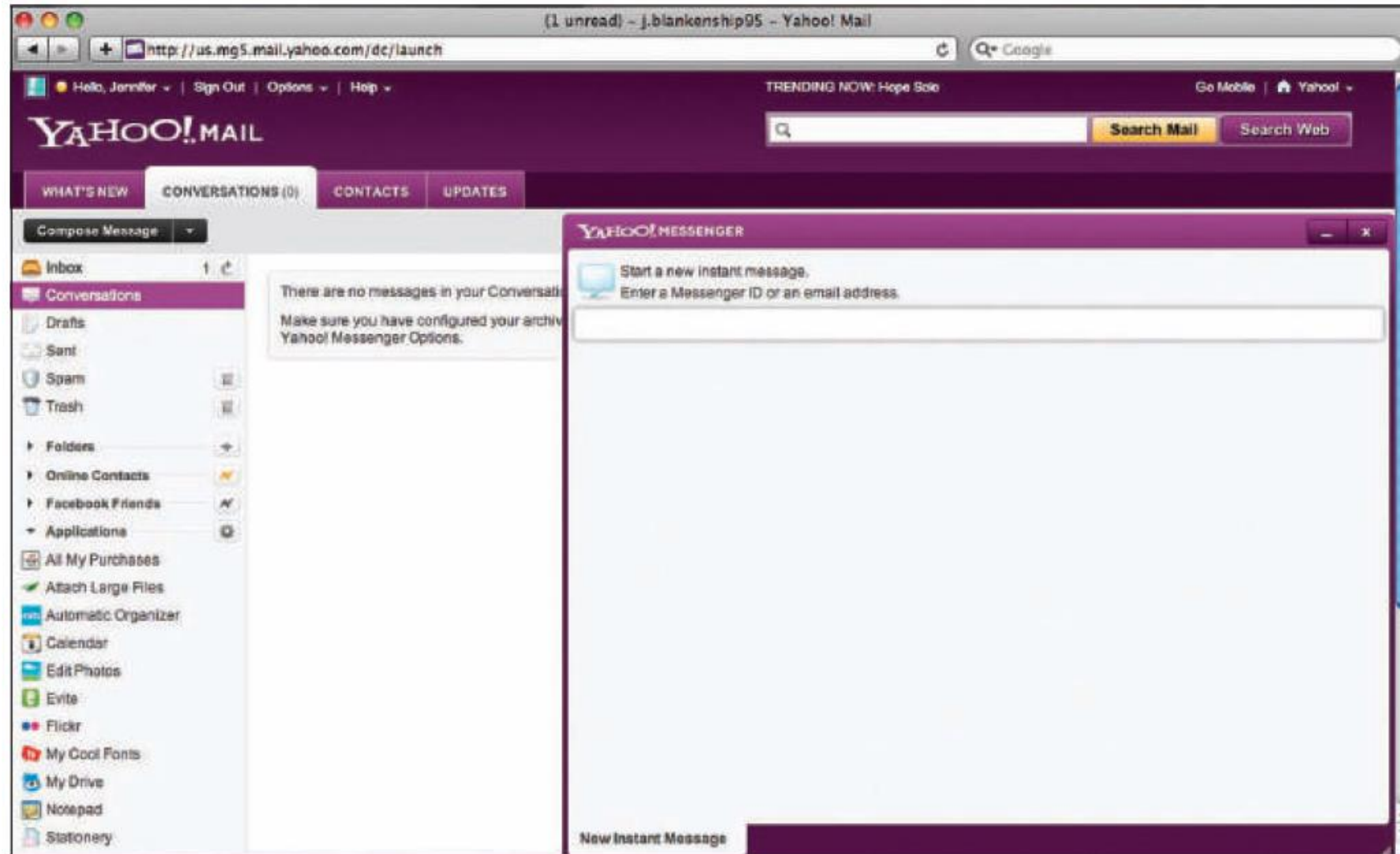
SOURCE: YAHOO! and the YAHOO! logo are trademarks of Yahoo! Inc. Reproduced with permission of Yahoo! Inc.

Blogs

- Shortened from the word Weblog or written as "Web log"

- Is a web site of personal or commercial origin that uses a dated log format updated, daily, or very frequently, with new information about a particular subject or range of subjects.

- Information can be written by the site owner, gleaned from other web sites or other sources, or contributed by users via e-mail.

- Often has the quality of being a kind of online diary from a particular point of view.

- Generally blogs are devoted to one or several subjects or themes, usually of topical interest.

- Blogs can be thought of as developing commentaries, individual or collective, on their particular themes.

- A blog may be any individual's recorded ideas (a sort of diary), a commercial information source open only to subscribers, or a complex collaboration open to anyone.

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Word Processing and Desktop Publishing (DTP)

Word Processing

- Software for word processing has transformed the process of writing just about anything.

- WP packages computerize the creation, editing, revision, and printing of documents (letter, memos, receipt) by processing text data (words, phrases, sentences, and paragraphs).

- Top word processing packages are MS Word, Google Doc, Lotus WordPro …

- These packages can also convert documents to HTML format for publication as Web pages on corporate intranets or the World Wide Web.

- They have some useful features: ***spelling checker*** (capability can identify and correct spelling errors), ***thesaurus*** (helps to find a better choice of words to express ideas), and ***grammar and style checker*** (helps to identify and correct grammar and punctuation errors, as well as suggest possible improvements in writing style)

DTP

- End users and organizations can use DTP software to produce their own printed materials (newsletters, brochures, manuals, and books with several graphics, photos, and color) that look professionally published.

- Word processing packages and desktop publishing packages like Adobe InDesign, MS Publisher and QuarkXPress are used for desktop publishing

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Spreadsheets

- Different spreadsheet packages are used by every business for analysis, planning, and modeling.

- Help users to develop an electronic spreadsheet, which is a worksheet of rows and columns that can be stored on PC or on a network server, or converted to HTML format and stored as a Web Page or Web sheet on the World Wide Web.

- Developing a spreadsheet involves designing its format and developing the relationships (formulas) that will be used in the worksheet.

- Based on the input, computer performs necessary calculations according to the formulas users define.

- Users could develop spreadsheets to record and analyze past and present data for a business operations.

- Microsoft's Excel boasts dimensions of 65,536 rows by 256 columns.

- The columns can be sized to display up to 255 characters and each cell (the intersection of a column and row) can contain up to 32,767 characters.

- Assuming a typical cell size of 1/40 high by 10 wide, if an electronic spreadsheet were actually spread out as a piece of paper, it would be over 1,300 feet high by 21 feet wide!

Current Trends

- Can use as a decision support tool to get the answers for what-if questions.

- Can do data mining.

- Can share as online sheets with workgroups, and peers.

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Personal Information Manager (PIM)

Personal information manager (PIM) is a popular software package for end-user productivity and collaboration, as well as a popular application for personal digital assistant (PDA) handled devices.

Various PIMs such as Microsoft Outlook and Lotus Organizer help end users **store, organize, retrieve** information about customers, clients, and prospects or schedule and manage appointments, meetings, and tasks.

- A PIM package will organize data users enter and retrieve information in a variety of forms, depending the style and structure of the PIM and the information users want.

For example, information can be retrieved as an electronic calendar or list of appointments, meetings, or other things to do; as the timetable for a project; or as a display of key facts and financial data about customers, clients, or sales prospects. Most PIMs now include the ability to access the World Wide Web and provide e-mail capability. Also, some PIMs use Internet and e-mail features to support team collaboration by sharing information such as contact lists, task lists, and schedules with other networked PIM users.

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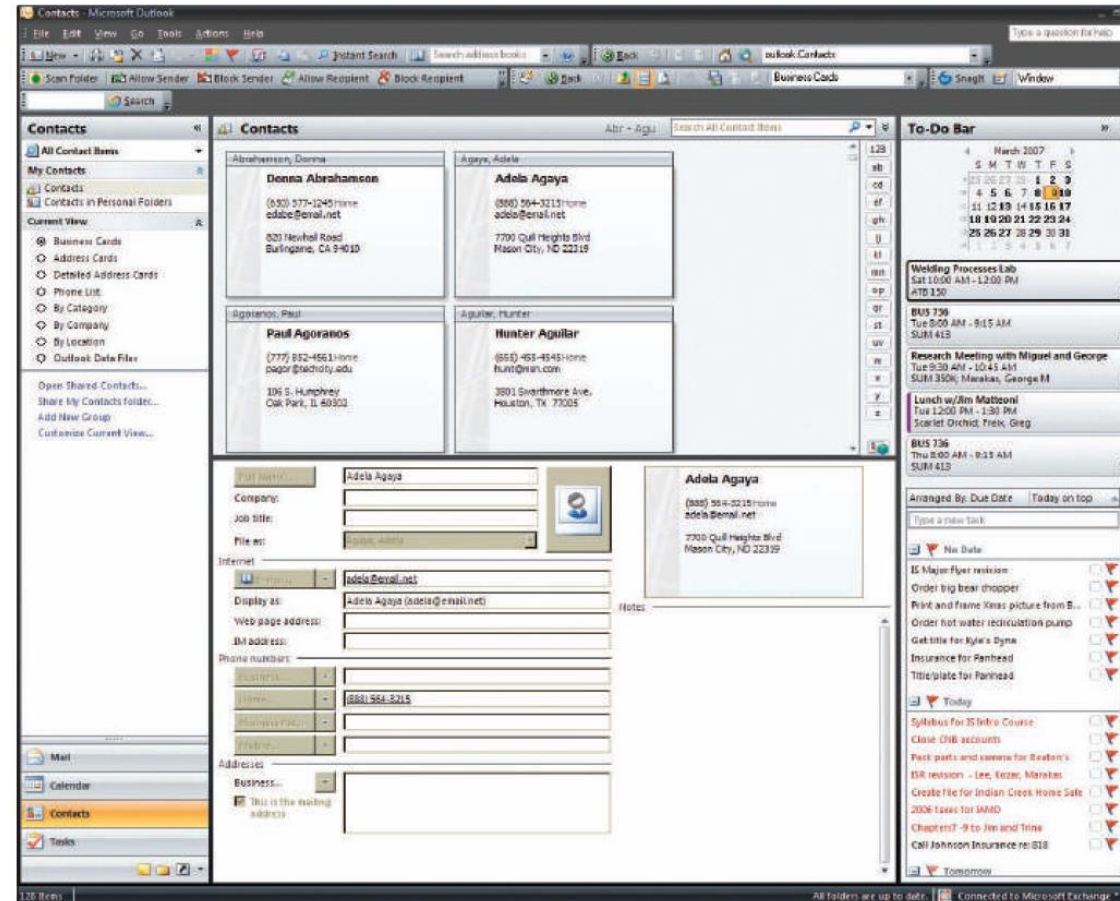
SOURCE: Courtesy of Microsoft®.

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Groupware

Is a software that helps workgroups and teams collaborate to accomplish group assignments.

- Is a category of general-purpose application software that combines a variety of software features and functions to facilitate collaboration.

For example, groupware products like Lotus Notes, Novell GroupWise, and Microsoft Exchange support collaboration through e-mail, discussion groups and databases, scheduling, task management, data, audio and videoconferencing, and so on.

- Groupware products rely on the internet and corporate intranets and extranets to make collaboration possible on a global scale by virtual teams located anywhere in the world.

- Collaborative capabilities are also being added to other software to give it groupware like features.

For example, in the Microsoft Office software suite, Microsoft Word keeps track of who made revisions to each document, Excel tracks all changes made to a spreadsheet, and Outlook lets you keep track of tasks you delegate to other team members. Recently, the Microsoft Office suite has included functions that allow multiple people to work on and edit the same document at the same time. Using this feature, any changes made by one team member will become visible to all team members as they are being made.

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Software Alternatives

Many businesses are finding alternatives to acquiring, installing, and maintaining business application software purchased from software vendors or developing and maintaining their own software in-house with their own software developer employees.

Large companies are **outsourcing** the development and maintenance of software they need to **contract programming** firms and other software development companies, including the use of **offshore** software developers in foreign countries and using the internet to communicate, collaborate, and manage their software development projects.

Application Service Providers (ASPs)

Businesses are turning to application service providers instead of developing or purchasing the application software they need to run their businesses.

So who are the ASPs?

Are companies that own, operate, and maintain application software and the computer system resources (servers, system software, network and IT personnel) required to offer the use of the application software for a fee as a service over the internet.

- ASP can bill their customers on a per-use basis or on a monthly or annual fee basis.

Reasons for using ASPs

- Low cost of initial investment, and the short time needed to get the web-based application set up and running.

- Pay-as-you-go fee structure is usually less expensive than the cost of developing or purchasing as well as running and maintaining the application software.

- Using an ASP eliminates or drastically reduces the need for much of the IT infrastructure (servers, system software, and IT personnel) that would be needed to acquire and support application software, including the continual challenges of distributing and managing companywide software patches and upgrades.

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Cloud Computing

Is a style of computing in which software and, in some cases, virtualized hardware resources are provided as a service over the Internet.

- Users need not have knowledge of, expertise in, or control over the technology infrastructure "in the cloud" that supports them.

- The term cloud is used as a metaphor for the internet, based on how the Internet is often depicted in computer network diagrams.

Advantages of Cloud Computing

- The real benefit comes from the cost savings.

- Users can avoid capital expenditure on hardware, software, and services, by paying the provider only for what they use.

- Consumption is billed on a utility basis (e.g., resources consumed, as in electricity) or subscription basis (e.g., time-based, as in a newspaper), with little or no up-front cost.

- Other benefits of thisTimesharing-style approach are low barriers to entry, shared infrastructure and cost, low management overhead, and immediate access to a broad range of applications.

- Users can terminate the contract anytime with financial penalties .

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Software Licensing

Regardless of whether a software application is purchased COTS or accessed via an ASP, the software must be licensed for use.

- Licensing is a complex topic that involves considerations of underlying intellectual property rights, including copyright, trademark, and trade secrets, as well as traditional contract law including Uniform Commercial Code (UCC).

- Users don't buy the rights of ownership. Rather, the individuals or companies purchase a license to use the software under the terms of the software license agreement.

- Software is generally licensed to protect the vendor's intellectual property rights.

- The license often prohibits reverse engineering, modifying, disclosing, or transferring the software.

Section-2

# System Software: Computer System Management

System Software

Consists of programs that manage and support a computer system and its information processing activities.

- System software is much like the central nervous system in the human body. As it is responsible for making sure all of the parts are connected properly to the brain so the "system" (in this case, the human body) will respond properly to commands sent from the brain.

We can group system software into two major categories:

1. **System Management Programs:** Programs that manage the hardware, software, network, and data resources of computer systems during the execution of the various information processing jobs of users. *Examples of important system management programs are operating systems, network management programs, database management systems, and system utilities*

2. **System Development Programs:** Programs that helps users develop information and procedures and prepare user programs for computer processing. *Major software development programs are programming language translators and editors, and a variety of CASE(Computer Aided Software Engineering) and other programming tools.*
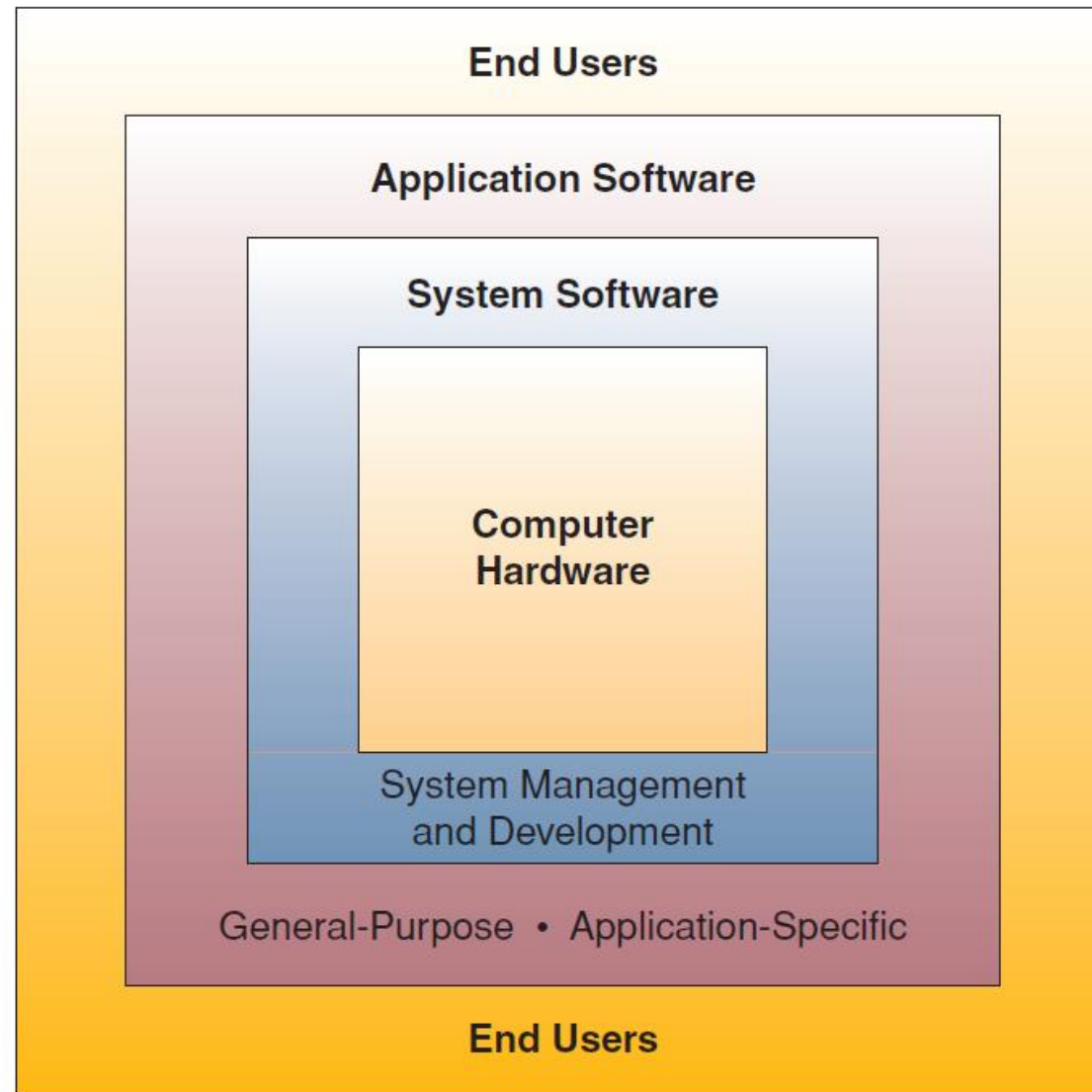
The system and application software interface between end users and computer hardware.

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Operating System (OS)

Is an integrated system of programs that manages the operations of the CPU, controls the input/output and storage resources and activities of the computer system, and provides various support services as the computer executes the application programs of users.
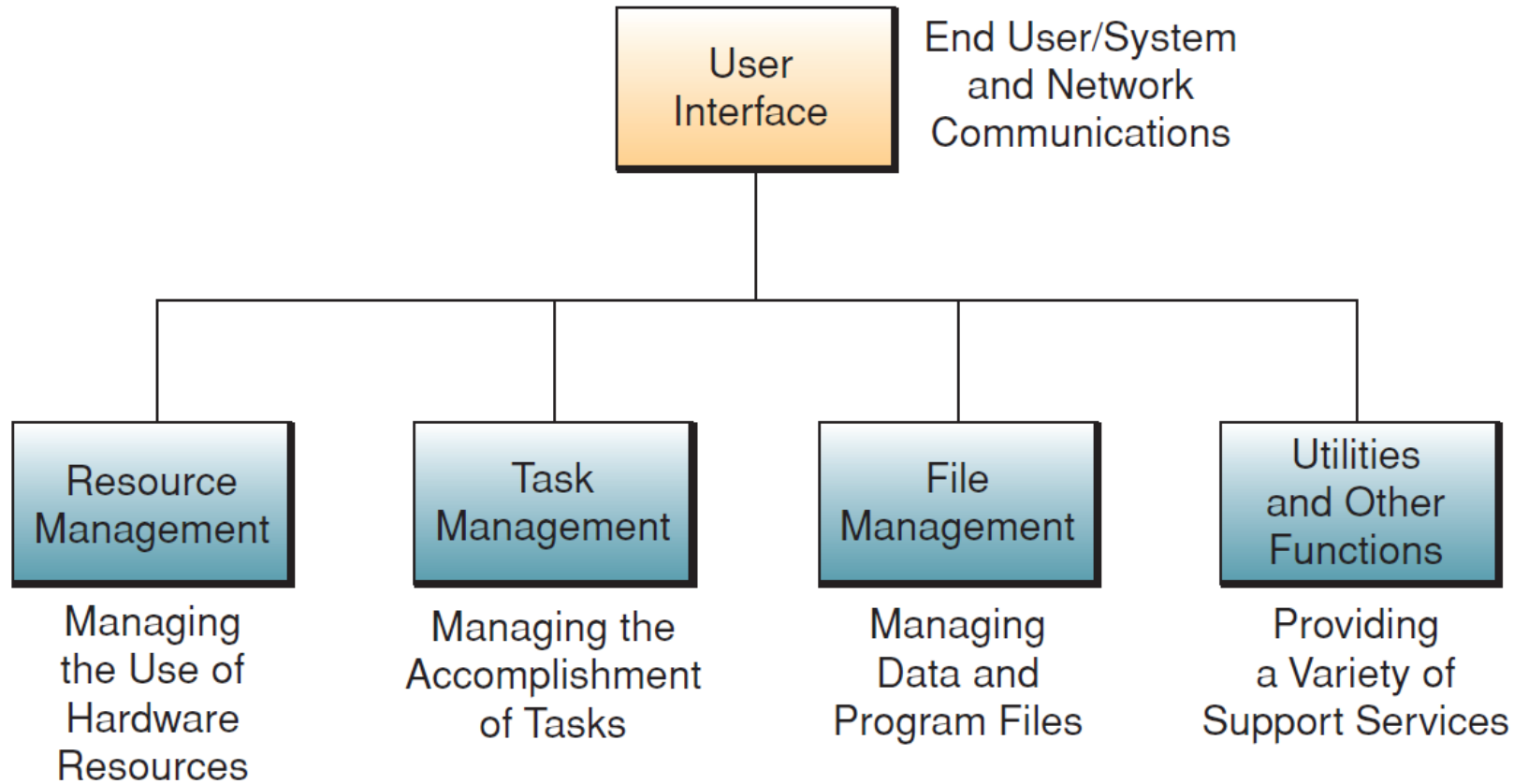
- The most important system software package for any computer.

- The primary purpose is to maximize the productivity of a computer system by operating it in the most efficient manner.

- Minimizes the amount of human interventions required during the processing.

- Helps user application programs perform common operations such as accessing a network, entering data, saving and retrieving files, and printing and displaying outputs.

- OS must be loaded and activated before user can accomplish other tasks. And this requirements emphasizes that OS are the most indispensable components of the software interface between users and hardware of their computer systems.

Most popular OSs are: MS Windows OS, MAC OS …

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Operating Systems Functions

Basic Functions of an OS include a UI, Resource Management, Task Management, File Management, and Utilities and other Functions

User Interface — End User/System and Network Communications

Resource Management — Managing the Use of Hardware Resources

Task Management — Managing the Accomplishment of Tasks

File Management — Managing Data and Program Files

Utilities and Other Functions — Providing a Variety of Support Services

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User Interface (UI)

Is the part of the OS that allows users to communicate with it so users can load programs, access files, and accomplish other tasks.

Three main types of UI are: *command-driven, menu driven, and graphical user interface.*

The trend in user interfaces for operating systems and other software is moving away from the entry of brief end-user commands, or even the selection of choices from menus of options.

Instead, most software provides an easy-to-use graphical user interface (GUI) that uses icons, bars, buttons, boxes, and other images.

▪ These GUIs rely on **pointing devices** like *the electric mouse or touch pad to make selections that help users get things done.* Most common and widely recognized GUI is the MS Windows desktop.

Resource Management

An operating system uses a variety of resource management programs to manage the hardware and networking resources of a computer system, including its CPU, memory, secondary storage devices, telecommunications processors, and input/output peripherals.

For instance, memory management programs keep track of where data and programs are stored. They may also subdivide memory into a number of sections and swap parts of programs and data between memory and magnetic disks or other secondary storage devices.

This process can provide a computer system with a ***virtual memory*** capability that is significantly larger than the real memory capacity of its primary storage circuits.

A computer with a virtual memory capability can process large programs and greater amounts of data than the capacity of its memory chips would normally allow.

File Management

File management programs control the creation, deletion, and access of files of data and programs.

- It also involves keeping track of the physical location of files on magnetic disks and other secondary devices. So operating systems maintain directories of information about the location and characteristics of files stored on a computer system's secondary storage devices.

Task Management

Task management programs of an OS help accomplish the computing tasks of end users.

- The programs control which task gets access to the CPU and for how much time.

- The task management functions can allocate a specific slice of CPU time to a particular task and interrupt the CPU at any time to substitute a higher priority task.

Several different approaches to task management may be taken, and each has advantages in certain situations.

Simply which tasks are performed and when.

Task Management – Different Approaches

Multitasking (sometimes referred to as multiprogramming or timesharing) is a task management approach that allows for several computing tasks to be performed in a seemingly simultaneous fashion.

Hold on!!

In reality, multitasking assigns only one task at a time to the CPU, but it switches from one program to another so quickly that it gives the appearance of executing all of the programs at the same time.

Types of Multitasking: There are two basic types of multitasking

Preemptive: the task management functions parcel out CPU *time slices* to each program.

Cooperative: it allows each program to control the CPU for as long as it needs it. If a program is not using the CPU , however it can allow another program to use it temporarily.

Most Windows and UNIX-based operating systems use the preemptive approach, whereas most Apple-style platforms use cooperative multitasking.

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- Most computers make use of some sort of multitasking.

- And on modern computers, multitasking is made possible by the development of powerful processors and their ability to address much larger memory capacities directly.

This capability allows primary storage to be subdivided into several large partitions, each of which is used by a different software application.

In reality what happens?

- A single computer can act as if it were several computers, or virtual machines (applications run independently at the same time), because each application program runs independently at the same time.

- The number of programs that can be run concurrently depends on the amount of memory that is available and the amount of processing each job demands.

Why?

That's because a microprocessor (or CPU) can become overloaded with too many jobs and provide unacceptably slow response time.

- However, if memory and processing capacities are adequate, multitasking allows end users to switch easily from one application to another, share data files among applications, and process some applications in a *background* mode.

Typically, background tasks include large printing jobs, extensive mathematical computations, or unattended telecommunications sessions.

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Programming Languages

A programming language allows a programmer to develop the sets of instructions that constitute a computer program. In simple words programmers use set of rules to create or build a program. Different programming languages have been developed with its own unique vocabulary, grammar and uses.

Machine Languages (or first-generation Languages/1GL): are the most basic level of programming languages.

- In early stages of computer development, all program instructions had to be written using binary codes unique to each computer.

- This type of programming involves the difficult task of writing instructions in the form of strings of binary digits (ones and zeros) or other number systems.

- Programmers must write long series of detailed instructions to accomplish even simple processing tasks.

Example:

Machine Languages:
Use binary coded instructions
1010   11001
1011   11010
1100   11011

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Assembler Languages (or second-generation languages/2GL): are the next level of programming languages.

- They were developed to reduce the difficulties in writing machine language programs.

- The use of assembler language requires language translator programs called *assemblers* that allow a computer to convert the instructions of such language into machine instructions.

- Are frequently called symbolic languages because symbols are used to represent operation codes and storage locations.

- Convenient alphabetic abbreviations called mnemonics (memory aids) and other symbols represent operations codes, storage locations, and data elements.

- Are still used as a method of programming a computer in a machine-oriented languages.

- In most cases, however, unless you become an operating system programmer, you will never encounter assembler language.

Example: for computation X=Y+Z in an assembler language might take the following form:

Assembler Languages:
Use symbolic coded instructions
LOD Y
ADD Z
STR X

High-Level Languages (or third-generation languages/3GL): use instructions, which are called statements, that include brief statements or arithmetic expression.

- Individual high-level statements are actually *macroinstructions;* that is, each individual statement generates several machine instructions when translated into machine language by high-level language translator programs called *compilers* or *interpreters*.

- High-level language statements resemble the phrases or mathematical expressions required to express the problem or procedure being programmed.

- The *syntax* (vocabulary, punctuation, and grammatical rules) and *semantics* (meanings) of such statements do not reflect the internal code of any particular computer.

- High-level languages like BASIC, COBOL, and FORTRAN are easier to learn and program than an assembler language because they have less rigid rules, forms, and syntaxes.

- However, high-level language programs are usually less efficient than assembler language programs and require a greater amount of computer time for translation into machine instructions. Because most high-level languages are machine-independent, programs written in a high-level language do not have to be reprogrammed when a new computer is installed, and programmers do not have to learn a different language for each type of computer.

Example: the computation X 5 Y 1 Z would be programmed in the high-level languages of BASIC and COBOL in the following image:

High-Level Languages:
Use brief statements or arithmetic notations
BASIC: X = Y + Z
COBOL: COMPUTE X = Y + Z

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Fourth-Generation Language/4GL: describes variety of programming languages that are more *nonprocedural* and *conversational* than prior languages. These languages are called fourth-generation languages (4GLs) to differentiate them from machine languages (first generation), assembler languages (second generation), and high-level languages (third generation)..

- Most 4GLs are *nonprocedural languages* that encourage users and programmers to specify the results they want, while the computer determines the sequence of instructions that will accomplish those results.

- 4GLs have helped simplify the programming process.

Natural languages are sometimes considered ***fifth-generation*** **languages (5GLs)** and are very close to English or other human languages.

- Research and development activity in artificial intelligence (AI) is developing programming languages that are as easy to use as ordinary conversation in one's native tongue.

For example, INTELLECT, a natural language, would use a statement like, "What are the average exam scores in MIS 200?" to program a simple average exam score task. Try going to www.hakia.com , a natural language search engine, and typing a questions like "What is the population of Chicago, IL?" I think you will be surprised at the volume of accurate results. Try entering the same question at www.google.com and you'll immediately get a long list of hits, but at the top you will see "Best guess for Chicago, IL population is 2,896,016." That's natural language!

Fourth-Generation Languages:
Use natural and nonprocedural
statements
SUM THE FOLLOWING NUMBERS

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Object-Oriented Languages: It's also considered as 5GL. Whereas most programming languages separate data elements from the procedures or actions that will be performed on them, object-oriented languages tie them together into **objects.**

Thus, an object consists of data and the actions that can be performed on the data. *For example, an object could be a set of data about a bank customer's savings account and the operations (e.g., interest calculations) that might be performed on the data. An object also could be data in graphic form, such as a video display window plus the display actions that might be used on it.*

- In procedural languages, a program consists of procedures to perform actions on each data element.

- In object-oriented systems, objects tell other objects to perform actions on themselves.

- Object-oriented languages are easier to use and more efficient for programming the graphics-oriented user interfaces required by many applications.

- They are the most widely used programming languages for software development today.

- Once objects are programmed, they are reusable. Therefore, reusability of objects is a major benefit of object-oriented programming.

*For example, programmers can construct a user interface for a new program by assembling standard objects such as windows, bars, boxes, buttons, and icons. Therefore, most object-oriented programming packages provide a GUI that supports a point-and-click, drag-and-drop visual assembly of objects known as **visual programming**.*

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Web and Internet Languages and Services

HTML (Hypertext Markup Language) is a page description language that creates hypertext or hypermedia documents.

- HTML inserts control codes within a document at points users can specify that create links (hyperlinks) to other parts of the document or to other documents anywhere on the World Wide Web (WWW).

- HTML embeds control codes in the ASCII text of a document that designate titles, headings, graphics, and multimedia components, as week as hyperlinks within the document.

- It is the language of the Web

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XML (eXtensible Markup Language) is not a Web page *format description* language like HTML. Instead, XML describes **the content of Web pages** (including business documents designed for use on the Web) by applying identifying tags or *contextual labels* to the data in Web documents.

For example, a travel agency Web page with airline names and flight times would use hidden XML tags like "airline name" and "flight time" to categorize each of the airline flight times on that page.

Or product inventory data available at a Web site could be labeled with tags like "brand", "price", and "size".

Why do we need to classify data?

By classifying data in this way, XML makes Web site information much more searchable, easier to sort, and easier to analyze.

For example, XML-enabled search software could easily find the exact product you specify if the product data on the Web site had been labeled with identifying XML tags. A Web site that uses XML could also more easily determine which Web page features its customers use and which products they investigate. Thus, XML promises to make electronic business and commerce processes a lot easier and more efficient by supporting the automatic electronic exchange of business data between companies and their customers, suppliers, and other business partners.

Java is an object-oriented programming language created by Sun Microsystems that has revolutionized the programming of applications for the Web, as well as corporate intranets and extranets.

- **Object-Oriented Programming (OOP):** Java is built around the concept of objects, which are reusable software components that model real-world entities. OOP principles like encapsulation, inheritance, and polymorphism enhance code organization, reusability, and flexibility.

- **Platform Independence:** Java programs are platform-independent too. Java's "Write Once, Run Anywhere" (WORA) capability allows code to execute seamlessly on different operating systems and hardware architectures thanks to the Java Virtual Machine (JVM). They can run on Windows, UNIX, and Macintosh systems without modification.

- **Web Application Development:** Java is also specifically designed for real-time, interactive, Web-based network applications.

- **Applet:** A small Java program designed to be embedded in web pages and can be executed by any computer running OS anywhere on the network.

Java Virtual Machine (JVM): A software environment that executes Java bytecode, enabling platform independence.

Bytecode: An intermediate code generated by the Java compiler, which is executed by the JVM.

Polymorphism: The ability of objects to take on multiple forms, allowing for flexible and adaptable code.

Encapsulation: The bundling of data (attributes) and methods that operate on that data within a single unit (object).

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Microsoft's **.NET** is a collection of programming support for what are known as Web services, the ability to use the web rather than users' own computer for various services.

- The purpose of .NET is to provide individual and business users with a seamlessly interoperable and Web-enabled interface for applications and computing devices and to make computing activities increasingly Web browser-oriented.

- The .NET platform includes servers, building-block services such as Web based data storage, and device software.

- The .NET platform is expected to enable the entire range of computing devices to work together and have user information automatically updated and synchronized on all of them.

In short, it's basically Microsoft's collection of programming support for Web services

Web Services are the software components that are based on a framework of Web and object-oriented standards and technologies for using the Web that electronically link the applications of different users and different computing platforms. Thus, Web services can link key business functions for the exchange of data in real time within the Web-based application that a business might share with its customers, suppliers, and other business partners

For example, Web services would enable the purchasing application of a business to use the Web to check the inventory of a supplier before placing a large order, while the sales application of the supplier could use Web services to automatically check the credit rating of the business with a credit-reporting agency before approving the purchase. Therefore, among both business and IT professionals, the term Web services is commonly used to describe the Web-based business and computing functions or services accomplished by Web services software technologies and standards.

- The XML language is one of the key technologies that enable Web services to make applications work between different computing platforms.

- Also important are **UDDI (Universal Description, Discovery, and Integration),** the "yellow pages" directory of all Web services and how to locate and use them, and **SOAP (Simple Object Access Protocol),** an XML-based protocol of specifications for connecting applications to the data that they need.

Programming Software

Computer programs consist of sets of instructions written in programming languages that must be translated by a *language translator* into the computer's own machine language before they can be processed, or executed by the CPU

Programming **language translator programs** (or language processors) are known by a variety of names.

An **assembler** translates the symbolic instruction codes of programs written in an assembler into machine language instructions. *Example: Converts assembly code into executable machine code.*

- Use case: Embedded systems where performance is critical

- Assembly language: **x86** assembly language (used in Intel and AMD processors), advanced reduced instruction set computer (**RISC**) machine (**ARM**) assembly language (used in many mobile devices), microprocessor without interlocked pipeline stages (**MIPS**) assembly language (commonly used in embedded systems and gaming consoles), and power performance computing (PowerPC) assembly language. The choice of assembly language depends on the target hardware and the specific requirements of the project. And all these translate directly to machine code

A **Compiler** translates high-level language statements. It produces a complete machine language program before execution. *Example: Converts C++ or Python code into an executable program.*

- *Common in application development for efficiency*

- *Example: C++ program compiled into an executable for Windows*

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An **interpreter** is a special type of compiler that translates and executes each statement in a program once at a time.

- Useful for scripting and real-time applications.

- Example: JavaScript in web browsers, Python scripts in data analysis.

Java as an Interpreted Language:

- Java applets are interpreted, meaning instructions are translated and executed during runtime.

- Enhances portability and ease of execution across different platforms.

Enhanced Software Development:

- Graphical programming interfaces and built-in development capabilities.

- Language translators with editing and diagnostic features to identify bugs.

Programming Tools: Help programmers identify and minimize errors as they write the code.

- Graphics-oriented programming editors and debuggers.

- Help to identify and minimize programming errors or *bugs*, increase efficiency and productivity.

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CASE (Computer-Aided Software Engineering) Tools: automated software support tools for developing systems

History:

- *Since the early days of programming, software developers have needed automated tools for many reasons.*

- *Initial concentration was on program support tools such as translators, compilers, assemblers, macroprocessors, and linkers and loaders.*

- As computers became more powerful and the software that ran on them grew larger and more complex, the range of support tools began to expand.

- The use of interactive timesharing systems for software development encouraged the development of program editors, debuggers, and code analyzers.

Introduction:

- As the range of support tools expanded, manufacturers began to integrate them into a single application using a common interface; and such tools were referred to as CASE tools.

- CASE tools can take a number of forms and be applied at different stages of the software development process.

*Those CASE tools that support activities early in the life cycle of a software project (e.g., requirements, design support tools) are sometimes called **front-end** or **upper** CASE tools.*

*Those that are used later in the life cycle (e.g., compilers, test support tools) are called **back-end** or **lower** CASE tools.*

*You will encounter them again when you study systems analysis and design. For now, remember that CASE is an important part of **resolving the problems** of complex application development and maintenance of software applications.*

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